Using the ‘Wisdom of the Crowd’ to Innovate in Health Professions Pre-Registration Curriculum Design

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Summary

This thesis's subject of inquiry is the role of crowdsourcing as a technological tool to enable stakeholder contribution in health professions education curriculum design, specifically the application of crowdsourcing in a local periodic diagnostic radiography degree programme revalidation. The stakeholder groups the research focused on were students, patients, and the public. Informed by a narrative literature review of crowdsourcing in health professions education, the research aimed to establish if crowdsourcing could be deployed to support the involvement of these stakeholders when designing a pre-registration diagnostic radiography programme at a single Higher Education Institute. Due to the limited evidence uncovered on the topic and the identified studies mapping to the 'systems' aspect of Jurgen Habermas's theory of communicative action, this lens was applied to this study. A pragmatic, action research approach using an embedded mixed methods design afforded the ability to explore how the crowdsource would need to be designed to enable students, patients, and public participation. Methodically applying Wadsworth's complete cycle questions and using the critical learning from each cycle for the preceding cycle supported understanding of how the tool could be employed in the curriculum design process. The final product of these 'reflect and refine' activities was a set of six (ICARUS) design principles that could be applied by other health professions educators seeking to use crowdsourcing in this way. Findings also demonstrated that people did engage with the opportunity, and those that joined represented a diverse demographic. Moreover, following a review of contemporary radiography education literature, crowd ideas were included in the updated curriculum programme specification. The impact of Covid-19 on the work and how the increasing use of digital data collection tools during this time has amplified the interest in crowdsourcing is discussed. The work recognises several limitations alongside recommending areas for future research.

Declarations and statements

Declaration

This work has not previously been accepted in substance for any degree and is not being concurrently submitted in candidature for any degree.

Signed:

Date: 31st of March 2022

STATEMENT 1

This thesis is the result of my own investigations, except where otherwise stated. Where correction services have been used, the extent and nature of the corrections are clearly marked in a footnote(s). Other sources are acknowledged by footnotes giving explicit references. A bibliography is appended.

Signed:

Date: 31st of March 2022

STATEMENT 2

I hereby give consent for my thesis, if accepted, to be available for photocopying and for inter-library loans after expiry of a bar on access approved by the Swansea University.

Signed:

Date: 31st of March 2022

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Acknowledgements

This thesis is submitted in memory of
Jane Ellen Lillias St. John (nee Phillips),
12th December 1958- 01st June 2002.

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I grew up in Co. Tipperary in Ireland, but drafting this thesis, I have often wondered what my Welsh Grandparents from Maesteg, and Pontypridd would make of their eldest granddaughter being the first in the family to hold a Doctorate, particularly at Swansea University, so close to my maternal roots.

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Abbreviations

AAB	Accreditation and Approval Board
ACM	Association of Computer Machinery
ACR	American College of Radiology
AHP	Allied Health Professions
ASSIA	Applied Social Science Index, and Abstracts
BAMMR	British Association of Magnetic Resonance Radiographers
CAHPO	Chief Allied Health Professions Officer (CAHPO)
CHCR	Centre of Health and Clinical Research
CIMO	Context-Intervention-Mechanism and Outcome
CINAHL	Cumulative Index of Nursing and Allied Health
CoR	College of Radiographers
COREQ	Consolidated criteria for Reporting Qualitative Research
CPD	Continuous Professional Development
CS	Crowdsourcing
CT	Computed Tomography
DEXA	Bone density scan
ECLIPSE	Expectation, Client group, Location, Impact, Professionals, Service
EDGE	Embryonic, Developing, Gripping, Embedding
FAQ	Facts and Questions
IRE	Internet Research Ethics
JBI	Joanne Briggs Institute
JISC	Joint Information Systems Committee
HCPC	Health and Care Professions Council
HEE	Health Education England
HEI	Higher Education Institute
HIT	Distributed Human Intelligence
HRA	Health Research Authority
HRE	Heads of Radiography Education
LGBTQIA+	Lesbian, Gay, Bisexual, Transgender, Intersex, Queer or Questioning, Asexual or Ally
LTP	Long Term Plan
MHRA	Medicines and Healthcare products
MRI	Magnetic Resonance Imaging
MTurk	Mechanical Turk
NCCPE	National Co-ordinating Centre for Public Engagement
NERC	National Environment Research Committee
NGT	Nominal Group Technique
NHIR	National Institute for Health Research
NHS	National Health Service
NHS RES	NHS Research Ethical Approval
NHSEI	NHS England and NHS Improvement
OfS	Office for Students
ONS	Office of National Statistics
PPI	Patient Public Involvement
QAA	Quality Assurance Agency
RSNA	Radiological Society of North America
SoR	Society of Radiographers

SCoR	Society and College of Radiographers
SMOG	Simple Measure of Gobbledygook
SPICE	Setting; Population; Intervention; Comparison; Evaluation
SPIDER	Sample, Phenomenon of Interest, Design, Evaluation, Research
SRSF	Student Representative Staff Forums
SUMS	Swansea University Medical School
TA	Thematic Analysis
UD	Universal Design
UDL	Universal Design Learning
US	Ultrasound
UWE	The University of the West of England
WC	World Cafes
WCAG	Web Content Accessibility Guidelines
W3C	World Wide Web Consortium

CHAPTER ONE: Introduction

1.1 Thesis introduction and layout

This thesis's subject of inquiry is the role of crowdsourcing as a technological tool to enable stakeholder contribution in health professions education curriculum design processes, specifically the application of crowdsourcing in a local periodic diagnostic radiography degree programme revalidation. To support the research strategy's cyclic and evolving nature, action research, the thesis is divided into nine chapters supported by appendices. The chapters include an introduction, background, literature review, methodology and methods, action research cycles one, two and three, the research summary and implications, and a reflection chapter.

Chapter one presents a global overview of curriculum and curriculum design processes. The role of curriculum stakeholders within the process is evaluated, including the challenges of identifying who these are. I also contemplate why meaningful engagement of stakeholders is essential. From here, I introduce the reader to the profession of diagnostic radiography. The pre-registration education requirements undertaken to gain UK state registration as a diagnostic radiographer are shared alongside the national policy drivers that influence this curriculum. Next, the organisation where the research was conducted and how curriculum design is interpreted and undertaken locally at a single Higher Education Institute (HEI) is summarised. This includes detailed information on a five-yearly curriculum review carried out by five programmes in the local department of allied health professions (AHPs) at the University of the West of England (UWE), Bristol, between 2018-2020. Finally, the steps involved to achieve re-approval are shared with a specific focus on step two, curriculum review and pedagogical development events, and the tools used locally to realise these activities.

Chapter two explores service users as health professions education stakeholders, why service users' contribution to healthcare professions

education is important, and how they contribute to curriculum design and delivery from recruitment, teaching and learning, and assessment. I conceptualise and reflect on the various participation, engagement, and involvement concepts, alongside surveying the terminology and meanings assigned to service users. I present an argument for using the phrase ‘patient, and public involvement’ (PPI) and explore their role as diagnostic radiography education stakeholders. I then consider how this translates to local practice at UWE Bristol. Students as stakeholders are also considered given the specific commitment by the local HEI to this stakeholder group. Traditional tools to support participation and involvement in the curriculum design process are discussed. Crowdsourcing is introduced as a computer science, business studies, and policy co-design tool. I theorise what this technological engagement tool could offer stakeholder involvement in the curriculum design process. By linking these strands, I conclude the chapter with a statement of the investigated problem.

Chapter three is grounded by a scoping literature review that summarises existing research on how crowdsourcing is used in health professions education and contextualises the study within the relevant literature. To support this activity, a validated crowdsourcing verification tool was applied to identify appropriate literature by distinguishing crowdsourcing from other types of crowd working, i.e., crowdlending. How crowdsourcing is conceptualised in health professions education is considered, and the perceived advantages and disadvantages of using crowdsourcing are explored. Drawing on public and patient involvement literature, I also explored how current crowdsourcing in health professions education maps to Jurgen Habermas' (1987) theory of communicative action and the difference between the ‘systems’ and ‘life-world’ which is regarded as the most highly developed theory of deliberative democracy (Englund, 2006). The positioning of this work through a ‘systems’ lens is explained. Finally, the research aim, and objectives are presented.

Chapter four presents an account of the research methodology and methods used. I consider my worldview’s lens and how this shaped the work’s methodological approach. The research approach: action research, is

evaluated and discussed. By revisiting the crowdsourcing verification tool introduced in chapter three, a detailed account of how the research was conducted and how crowdsourcing was applied is shared. Supported by appendices, ethics, participant recruitment and data analysis are considered.

In chapter five, supported by charts and tables, I report the results of action cycle one undertaken in June 2019. The stakeholder focus for this cycle was the 'internal crowd' of UWE Bristol BSc (Hons) Diagnostic Radiography students. How themes were discovered and organised are described, and these themes are critically evaluated. Categorical data is also presented - the results concerning the study questions. I conclude the chapter by applying full-cycle questions to consider adjustments between this cycle and the next in preparation for action cycle two with patients, and the public.

For chapters six and seven, the stakeholder focus for action cycles two and three were patients, and the public, with this research undertaken in September and October 2019. Contrasting the previous chapter, these participants represent a crowd external to the organisation. Charts and tables support this section. How themes were discovered and organised are described, and these themes are critically evaluated. Categorical data is also presented. Again I applied the complete cycle questions to consider the adjustments needed between cycles two and three.

From here, chapter eight proposes a set of crowdsourcing design principles that could be used by other curriculum design teams when engaging stakeholders in health professions curriculum design. The impact of the Covid-19 pandemic on the research timelines is considered. Of note, England - wide crowdsourcing work I was involved with during the thesis write-up with Health Education England (St. John-Matthews & Hobbs, 2021; St. John-Matthews et al., 2021; St. John-Matthews et al., In Press) and NHS England and NHS Improvement is described. I then revisit the research aim and objectives, mapping how these have been addressed. In this chapter, I also consider the limitations of this work and areas for future research.

The concluding chapter, chapter nine, offers a reflective narrative of the research journey to support reader confidence in the trustworthiness of the study findings. My background experiences as an educator are disclosed and supported by a positionality statement. I share examples of the reflexivity practiced throughout the thesis. This includes how my position changed as the research progressed from an ‘insider within’ to an ‘insider outside’. How stakeholder critical lenses were applied to the work and my experiences of working with action research are explored. I revisit my Professional Doctorate, Research in Health Professions Education, year two portfolio, submitted as a summative assessment in 2017. I use this to reflect on my progress over the duration of this research.

1.2 Curriculum and curriculum design process overview

Curriculum is described as a plan for learning that includes a programme aims, intended learning outcomes, syllabus, assessment, learning, and teaching methods, which play out as a sequence of learning and experiences organised in a particular way (Biggs & Tang, 2011; Tyler, 1949; Walker, 2002). Such a learning plan is often reflected in concrete curriculum materials. For example, the teaching goals and the subsequent content worth teaching due to their relevance for students and society is a core curriculum question (Tyler, 1949). This question can be answered by exploring views on past and future aspirations (Williamson, 2013). Discourse on the substantive curriculum perspective is thus an essential part of curriculum as a field of study in our present times of rapid changes in the labour market and the rapid production of knowledge (Voogt et al., 2001).

Curriculum design is an iterative process in which knowledge about design procedures and curriculum quality indicators are intertwined with socio-political interests and many different stakeholders' needs. Curriculum design also bridges the gap between curriculum intentions and curriculum implementation. Scholars increasingly agree that curriculum design needs to be understood as a process of systemic change (Fullan, 2008; Van den Akker, 2003). The

curriculum is far more than a simple learning plan from this perspective. Instead, the curriculum is a social-cultural practice whereby meaning progresses through the teacher's active involvement and other stakeholders in the design process (Voogt et al., 2011). The Joint Information Systems Committee (JISC, 2016) describes two types of curriculum design activity. Firstly, describing the decisions taken by curriculum teams as they design the learning experience. Secondly, the connected institutional processes including information management, market research, marketing, quality enhancement, quality assurance, and programme and course approval.

The joint production of value by stakeholders, is deemed positive by several secondary education studies. Co-design, can for example promote educator ownership over the curriculum, where reform goals that guide development are set by policymakers who are far from the classroom (Wesbroek et al., 2020). In addition, codesign can facilitate curriculum renewal, transforming teachers' goals for students and pedagogical frameworks. It can also support integrating technology into teaching (Agyei et al., 2011). Furthermore, teachers can continue to learn from the implementation process. Finally, there is some evidence that co-design facilitates sustainability by creating ongoing curriculum renewal processes (Penuel, 2019).

Of course, there are limitations with co-design. Firstly, there is the willingness and ability of participants to engage. If staff cannot be released to participate or are unwilling to set aside the necessary time to support co-design, the process will not work (Gast et al., 2010). Secondly, lack of buy-in can change things on paper but not in practice (Brown et al., 2011; Taylor & Znajda, 2015). Thirdly an unequal power balance can impact the extent and quality of the discussion. Usher and Farmer (2018) write that students and junior staff were often invited to co-design conversations at their institute. Still, senior academics did not always feel that this group of stakeholders could give candid feedback. Finally, there is a need to know the limits of collaboration. At some point, a module or course will become the individual module or programme leader's responsibility. Usher and Farmer (2018), in their study of a local co-design approach, concluded that despite their work and broader literature supporting

collaborative co-design, there needs to be institutional support for co-design to work in terms of time, recognition and resourcing.

JISC (2016) writes that curriculum design involves a complex interplay between the institute's values, supporting systems and processes, and the expertise of those designing and delivering curricula. Changing an aspect in one area i.e. course information can have a knock-on effect elsewhere on student recruitment or the approval process. Moreover, there are boundary conditions under which co-design can produce these positive outcomes. For one, the organisational conditions matter. Educators need time to develop curriculum and learn curriculum design skills (Albashiry, 2019; Hamdelzalts et al., 2019). Additionally, as coordination of an array of stakeholders is required, design project coordination amongst these groups at different levels within the organisation, formal and informal communication methods to ensure coherence are needed (Hamdelzalts et al., 2019). Finally, a well-facilitated design process helps educators focus on the task and consider particular curriculum structures and pedagogies that best support student learning (Hamdelzalts et al., 2019). Moreover, careful attention to cultural and political dimensions of design processes and implementation, related to national, regional, and school-level operations, is required for co-design success (Agyei & Kafyulilo, 2019).

1.3 Critical evaluation of curriculum stakeholders and their engagement

The term stakeholder encapsulates anyone who has an invested interest in a programme of study. JISC (2016) acknowledges that involving stakeholders in curriculum design practices introduces fresh insights to improve how a programme or module is designed and realised. JISC notes that most institutes will already have strategies for involving students, employers, and professional bodies in the curriculum design, and increasingly, the contribution of other stakeholders is being recognised. They also underline the role of professional and IT staff, business and community representatives, and alumni in developing the curriculum.

Designing a curriculum in a collaborative co-design way ensures a community of practice is established whereby the community shares knowledge and experiences in solving problems encountered through the process while learning during the process (Walker, 1971). Yet JISC (2016) acknowledges that while identifying who the key local stakeholders are is one of the first questions to resolve, it can be challenging to determine the full spectrum of individuals with a stake in developing a particular curriculum. Obviously, those teaching a programme of study are core stakeholders with the importance of those teaching a programme of study, academic or clinical, grounded in the social nature of learning in collaborative design (Pieters et al., 2019). Additionally, as previously highlighted, curriculum design offers an opportunity for educator learning supported by two essential design elements, materials and conversations. Vygotsky (1978) argued that the mediated activity between the curriculum materials and the articulated reflection on the purpose of those materials through design team conversations leads to teacher learning. Furthermore, involving all teachers in the design process supports teacher development and may develop a relationship with the curriculum, leading to teacher learning and 'buy-in' (Brown, 2009; Remillard, 2005). However, Wesbroek et al. (2020) caution that the premise behind collaborative teacher design is conceptual, and that the empirical evidence base is less evident.

Using the 'Interconnected Model of Professional Growth' developed by Clarke and Hollingsworth (2002) and applying this to nine studies of collaborative curriculum design from six different countries, Voogt et al. (2011) have shown that the interaction of educator design teams with external stakeholders can positively add to the quality of the design and teachers' learning. Pieters et al. (2019) link this observation to Vygotsky's (1978) notion of the 'zone of proximal development', which describes the interaction between learning and developing. In their view, learning occurs when actual development expands through interactions with experts and peers who bring new knowledge. Garavan (1997) explains that learning is better seen as the overarching concept under which formal education and training occur, whereas development results from learning and training. JISC (2016) note that while it is not easy to engage all those who have a stake in a curriculum, the positives of

doing so can introduce fresh insights that can improve how a course or module is designed and delivered. Moreover, in some cases, the engagement process can engineer a new consensus that aids in implementing innovative solutions for challenging curriculum areas. My observation for this research is that with University programmes, the apparent stakeholders after educators are professional services staff, employers, and students. Health professions programmes add another dimension of stakeholders, including the profession's regulator, clinical staff who support learning in practice, professional bodies, and service users. As highlighted in the thesis roadmap, all of which are explored in detail in chapter two.

The next challenge is developing meaningful engagement of each stakeholder group and choosing the most appropriate strategy for individual stakeholders that enables dialogue to be successfully initiated and sustained. Scholars foreground the value of co-design in two arenas within the literature, with some promoting the usability and sustainability of innovations (Blumenfeld et al., 2000). Others foreground the value as an opportunity to democratise innovation by capturing a wide range of voices to define education's aims and objectives (Björgvinsson et al., 2010; Penuel, 2019). That is not to say all agents will agree. However, Usher and Farmer (2018) note that confrontation, when handled constructively, is important to the process of course design as it offers individuals an opportunity to reflect on their practice. Ho (2000) writes that this may prompt some teachers to begin to transform their teaching. Here, the facilitator's role is critical and, if possible, should be an independent member of staff (Usher & Farmer, 2018).

In Penuel's (2014) research within secondary schools, the author highlights that democratising innovation means continuously seeking to expand opportunities for all stakeholders to shape the aims and objectives of reform to include stakeholders who are not typically involved in the design process. Furthermore, they postulate that design, in these situations, inevitably entails some repair of inequitable social relations, and this extends beyond developing a new curriculum (Booker & Goldman, 2016; Ishimaru & Takahashi, 2017). This latter goal of democratising innovation closely aligns with the traditions of

participatory design that are well-developed in Scandinavia (Björgvinsson et al., 2012a, 2012b) and are emerging within the learning sciences community (Bang & Vossoughi, 2016; DiSalvo et al., 2017). This point is crucial because it gives a language for describing what we are doing when we co-design (Hillgren et al., 2011) offers a set of values that link to commitments of social and economic democracy (Ehn, 1992). It also requires us to consider 'Who designs?' and how power and privilege undermine efforts to include diversity in co-design (Esmonde & Booker, 2017; Mendoza et al., 2018).

While this thesis is focused on a degree programme, I believe it appropriate to draw from the secondary school evidence base given the parallels of pre-registration diagnostic radiography education in so much as there are national education standards that must be met to ensure graduates are eligible to practice. However, I recognise that unlike traditional curriculum design processes in secondary schools, third level educators have the scope to mould a programme to local institutional values and delivery methods. Thus having more control locally on how a curriculum is realised. Furthermore, there is recognition that the cost of education is one area where third-level education differs as the current cost of undertaking a degree programme in England is £9,250 per year, whereas state school education is free. Therefore, fees may influence how university students see themselves as education consumers rather than co-designers. The roles students can adopt in third-level education will be explored in more detail in chapter two. Likewise, the pedagogical underpinning differs between secondary and third-level education. However, I argue that the foundations of curriculum design process as a mechanism for systemic change hold at all education levels.

1.4 Introducing diagnostic radiographers

In England, diagnostic radiographers are autonomous allied health professionals (AHPs) who employ various imaging techniques and equipment to produce images of an injury or disease. Diagnostic radiographers will take the images and often report on them so that the correct treatment can be given

(College and Society of Radiographers (SCoRa, 2018). "*Diagnostic Radiographer*" is a protected title, and the Health and Care Professions Council maintains a list of the 25,000 registered persons holding this title (HCPC, 2020). In addition, the HCPC regulates fifteen health, psychological, and care professionals in the United Kingdom, realising this through setting professional standards, holding a register, quality-assuring education, and investigating complaints. The professions the HCPC regulates have one or more designated titles protected by law, and professionals must be registered to use them.

Since the 1990s, the training and subsequent registration with the HCPC are attained across the UK through gaining a BSc (Hons) or a pre-registration Masters (conversion course from another degree) at one of 26 diagnostic radiography programmes (SCoR, 2018). UWE Bristol is a recognised training provider with a cohort of 65 students joining the three-year undergraduate diagnostic radiography programme each academic cycle (UWE Bristol, 2018). For this profession, the regulatory body informs the curriculum content, ensuring the *"Standards of Proficiency"* are met for students to become registered professionals (HCPC, 2013). Other benchmarks which require consideration when undertaking this research, alongside the UWE Bristol enhancement framework, were the Quality Assurance Agency (QAA) for higher education benchmarks (QAA, 2001), the *"Skills for Health"* radiography occupation standards (National Occupation Standards, 2018), and the College of Radiographers (2020) professional body requirements. Established in September 2004, the College of Radiographers Approval and Accreditation Board (AAB) oversees the approval and accreditation activity undertaken by the organisation. The Board develops policies and advises on all aspects of approval and accreditation of programmes, individuals and departments

While there is an indicative national curriculum, there is scope for interpretation. Therefore, individual institutes have freedom in curriculum understanding and can develop their course ethos and aims by designing individual modules and local programme specifications. As per HCPC requirements, the programme undergoes annual monitoring to ensure it continually meet education and training standards and delivers the standards of proficiency. Programmes are

then reapproved every five years. For UWE Bristol, the most recent validation process started in July 2019, with the pre-Covid-19 go-live date for the new programme planned for September 2020. Approval and validation remain in place for five years. As demonstrated in ***appendix* 1**, this did not happen due to Covid-19, with the approval and validation moved from April 2020 to January 2021 and the new curriculum going live in September 2021. The impact of Covid-19 on the timeline for this thesis is explored further in chapter eight.

Traditionally, pre-registration students developed skills in conventional general x-raying. New graduates would typically spend the first two years consolidating this knowledge on qualifying. This mode of undergraduate training is in keeping with the current standards of proficiency (HCPC, 2013), with the one requirement for a registered diagnostic radiographer within these specialised areas of practice to carry out an unassited computed tomography (CT) head scan. All other technical procedures (ultrasound, nuclear medicine, mammography, magnetic resonance imaging (MRI), interventional radiology only require a registrant to be either aware of the procedure or assist with the procedure. After a one-year preceptorship, graduates would choose to work in conventional imaging or specialise in these areas (Westbrook, 2017). Practitioners would require further in-house training or postgraduate qualifications to undertake these roles, depending on the selected field.

However, as a diagnostic radiography educator, I note that the imaging landscape in diagnostic radiography education and the skills needed by graduate diagnostic radiographers is changing. This evolving skill need is partly driven by the increasing role of radiographer reporting, improved technology capability, and availability such as ultrasound, CT and MRI, imaging modalities. These diagnostic tools are central to enhancing several major health conditions, including stroke, respiratory disease, cardiovascular disease, cancer diagnosis, and cancer care pathways, all areas of care mandated in both the NHS England Long-term Plan (2019) and the Richards Diagnostic Renewal and Recovery Report (2020). However, this increasingly sits against a backdrop of evolving national policy, which seeks to expand people's choices and control over their care (NHS England, 2020). Hence, the curriculum's size

and the number of subjects to be covered, i.e., teaching technology, patient care, and patient choice, require consideration within a pre-registration diagnostic radiography programme. This need to be responsive to both a changing labour market and rapid production of knowledge echoes observations made in section 1.3, whereby Tyler (1949) emphasises that teaching goals should align with students' and society's needs.

This personal observation of a changing skills economy is supported by conclusions drawn in a national survey of radiology managers, which sought to ascertain the ‘fitness for purpose’ of diagnostic radiography graduates (Sloane & Miller, 2017). The term ‘fitness for purpose’ was first coined in seminal work conducted by Williams and Berry in 1999 and 2000. The authors sought to establish a competency model for newly qualified diagnostic radiographers acceptable to several key stakeholders. Using a Delphi method, they convened a national panel of fifty representatives, including radiology service managers, diagnostic radiographers, educationalists, radiologists, and diagnostic radiography representatives. The panel considered three terms: ‘fitness for award’, ‘fitness for practice’, and ‘fitness for purpose’, identifying nine themes. Here ‘fitness for award’ related to the educational preparation of healthcare professionals based in Higher Education whereby being awarded a degree is an established measure of achievement. ‘fitness for purpose’ is related to the employer's needs and what they deem as competency. Finally, ‘fitness for practice’ is linked to a diagnostic radiographer's registration, representing an endorsement of an individual's capabilities by the professional regulator.

Sloane and Miller (2017) identified four key themes of what needs considering in the modern ‘fitness for purpose’ agenda almost twenty years later. These are the curriculum content and structure, diversification in the diagnostic radiographer's role, professionalism, resilience, and career structures' reformation. Additionally, their study concluded that as medical imaging evolves, consideration must be given to new and innovative curriculum design. This call to action with curriculum design solutions was reiterated two years later in a review article by Sloane and Hyde (2019).

This assessment of the situation builds on several studies where the views shared by newly qualified UK graduates highlighted a gap between what new graduates had learnt during their training and the realities of working as a registered diagnostic radiographer (Harvey-Lloyd & Morris, 2020; McKay et al., 2007; Naylor, 2016; St. John-Matthews, 2010). While these studies with newly qualified diagnostic radiographers represent local studies with small sample studies, collectively, they draw the same conclusions from graduates educated at different Higher Education Institutes (HEIs) across England. When viewed together, they display the ongoing tension between what is taught within the pre-registration diagnostic radiography programme and what is required in the real-world working environment. It is essential to point out that these papers do not include service users or students as stakeholders. In addition, there appears to be a dearth of published peer-reviewed articles on the role of diagnostic radiography pre-registration students in curriculum design, with a single paper by Hyde (2015) located. This study critically evaluated student diagnostic radiographers' experience transitioning from the classroom to their first clinical placement and subsequently changed the first-year curriculum at a single HEI.

That is not to say service user input is not considered in the modern diagnostic radiography degree programme design process. Of note, Harvey-Lloyd and Strudwick (2018), in their review of service user involvement in a local pre-registration diagnostic radiography degree programme, outlined service users' roles across several areas from recruitment to assessment, including curriculum design. This review article built on previous research by the authors on the same topic, which recorded student perceptions of having service users share their stories in a teaching session (Harvey-Lloyd & Strudwick, 2013). However, there does appear to be a gap in the evidence base in the subject discipline of diagnostic radiography education in gaining service user perspectives in the curriculum design process. Therefore this area is further considered in chapter two.

This point about service users is important for two reasons. Firstly, it links to the original work by Berry and Williams (1999) that acknowledges that radiography

combines technical skill and patient care. Likewise, service user voice is an essential focus of the NHS Long Term Plan for England (NHS England, 2019). This national policy highlights the need to partner with service users and individuals to deliver personalised service user-centered care. Secondly, as JISC (2017) identified, a wide range of stakeholders is critical in curriculum design to support innovation and creativity. The latter is something Sloane and Miller (2017) advocate as the key to modernising diagnostic radiography pre-registration training, i.e. the need for innovation and creativity. Hence, common sense suggests that service users are worthy of considering in this thesis as curriculum design stakeholders. Furthermore, who better to challenge diagnostic radiography educators to consider how they are training diagnostic radiography educators than those who receive our student and graduate services? Consequently, service users alongside student involvement in curriculum design are considered in chapter two.

1.5 Introducing the organisation where the research was undertaken

Based on the above observations that pre-registration diagnostic radiography degree programmes have a national curriculum that can be interpreted locally, I assert that it is crucial to consider where the thesis research was undertaken. The theory of situated cognition postulates that how an individual behaves can be understood when viewed alongside the social system with which the individual aligns (Greeno et al., 1998; Greeno, 2011; Sarason 1991) noted that the behaviour of educators is deeply embedded in the system called school. I note for this research that this is the HEI where the research was conducted, and the following provides background on this.

UWE Bristol is a modern civic university located in Bristol, receiving university status in 1992. Its origins can be traced to the Merchant Venturers' Technical College, founded in 1595 by the Society of Merchant Venturers. According to the UWE Bristol strategy (2020), the University's ambition is to be recognised for its successful, impactful, and practice-oriented programmes, strong industry

networks and connections, agile working methods, and inclusive global outlook and approach. Four priorities anchor the strategy:

1. Outstanding learning
2. Ready and able graduates
3. Research with impact
4. Strategic partnerships, connections, and networks

Student involvement is seen as critical to the strategy delivery. In the UWE Bristol 2020 Strategy, the University states its ambition is to build a sector-leading student representation structure, ensuring students are part of the decision-making processes, informing the actions taken, including how curricula are developed.

At the time of conducting the research, in 2019, the Faculty of Health and Applied Sciences housed the Allied Health Professions department, supporting eight professions and fourteen programmes of study alongside various continuous professional development study days, courses, and modules. Professions hosted by the department were physiotherapy, sports rehabilitation, optometry, occupational therapy, physician associates, paramedics, therapeutic radiographers, and diagnostic radiographers. The current Faculty of Health and Applied Sciences was created in 1996 when the Avon and Gloucestershire and Bath and Swindon Colleges of Health Studies joined the University. This date is important for two reasons. Firstly, it is the first time diagnostic radiography was taught at the University. Secondly, at this time, diagnostic radiography education in the area moved from a diploma to a Degree. Hence UWE Bristol has trained diagnostic radiographers for almost 25 years. Subsequently, the local degree programme has undergone several internal and external programme revalidations, evolving from the original diploma training.

1.6 Exploring the local UWE Bristol curriculum design process

Combined with details of where the research was conducted, I insist it is crucial to share UWE Bristol's curriculum design process details. Providing these details is required because UWE Bristol adopts a university-wide policy to refresh and renew curricula across the institution. Named *Learning 2020* (UWE Bristol, 2016), this cross-institutional approach for curriculum co-design is rare, although it is becoming more common (Cleaver et al., 2017).

UWE Bristol learning (2020) is described as a flexible application to curriculum design that celebrates and fosters local programme distinctiveness, purposively shifting away from what can be perceived as abstract strategic change initiatives and tick-box quality assurance processes (Cleaver et al., 2017). This approach to curriculum design is anchored in the premise that teaching, like research, should be disciplinary "community property".

"Rather than seeing local distinctiveness as a barrier to sharing, we believe that a strong understanding of "why we do things the way we do" provides staff and students with the confidence to know what they bring to the interdisciplinary table, why they do things differently from others, and a willingness to seek out informed connections and build synergies" (Shulman, 1993, pp.5-6).

This local policy and process are enacted through the Enhancement Framework (EF) for Academic Programmes and Practice, which reflects the critical strands of Strategy 2020 and covers curriculum design, delivery, approval, and review of UWE Bristol, programmes and teaching, learning, and assessment practices. The Enhancement Framework is guided by six core design principles which state a programme of study should be:

- Programmatic by design
- Discipline and practice-oriented
- Scholarly and enquiry-based
- Inclusive and international
- Graduate attribute enabling
- Transformative for staff and students

The Enhancement Framework (UWE Bristol, 2021) consists of three interconnected phases - ***Figure 1***.

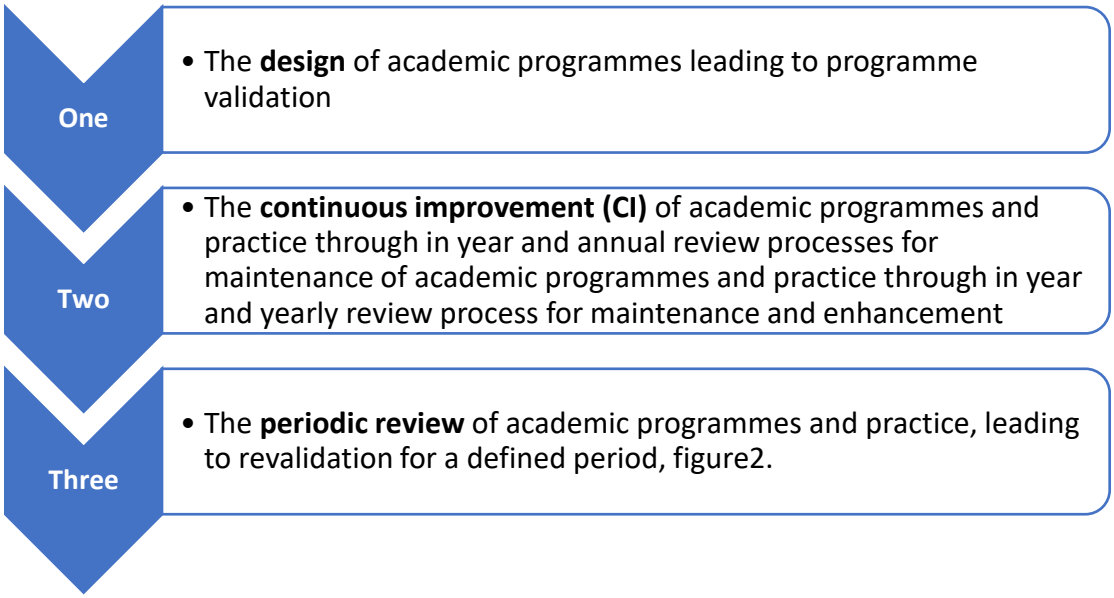


Figure 1. *UWE Bristol Enhancement Framework (EF) phases*

This thesis explores local processes and tools used to enable step two of the UWE Bristol curriculum design processes within the design phase of academic programmes, phase one of the enhancement framework, ***Figure* 1**. This approach is because step two is where stakeholders engage with the curriculum design process, ***Figure* 2**.

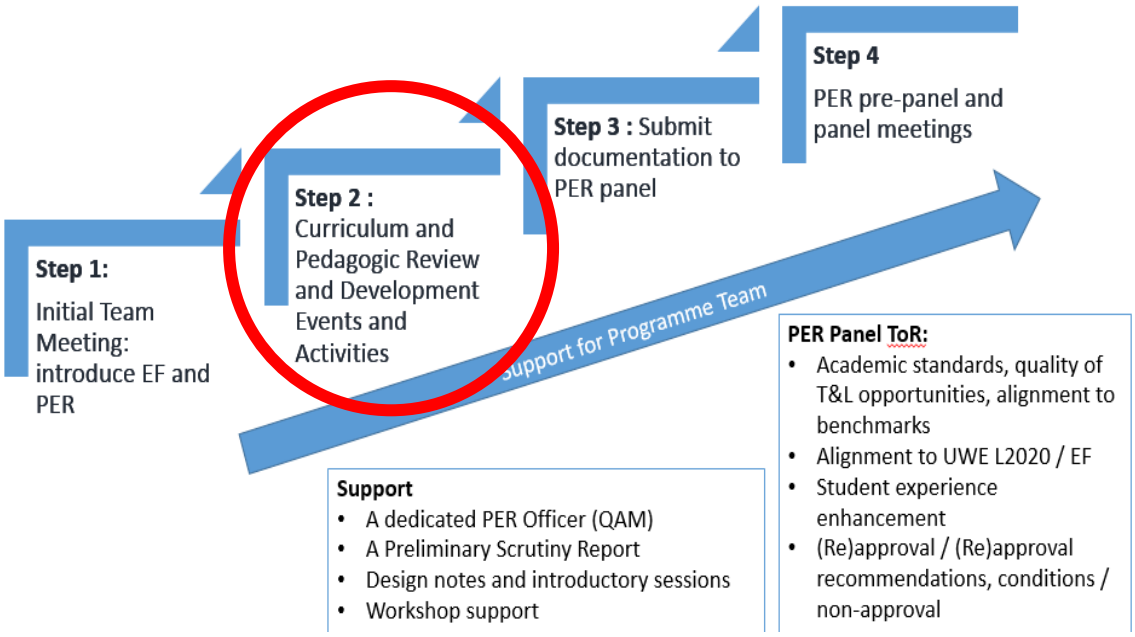


Figure 2. *UWE Bristol Enhancement Framework (EF) phase one steps*

For step 2 (curriculum & pedagogic review and development events), design workshops were undertaken, including generic design meetings (n=5), departmental themed workshops delivered as focus groups (n=10), and individual programme workshops (n=3). These ran from June 2018 to December 2019 with key stakeholders for this validation **- *appendix* 2.** The design meetings were conducted to oversee the programme development, review the documentation development, and engage relevant professional services in the design process. Conversely, the workshops enabled academic and professional services teams to consider the programme's aims and collect course design resources guided by ten themes. These included the following topics: the future of health and social care; inclusive curriculum; enterprise and employability; research; health promotion; simulation and technology-enhanced learning; sustainability; public patient involvement and engagement; personal tutoring systems. As previously noted, with health professions courses, once local University validation is confirmed, the programmes are presented for (re)validation by the regulator and the related professional body.

To ensure institutional support is in place to support this collaborative curriculum co-design, a key enabler discussed in section 1.2, several resources were in place to realise this activity at UWE Bristol. To support this approach, members of the programme team, including the programme manager and module leaders, were given allocated quantifiable time resources to engage with collaborative curriculum design via the UWE Bristol workload allocation management (WAMs) model. An Allied Health Professions executive department team member oversaw this process, responsible for teaching quality, acting as the project manager. Workshops were facilitated via an outside member of the programme team to support reflection on individual design choices so a group consensus could be achieved

1.7 Chapter summary

This chapter has introduced the reader to diagnostic radiographers and the tensions of ensuring that this professional group's current and future skills are

captured within a pre-registration programme curriculum, all of this being against the backdrop of regulatory requirements and national policy and drivers. The HEI where this research was undertaken, UWE Bristol, was presented with the curriculum design approaches and tools used locally.

There are benefits and limitations to collaborative curriculum co-design. Benefits include educator learning, educator buy-in before implementing a curriculum, building a cohesive curriculum, innovations including pedagogical approach and curriculum content. Concerning the latter concept of innovation, the value multiple diverse stakeholders bring to curriculum design was discussed. Limitations include the willingness for stakeholders to engage, knowing the limits of collaboration and who has overall responsibility for a programme design, the curriculum being changed on paper but not in practice, and how an unequal power balance can impact the extent and quality of the discussion. However, many of these can be overcome through institutional support of curriculum co-design through time, recognition, and resourcing.

The role and importance of stakeholders have been examined, including the challenges of identifying who stakeholders are for a programme of study. How to engage this broad group was considered. Two key stakeholders emerged from this appraisal, namely service users and students. Chapter two provides the opportunity to explore both of these groups. The reader will be introduced to the potential role of crowdsourcing, an instrument that originates from computer science, business studies, and policy development, in the curriculum co-design process of a local pre-registration BSc (Hons) Diagnostic Radiography programme.

CHAPTER TWO: Background

2.1 Chapter introduction

This chapter begins by considering the importance of including service users within health professions education. First, models of service user participation, including ladders, pathways, bridges, mosaics, and EDGEs (the embryonic, developing, gripping, embedded scale), are explored regarding historical development. Next, the language used to define a service user is investigated, and I seek to disentangle the term 'patient public involvement' (PPI). I then appraise how PPI is managed locally at the UWE Bristol Faculty of Health and Applied Sciences. Finally, local PPI activities are mapped to the EDGE tool to identify good practices and areas for improvement.

Given the commitment by UWE Bristol to ensure student representation across University activities, including curriculum design (UWE Bristol, 2015), students as HEI stakeholders are rationalised, and literature encompassing their role in curriculum design is considered. This is followed by an exploration of traditional stakeholder engagement tools used in the curriculum design process, focusing on these support stakeholder dialogue. The concept of crowdsourcing as an engagement tool is introduced, and how this technology could enhance curriculum design through supporting diverse stakeholder voices in design processes is examined. A discussion on the next steps for this research concludes chapter two.

2.2 Service users as health professions education stakeholders

Since the 1980s, developing through the 1990s, actively involving people in healthcare has become an essential strand of UK government policy, with 'hearing the patient voice' viewed by policymakers as a way to prevent failings in healthcare quality (Francis, 2013). This commitment is endorsed within the NHS Constitution (2001) and the NHS England Long Term Plan (2019), which lays out a vision to shift power to people. This policy highlighted that leaders

must work to engage people in improving healthcare alongside ensuring resources are available (funding and workforce). Similarly, international evidence (Fremont et al., 2001) recognised that service users are best placed to judge their experiences and support the preparation of health professionals. This is a view supported by Bennett and Baikie (2003), Debyser et al. (2011); DeMarco (2010); and Scammell et al. (2015).

However, actively involving people has not always been the case for health professions education, and it was not until the 2000s that people involvement became a core aspect of health professions curriculum. This change in approach can be pinpointed to 2003 when the Department of Health introduced a new qualification for social workers moving from a diploma to a degree programme. It is the first time that it was documented that those offering healthcare professions degrees needed to demonstrate people's involvement in programme design and delivery. This is seen as a pivotal drive for the use of service users in the social work curricula, and as a profession, Social Work has been instrumental in driving this agenda forward alongside mental health nursing (Levin, 2004; Minogue et al., 2009).

The literature shows that people participate in health professions education in numerous ways. People involvement includes recruitment of students (Vandrevala et al., 2007; Rhodes & Idha, 2011; Hadwen et al., 2016; Heaslip et al., 2018), service user-led teaching sessions (Agnew & Duffy, 2010); practice-based activities, assessments and course design (Rush, 2008; Strudwick & Harvey-Lloyd, 2013). Yet, the literature acknowledges there are challenges to engaging people, such as funding (Downe et al., 2007); accessing vulnerable groups to ensure representation (Matka et al., 2009) and power relationships between both groups (Felton & Stickley, 2004; Minogue et al., 2009).

2.3 Enabling participation, engagement, and involvement

There is no single widely agreed meaning for these terms. Work by Karsten (2011), which sought to collect information about different theories of

participation, logged thirty-six different models developed between 1969 and 2011. Here they wrote that the practice of engaging others could include consulting them for their opinions; listening and advocating for them; recognising and drawing on their experience; having an active dialogue or debate, and inspiring and encouraging them to become involved. Tritter (2009) defines service user involvement as how individuals draw upon their experiences or apply their priorities to evaluation, organisation, and delivery of health services.

The degree of involvement of service users can be characterised along a spectrum of participation from minimal involvement to full partnership. The HCPC (2017) states that by the phrase 'being involved', service users and carers must somehow contribute to the health professions education programme. However, the HCPC does not specify the exact areas where service users must be involved. Nor do they indicate the level of participation. Yet, echoing the previously discussed literature, they list areas of involvement such as admissions, selection, developing teaching approaches and materials, planning, developing the programme, teaching and learning activities, feedback and assessment, and quality assurance and evaluation. This section seeks to make sense of the complexity surrounding service user participation practice terminology. It does this by exploring the historical development of engagement models by mapping the evolution of key participation theories. The segment also considers what model is applied in practice at UWE Bristol.

According to Oliver and Pitt (2013), the most widely referred model is that by Sherry Arnstein, who, in 1969, developed a typology depicting a ladder of participation outlining eight stages in ascending order. The ladder identifies levels of involvement, ranging from formal government leaders manipulating the public, informing them, and consulting with them. In this model, the goal is for the public to have control of decisions made about their communities (Arnstein, 1969). This model has been cited by Harvey-Lloyd and Strudwick (2018) as a way to consider service user involvement in diagnostic radiography education. Yet Arnstein has acknowledged that this model has been criticised for being over-simplistic (Oliver & Pitt, 2013), recognising that the ladder does little to help us understand how to enable democratic participation. Burns et al. (1994)

continued by emphasising that the rungs on the ladder should not be equidistant. They also noted that it is easier to climb the lower rungs than to scale the higher ones. Despite these critiques, the model has been widely adopted and is seen as a seminal participation theory – ***Figure* 3.**

12	Independent
11	Entrusted
CITIZEN CONTROL	
10	Delegated
9	Partnership
8	Limited decentralised
7	Decision-making
6	Advisory bodies
5	Consultation
CITIZEN PARTICIPATION	
4	Customer care
3	Poor information
2	Cynical consultation
1	Civic Hype

Figure 3. *Ladder of citizen empowerment (Arnstein, 1969)*

The pathways of participation model developed by Shier (2001) moved the focus of who initiates participation from the participant to the organisation. Shier's model, which was initially designed to involve children and young people, has five levels of participation, with each level seen as discrete but interconnected. These levels are overlaid by three stages of commitment, as demonstrated in ***Figure* 4**.

STAGES	DESCRIPTION
Openings	A willingness to support people's democratic involvement
Opportunities	The procedures and activities within an organisation that support participation
Obligations	The infrastructure of policy that is built to enable democratic participation to become the norm

Figure 4. *Three stages of commitment (Shier, 2001)*

This model has also been criticised for implying a hierarchical process. However, Shier responded to these criticisms by pointing out that we seldom use a ladder to climb to the top in real life. Often, we just want to get to a rung some way up to work at the correct height for our job. Without the ladder, it would be impossible to climb to the appropriate height. Shier's (2001) model was crucial in shifting the emphasis towards a focus on what an organisation needs to do to create opportunities for participation. Barber (2007) conceptualises this process as creating an engagement zone where practitioners attempt to match the needs of service users with the appropriate level of support, pointing out a critical shift from blaming people for failing to participate in civic life to holding organisations to account for failing to develop tools to enable participation. Here enabling engagement can also be visualised via the idea of a bridge. Boylan and Dalrymple (2009) write that this is important as it considers how power can be negotiated and shared.

The bridge model has been used by Upward and Taylor (1995) to demonstrate effective user involvement in community care. The bridge represented the two-way flow of information from both parties who had equal power. Upward and Taylor (1995) viewed participation as dynamic and ever-changing. Therefore, the bridge needs a firm foundation supported by pillars of legislation and developing knowledge through theory and practice. They argued that the flow across the bridge needs to be continually developed in both directions through participatory ways of working. The bridge's strength depends on the policy agenda, time and resources allocated to maintain and develop it. Thus the bridge needs good maintenance and firm foundations.

Tritter and MacCallum (2006) proposed using multiple ladders, reflecting distinct categories of users, some with more rungs than others. Numerous bridges between the ladders are needed to allow diverse ways to contribute to suit the individual. This scaffolded approach thus captures the complexity of the situation. The mosaic enables service user involvement to be mapped and monitored through a zooming in and out approach. It brings attention to the types of people participation, the types of people involved, and the alignment with the various phases of decision-making involved. Rowland et al. (2020)

adapted the mosaic concept to health professions education, thus supporting organisations to map their current provision and subsequently identify gaps. They cross-reference the mosaic with a two by two 'types of involvement' model presented by Tritter (2009) - ***Figure* 5**.

	DIRECT	**INDIRECT**
Individual(s)	Individuals participating in a curriculum committee	Individuals participating in a focus group that will inform curricular decision making
Collective	Representative(s) of a patient group co-designing an education session	A patient group producing educational materials to influence current decisions making

Figure 5*.A health professions education mosaic of involvement (Tritter, 2009)*

The purpose of this was to clearly distinguish between the public speaking for oneself and the public speaking for others. There are also clear distinctions between acting directly or indirectly in decision-making. In 2018 the National Co-ordinating Centre for Public Engagement (NCCPE) designed the EDGE (embryonic, developing, gripping, embedding) tool to support discussion and dialogue within higher education institutions to help frame a strategy for supporting public involvement in education (NCCPE, 2020). This tool builds on a mosaic concept, layering this against three core focal points: purpose, process, and people - ***Figure* 6**.

THE EDGE TOOL SCALE	
E	**EMBRYONIC:** patchy or non-existent
D	**DEVELOPING:** unsystematic and non-strategic
G	**GRIPPING:** taking steps to develop a strategy
E	**EMBEDDING:** strategic and operational support in place

Figure 6. *The EDGE tool scale*

These three core items are subdivided into nine dimensions to help universities assess their current support for PPI and identify areas where they would like to see a change in health professions education and all subject disciplines. These dimensions are then mapped against the EDGE scale - ***Figure* 7**.

CORE ITEM	DIMENSIONS
PURPOSE	**MISSION.** Have you created a shared understanding of the purpose, value and meaning of engagement and embedded this in your strategy and mission? **LEADERSHIP.** Do you support champions across the organisation who embrace engagement? **COMMUNICATION.** Do you communicate consistent, clear messages to validate, support and celebrate it, and ensure open and two-way communication with internal and external stakeholders?
PROCESS	**SUPPORT.** How do you coordinate your support to maximise efficiency, target support, improve quality, foster innovation, join up thinking and monitor effectiveness? **LEARNING.** What opportunities do you provide for learning and reflection, and what support do you provide for CPD? **RECOGNITION.** How do you recognise and reward staff involvement within recruitment, promotion, workload plans and performance reviews, and how do you celebrate success?
PEOPLE	**STAFF.** Do you ensure that all academic and support staff have opportunities to get involved in informal and formal ways? **PUBLIC.** Do you proactively involve stakeholders/users/publics in shaping the mission and the delivery of the strategy and maximise opportunities for their involvement? **STUDENTS.** How are students involved, and what opportunities do they have to contribute their expertise and energy?

Figure 7. *The nine dimensions of the EDGE tool*

As per the mosaic approach, applying the EDGE tool is useful when demonstrating how a programme of study meets a regulator requirement as institutes can demonstrate where and how involvement occurs (NCCPE, 2018). The main reason for adopting the EDGE tool over the other options is because UWE Bristol and the University of Bristol (NCCPE, 2018) created the tool. The EDGE tool has been applied to all HCPC registerable programmes at UWE Bristol, including the diagnostic radiography programme. This activity gave a framework to plan, monitor, and evaluate people's involvement. However, the level of involvement that should be undertaken is unclear when applying the tool. I observe the wording used is similar to the regulator, the HCPC, with both using the word ‘involve’. In my view, this is a shortcoming of the tool.

2.4 Service users: Concepts, meanings, and terminology

At this point, it is helpful to consider the phrasing used to describe those who engage with healthcare. I deemed this important because the language used for this group could lead to a power dimension and hierarchy of control. If this existed, I needed to be aware of it alongside the impact of the discourse I adopted on the lens I viewed this work, the decisions I made during the research and my interpretation of the research findings (McLaughlin, 2009).

Oliver and Pitt (2013) present a range of words found in the literature to describe engaged stakeholders alongside a historical perspective of how these words have been viewed in the context of engagement activities – ***Figure* 8**.

A range of words and labels found in the literature and different professional practice contexts. These include:		
Resident	Young person	Stakeholder
Patient	Client	Citizen
Customer	Advocate	Expert by experience
Consumer	Member of the public	Carer
	Survivor	

Figure 8. *Who is a service user?*
(Oliver & Pitt, 2013)

They note that the literature is full of debates on the positives and negatives of the associated terminology. The regulator, the HCPC, describes 'service users' as those who use or are affected by the services of HCPC professionals registered and carers as those who have or currently look after family or friends in need of support. They write that these terms have been chosen to represent the diversity of the professions it regulates, and how people interact with each professional group. They highlight that in many professions, registrants will work closely with individuals who are the end-users of their services. In other professions, the registrant's contact with the individual end-users of their services and carers is less direct. In these professions, service users could include organisations or other clinicians, but they could also include groups such as patients who benefit from their work. I note that diagnostic radiography sits in this space.

Coulter (2011) argues that the term service user is clumsy, implying a relationship with an inanimate object instead of an active partnership. Subsequently, Barnes and Cottrell (2012) state that the term needs to be defined in each context. They continue by saying that when thinking about the language we use to describe user involvement, we need to be aware of its purposes and recognise that language is one of the sites of struggle in power relations between those who provide and those who use its services.

In contrast, the terminology used by the professional radiography body, the College of Radiographers (2018), is 'patient' and 'public', as is the wording used in the key current policy documents written by NHS England and NHS Improvement (2019). Furthermore, when those accessing medical imaging were asked what they should be called during the design of the College of Radiographers *'Patient Public Practitioner Guidelines within Imaging and Radiotherapy: Guiding Principles (2018),* those asked chose the term patients.

The term 'patient, and the public' captures two critical points. Point one is that not all patients involved in health professional education are ill or currently receiving care. This observation is supported by the Health Foundation (2011), which highlight that many healthy people have perspectives or experiences valuable to health professional learning. These include seniors, caregivers, and family members of people with chronic illnesses or disabilities, parents of children, people from specific ethnic groups, people who are marginalised (for example, the homeless or recent immigrants). They acknowledge that the term 'lay' may be more inclusive, but it defines people in terms of who or what they are not (a professional). Furthermore, it implies a lack of expertise.

Point two is that it is important not to confuse the term patient and the term public. Fredriksson and Tritter (2017) argue that patients have specific interests as health service users, whereas members of the public are engaged to reflect broader societal interests. Thus, although the 'people' might be the same, i.e. a patient is a public member, 'interests' represented by patients may be different from the interests represented by the general public. Furthermore, the problems of particular specific subgroups of patients may be unique. For

example, the main problem associated with participation research and peer work in psychiatry and care of those with HIV (human immunodeficiency virus) may be related to inequality and power imbalances debates in health and social care.

Conversely, conversations with patients with rare disorders may centre around access to treatments and ongoing medical research. In these scenarios, the interests of health professionals and patients may be strategically aligned. Furthermore, a patient may also be recognised as a public policy agent illustrated by a patient refusing to take antibiotics because this increases the likelihood of increasing antimicrobial resistance. Hence there is no singular patient perspective, just as there is no singular articulation of a unifying problem statement that unites all patient concerns.

PPI is often used within involvement research and design development policies without distinction between patients and the public. Being clear about the difference between involving patients and involving the public is vital if the design and implementation of involvement policies are to achieve the intended goals and not be counterproductive, thus resulting in mismatched expectations (Fredriksson & Tritter, 2017). Health professionals know intuitively that there are many patient voices, and it is my observation that radiography spans a spectrum of patient groups. Therefore, there are circumstances where these voices are in tension with one another.

Yet the term patient has conations with arguments against using this label, associating it with an inferior status alluding to passivity, the sick role and disempowerment (Coulter, 2011). Duffy and Etherington (2012) offer an alternative framework of service users being constructed as ‘ordinary citizens’ who are empowered to collaborate with professionals. Kvarnstrom (2012) builds on this, highlighting a scenario whereby a practitioner approaches working with service users that sees them as ‘fellow citizens’ alongside whom it is a privilege to work. This aligns with the idea of who holds the knowledge in the context of healthcare provision. Where professionals may have professional knowledge, it is noted that patients hold situational expertise and can be

classed as experts with experience. Eversole (2012) notes that situational knowledge is essential as it is this contextual knowledge that is vital for enabling development activity to succeed. However, Rowland et al. (2019) caution that this democratic framing can create its own problems. When activities such as curriculum design are framed as a right rather than a skill, the expertise of educationalists is potentially erased. This kind of erasure risks creating a dynamic of mutual powerlessness, where educators and patients alike struggle with the types of contributions which patients in decision making spaces can make. As explored in chapter nine, the word citizen raises another issue as not everyone living in a country will hold citizenship, and equally, citizens of a country may live outside of the country. Of note, those within a country will include refugees, migrant groups and travelling communities. To use this word eliminates these marginalised communities from this research.

For this Doctorate, I use the term 'patient public participation' and specifically the phrase 'patients, and the public'. I have chosen to write the phrase with an oxford comma after the word patients to remove the ambiguity of my use of the phrase in this thesis. This, therefore, aligns my use of the phrase with the explanation given by Fredriksson and Tritter (2017), whereby they highlighted the individual and collective roles of both groups and how these can differ. On writing this section, I reflect that it is unlikely there will be a singular universal term for describing those who engage with healthcare. I just need to be aware of my viewpoints on the topic, something explored further in the reflective account in chapter nine.

2.5 Patient public involvement (PPI): The UWE Bristol programme

In 2019 when conducting this research at the Faculty of Health and Applied Sciences at UWE Bristol, 100 registered patients supported education across the entire portfolio of healthcare programmes, supporting 2,750 learners through ad hoc hours. Additionally, academic staff acted as Faculty PPI leads – one for research and one for teaching and learning. Their role was to provide strategic leadership in this area, support academic and research staff by engaging the

public in their activities, and oversee the PPI activities happening across the department. A PPI administrator supported this work. As a unit, this team supported direct PPI across teaching and research areas, including recruitment, selection, teaching, sharing stories and assessment. Within the Department of Allied Health Professions, a part-time academic team member was a cancer lived experience expert who supported programmes with recruitment activities, sharing their lived experiences with students and acting as a standardised patient in simulation activities.

Mapping the EDGE tool to activity at UWE Bristol, it is apparent that although there are mechanisms to support PPI across the diagnostic radiography curriculum, input into curriculum design is one-dimensional, with a single PPI representative supporting the design phase. Hence the input into the design of the degree programme could be described as embryonic (patchy). This local experience of PPI echoes the broader health professions education literature. The aim would be to move this to embedded, i.e. PPI is fully operationalised in curriculum design processes with a range of representatives. It is crucial to have PPI in all health profession training programmes. Notwithstanding, it is worthy of considering this in the context of diagnostic radiography and the nuances of patient care within this professional group. Linking back to research by Penuell (2014) on the need to continually seek to offer opportunities for all stakeholders to participate and the NHS Long Term Plan (2019) aspirations of reducing health inequalities, there can be no doubt that including a range of patients, and public voices in curriculum design and delivery, notably those not typically 'at the table' can support the development of this understanding.

Whilst PPI is a regulator requirement (HCPC), it was not a listed criterion for the College of Radiographers (CoR) Approval Accreditation Board (AAB) in 2019 when this research was undertaken. Nevertheless, Harvey-Lloyd and Strudwick (2018) highlighted that anecdotal evidence suggests AAB assessors look for PPI when validating and revalidating diagnostic radiography courses. Also, the engagement of the patient, and the public in educating the radiography workforce is highlighted in section 3 of the CoR (2018), "*Patient public*

and practitioner partnerships within imaging and radiotherapy guiding principles" professional guidance document.

Chau (2020) highlighted that as a society, efforts must be made to ensure that all patients have equitable access to an excellent quality health service. They concluded that culturally competent care is key to day-to-day radiography practice. Although cultural competency applies to all healthcare fields, it is particularly complex in diagnostic radiography. As described by Andersson et al. (2008), the role of the diagnostic radiographer encompasses a variety of components – from caring for the patient to handling and operating technical equipment with limited time to convey instructions.

Correspondingly those being imaged; patients, can find themselves in stressful and unfamiliar environments. As early as 1978, Fengler noted these contradictory roles as technologist and carer. Diagnostic radiographers are also faced with the challenges that they rarely reencounter the same patient, unlike other health professionals, thus seldom building a rapport beyond the episode of care (Strudwick et al., 2011). This uniqueness in the patient episode makes it difficult to extrapolate what good patient care looks like from research linked to other healthcare disciplines.

Harvey-Lloyd and Strudwick (2018) emphasise that diagnostic radiographers must feel comfortable interacting with and caring for patients from diverse backgrounds and cultures, supporting the individual needs of every patient they may encounter in their professional role. Comparing the 2001 and 2011 National Office for Statistics (ONS) dates, they emphasise the increases in ethnic characteristics such as Asian/ Asian British and 'white other', including individuals from Eastern European (ONS, 2011). They continue by highlighting that not only is the UK diverse in terms of ethnicity, but the population is also made up of various protected characteristics such as sexual orientation, disability, and faith alongside different ages and genders.

Chau (2020) notes that the mechanics of teaching diversity and cultural competency in radiography is through the term 'adaptive technique', which is

often introduced after learners have learnt the basics. I note that this approach sits within Bruner's (1960) spiral curriculum, whereby there is an iterative revisiting of topics, subjects, or themes throughout the degree programme. This works in practice because early teaching and learning sessions are about learning how to image and support an average presenting adult. Then as the course progresses, this is expanded to learning how to make modifications to radiographic techniques (Carroll & Bowman, 2013). These teaching episodes include emphasising communication skills, imaging techniques and expressions of nonverbal cues when imaging patients from diverse cultural backgrounds and patient groups such as children or those with medical conditions such as Parkinson's, dementia (Bleiker et al., 2018). This offer aligns with the HCPC Standards of Proficiency (HCPC, 2013) which states that radiographers should build relationships with patients based on respect to provide optimal care despite personal differences:

Standard of Proficiency 5: *Radiographers must be aware of the impact of culture, quality, and diversity on practice* (HCPC, p8, 2013)

Standard of Proficiency 6: *Radiographers and must practice in a way which focuses on non-discriminatory practice* (HCPC, p9, 2013)

Tritter and McCallum (2006) wrote that whilst accepting that patients are not homogenous, placing diversity in rigid terms of disability, socioeconomic status, and ethnicity offers a limited conceptualisation. I note that applying a lens of intersectionality, how race, class, gender, and other individual characteristics 'intersect' with one another and overlap, can support us in delivering personalised care as this acknowledges that diversity is a complex construct. The term intersectionality emerged when Black feminists began to speak out about the middle-class whiteness of mainstream feminism because they felt that it was difficult to identify with the issues of the (white) feminist movement. Crenshaw (1989) stated that to understand the oppression of Black women, it is necessary to look at the intersection of Blackness and womanhood. While many who championed intersectionality early on were African American women, the term has proven essential to understanding a wide range of individuals' differences, including sexual orientation, age, class, physical ability, and more. Thus intersectionality is how race, class, gender, and other characteristics intersect.

Intersectionality operates as an observant of power imbalances and the tool by which those power imbalances could be eliminated. Educating future practitioners on equality and diversity is even more relevant, as is the need to capture multiple diverse voices in education activities. Without an intersectional lens, events and movements that aim to address injustice towards one group may perpetuate inequities towards other groups.

2.6 UWE Bristol students as stakeholders in curriculum design

The UWE Bristol Strategy 2020 commits to having students involved in all aspects of the university, including curriculum design. At UWE Bristol, students were not formally included in the diagnostic radiography curriculum design process of the new 2021-2026 curriculum. However, between 2014 and 2019, the diagnostic radiography programme team did hold regular Student Representation Staff Forums (SRSF) where elected student representatives and the academic team reviewed curriculum structure. Here nine representatives, three per year group, represented the voice of 172 learners. This indirect approach is not unusual for either the subject discipline of diagnostic radiography or other subject disciplines across UWE Bristol.

This observation, students' lack of direct involvement during the periodic curriculum review phase, aligns with a national report commissioned by the UK professional body for University Educators, Advance HE (Healey & Healey, 2019). The report acknowledges that engaging students in curriculum design is perhaps the least developed area of student partnership activities (Healy & Harrington, 2018). Yet, the evidence supporting this claim is weak as the report references descriptive case studies rather than empirical research. I recognise a similar trend in published diagnostic radiography education literature whereby there is a lack of research about the involvement of the students in periodic pre-registration curriculum revalidations. Of course, this does not mean the activity is not happening. All it demonstrates is that those undertaking this activity are not researching or publishing on the endeavour.

These observations raise the question of whether students want to be involved in the curriculum design process. Whilst I did not ask this question of UWE Bristol diagnostic radiography students, Geraghty et al. (2019) highlighted that there is limited research on how students perceive these opportunities in health professions education (Fetterman et al., 2010; Hsieh et al., 2015; Yengo-Kahn, Baker et al., 2017). In their survey of medical students at a US University (753 students across five-year groups), 563 students responded to their questionnaire on the topic. The results identified support for the opportunity to engage with this aspect of their course. It is not easy to ascertain if this research from the US is transferable to England. However, there are similarities as students in both countries pay for their pre-registration health professions education.

At this juncture, it is worth considering the language used to describe those who access tertiary education as was previously undertaken for patients, and the public. Biesta (2010) alerts us to how the words we use are multi-layered so that using one particular word can influence the power dynamic between students and educators. Furthermore, as per the patient, and public conversation, many words describe students and their roles – ***Figure* 9**.

A range of words and metaphors that can be found in the literature and different professional practice contexts. These include:	
Student	Learner
Undergraduate	Pupil
Postgraduate	Student as producer
Novice	Student as partner
Trainee	Student as co-creator
Apprentice	Student as a change agent

Figure 9. *Who is a student?*

The context in which health professional students are taught is changing at an unprecedented rate (Buckley, Fell & Draper, 2018). The most notable change in England is replacing allied health professional student bursaries (including diagnostic radiography students) with student loans. This change in student funding is further compounded by the metrics used to measure a programme's success. Namely, the National Student Survey (NSS, 2019) and the Teaching Excellence Frameworks (Office for Students, 2019). As highlighted by Robinson

and Sykes (2014), these metrics frame those who access degree education as customers, with a degree the final product of the transaction. Moreover, academia is framed as a service provider rather than an educator. Subsequently Robinson and Sykes (2014) argue for the need to construct those accessing degree education as learners. Here learners are positioned in an equal knowledge transfer relationship with learning and development considered items to be measured and valued (Leathwood & O'Connell, 2003).

Yet a survey by Tomlinson (2017) conducted across seven institutes identified that whilst most individuals accessing degree education were ambivalent to paying for their education, some did see it as a way to hold universities to account when they perceived that they had had a poor experience. My view echoes these findings whereby viewing students as consumers may offer some students agency. Moreover, Biesta (2010) states that whilst the phrase learners can be seen as a way to liberate the learner, first from the teacher and then the broader educational system, to call someone a learner suggests an inequality between those who have learned and those who still need to learn. Similarly, Biesta (2010) challenges the word student whereby the educator demands effort from the student and verifies the effort made.

Given these differing viewpoints around terminology, Dollinger and Mercer-Mapstone (2019) offer an alternative way of how those accessing degree education can be viewed, albeit they frame these individuals as students. Here four metaphors are proposed when considering the roles students can play in the university environment: students as producers, students as co-creators, students as partners, students as change agents. Martens et al. (2019) write that it is essential to consider these terms to better understand the process and outcomes of student participation, thus supporting the selection of appropriate approaches. However, they acknowledge that these terms can be used interchangeably, thus leading to confusion.

The metaphor 'students as producers' recognises that in HEIs, all knowledge is produced by those who interact in the University communities, including students (Hennig-Thurau et al., 2001). Using this term also highlights students'

intellectual value to higher education (Neary & Winn, 2009). 'Students as co-creators' further posits that students have valuable perspectives, ideas, and experiences. Conversely, this phrasing highlights the difference between students as producers and co-creators. Whereas students as producers could be framed as describing individual and group processes, the metaphor of students as co-creators describes only group endeavours.

The metaphor of 'students as a partner' has been defined as a reciprocal collaborative process whereby all participants have the opportunity to contribute, although not necessarily in the same ways (Cook-Sather et al., 2014). The phrase is seen as a way to reconceptualise relationships between staff and students, seeing the relationship as a space for mutual empowerment. The term 'students as change agents' describes processes akin to those in partnership but replaces the leadership and agency within the student's domain (Kay et al., 2010). The term describes work initiated, designed, and led by students either alone, with other students, or with staff (Dunne & Zandstra, 2011). Dollinger and Mercer-Mapstone (2019) highlight that this phrasing presents a pushback against the positioning of students as consumers, and is the rarest form of the different student roles.

For this Doctorate, I use the term student as the most cited in the literature, although I am uncomfortable with this word. The choice of this word is important as it frames how I view the design process and the tools used to achieve this, as will be explored in section 2.8. To counterbalance my hesitancy with the word student, this research considers 'students as partners, who add value to the curriculum design process given their insights as individuals currently accessing the diagnostic radiography degree programme. As previously discussed with patient, and public involvement, this approach acknowledges the individual and collective intersecting understanding students bring to curriculum design and ensures they have the tools to do so. Equally, it is critical to consider how students see themselves so as not to close off pathways to engaging students in relevant ways.

Regarding how to support student participation, it is self-evident that the arguments surrounding this concept reflect those noted about the involvement of patients, and the public in all aspects of healthcare. Likewise, the drivers for student engagement are multiple and should consider economic, organisational, political, and social contexts (Healey & Healey, 2019). Several points are worth mentioning linked to why student engagement is important. Firstly they see things from a learner perspective, it is motivating for them, it gives them a sense of ownership for their learning and given their lived experience, they can advise on structure and sequence (Healy & Healy, 2019). Secondly, the existing models of participation for students are not as vast as those for PPI. Models for student participation include the onion model of Druin (2002), which describes four roles: students as users, testers, informants, and design partners. This model was followed by the ladder of student participation proposed by Bovill and Bulley (2011). Finally, the Advance HE Framework for student partnership produced by Healey & Harrington (2014) was developed to engage students as partners. My view is that I need to be careful not to make the simplistic assumption that applying these models will lead to student participation.

2.7 Tools to support involvement in curriculum design processes

Given the importance articulated in this chapter of capturing multiple diverse voices in diagnostic radiography curriculum design, I deem it important that all people (staff, students, patients, and public) are fully embedded in the processes – ***Figure* 10**.

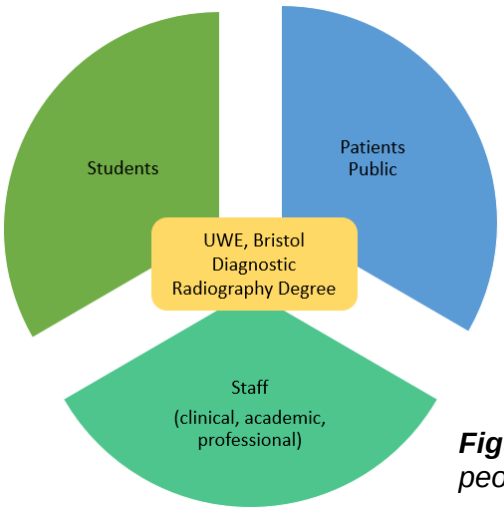


Figure 10*. Involvement of all people (public, staff, learners)*

To do this, an opening to engage is required using a tool that offers an equality of opportunity for everyone to share their ideas. The following section explores the traditional tools available to realise this and how these tools are used to operationalise engagement. These tools are considered against a backdrop of the three barriers to engagement for external stakeholders. These barriers include funding (Downe et al., 2007), accessing vulnerable groups to ensure equity of representation (Matka et al., 2009) and power relationships between academics and patients (Minogue et al., 2009; Felton & Stickley, 2004).

When designing health professions, curricula tools reported in the literature to engage stakeholders are focus groups (Merton & Kendall, 1946), the nominal group technique (Van De & Delbecq, 1971), world cafes (Brown & Isaacs, 1995) and the Delphi method (Helmer- Hirschberg, 1967), each having advantages and disadvantages. There is some literature on engaging stakeholders in diagnostic radiography curriculum reviews (pre-and post-registration) using these tools, with the most common tool adopted being the Delphi method (St. John-Matthews et al., 2017).

A focus group allows a group of experts to come together and discuss an issue and emerged from the discipline of market research. Advantages of this tool are complete responses, clarification through follow-up questions, captive subjects, and it takes fewer resources (time and effort) than individual interviews. Furthermore, people are more aware of their perspectives when confronted with an active challenge (Ramaul, 2010). Even so, this can be a disadvantage, as individuals in a group scenario may conform to group responses, and there may be issues with some members of the group being reticent. Therefore, focus groups require a skilled facilitator, especially if there is one vocal participant.

On the other hand, the Nominal Group Technique (NGT) is used to identify specific topics or problems. This technique was developed by Van De and Delbecq (1971) to support the effectiveness and efficiency of work programmes within various sectors. It was first applied by Sink (1983) in health service planning. NGT works on the principle that working with a group allows solutions to be

thought out, analysed, and implemented plans to be considered. A trained facilitator uses a highly structured format to gather information from all group members whilst still permitting individuals to rank the importance of the group's discussion topics. This approach means issues with group dynamics are reduced, although they are not eliminated.

Other NGT advantages include the development of a range of ideas. More recently, following the Covid-19 pandemic, there has been increased reporting of conducting the NGT online (Michel et al., 2021). Nevertheless, whilst it is a good stand-alone technique for simple issues, it needs to be combined with other techniques where concerns are more complicated or affect people outside the group's sphere of influence. Also, group members have to make themselves available for a required time on a specific date (Williams et al., 2006). Finally, for an NGT to be successful, those in authority must accept the conclusions of the activity.

Ledwith (2010) described world cafes (WC) as a way of working with large numbers of people where small dialogical groups have discussions at different tables and may move between tables for deep participative conversations. Developed by Brown and Isaacs (2005), it is a participatory tool that seeks to uncover the ideas and opinions of community members. In a review and application of WC as a method to gather qualitative data, Lohir et al. (2020) found that the WC could be added to the toolbox used by qualitative researchers. They documented that WC is well suited to collect the views and perceptions of a large group of people over a relatively short period of time and is resource-efficient. WC also helps explore and verify themes over a large number of participants. However, similar to focus groups and the NCT, there remain concerns with participant anonymity and how this impacts the final decision. Equally, people need to take part physically.

Russell et al. (2020), when considering the wider context of patient public involvement, note that the mechanisms used in traditional PPI meetings such as time control slots to speak and pre-set agendas serve to ensure patient discussions are contained. They wrote that adopting these approaches can

perpetuate power imbalances rather than empowering patients, and the public. My observation is that many of these elements can be found in the tools listed above. Thus, these approaches run the danger of having the opposite effect rather than being empowering. Komporozo-Athanasiou et al. (2018) concurred, stating that the structure of meetings that many PPI organisers employ in terms of orientation, time, and content can ensure that the PPI is directed towards researchers' aims, namely, generating grant income and research papers.

The Delphi technique was devised at the beginning of the cold war to anticipate the impact of technology on combat. At the time, shortcomings of traditional forecasting methods were recognised, including theoretical approaches, quantitative models, focus groups or trend exploration (Research and Development Cooperation, 2016). Hence, the Delphi technique was developed because individual statistical predictions were more structured than unstructured face-to-face group predictions. The classical Delphi technique consists of two or more rounds of questionnaires administrated to an expert panel. The first questionnaire asks opinions in an open-ended manner, thus collecting qualitative data. Responses are analysed by the researcher(s) and returned to the 'experts' in a series of rounds that collect quantitative data. Statements are ranked using a Likert scale, and rounds continue until a consensus is reached on some or all of the items (Von der Gracht, 2012). Each round is supported by controlled feedback from the researcher(s). Consensus reached using this technique does not mean that the correct answer has been found but rather that the experts have come to an agreement on the issue(s) being explored (St. John-Matthews et al., 2017). Over time, the technique has evolved, with Kenney (2009) proposing ten distinctive categories.

The ability to contribute to an online e-Delphi, outside of a set time and physical meeting place can alleviate issues of group dynamics and anonymity posed by focus, NGT, interacting groups and world cafes. Although total anonymity cannot be guaranteed as respondents may know each other, their judgements and opinions are kept anonymous, and only the researcher has access to this information (Keeney et al., 2011). Anonymity is the ability of group members to contribute comments without being identified (Dennis et al., 2001). Research

has shown that anonymity in the online environment is vital, as when participants are aware of the background of an individual who contributes knowledge, biases are introduced based on assessments about expertise, credibility, power, and influence, and this may impact participants' willingness to contribute new knowledge (Whitehead, 2007).

However, the method is also not without challenges. The purpose of the Delphi technique is to capture opinion in a formal structured way; however, this provides a challenge in defining who these individuals are (St. John-Matthews et al., 2017). It is argued that those invited to input into a Delphi need expertise of the topic under investigation. Some studies have looked at self-rating expertise as a valid method of identifying panel members (Dalkey et al. 1970; Best, 1974; Rowe & Wright, 1999). Others have found the opposite, Brockhoff (1975); Larréché & Moinpour (1983). While these studies provide useful observations, the approaches adopted by them link more to ways of measuring expertise rather than the role of experts and the impact of involving key experts on the accuracy of the final output.

Taking a global view of all the tools evaluated, I note that Maguire and Britten (2017) cited studies that suggesting organisation led involvement encourages a particular type of individual to participate, specifically those who feel comfortable with the formal business formats. This means that those involved in health research are predominantly white, middle class, retired people, often from a health or research background. Thus, I argue that if there is a homogenous type of person engaging, these tools perpetuate the power imbalances explored when discussing intersectionality. Without disregarding the vital role these tools play and the advantages they have, it is my view that it is essential to consider what other tools might be available to support endeavours to ensure a diverse range of people participate in the healthcare curriculum design process.

2.8 Introducing crowdsourcing

Crowdsourcing is a computer science, policy development and business technological enabler that works through an institution outsourcing a function usually performed by an employee or group of individuals (Howe, 2006) whereby crowdsource users, known as the crowd, form a spontaneous community who undertake a task which typically involves the pooling of knowledge resources. Subsequently, the crowdsourcer can use the knowledge and expertise of many users to complete the task (Borras & Edquist, 2014). From this, the participants (known as crowdworkers) receive the satisfaction of economic, social recognition, self-esteem, and the development of individual skills. Crowdsourcing involves the crowd working through online activities such as facilitated workshops. Providing this online means individuals are not confined to physical space and set times, alongside being deemed a quicker engagement activity (Schenk & Guittard, 2009), addressing issues seen with more traditional involvement tools described above. Furthermore, this form of self-selecting open call engagement, whilst not necessarily representative of populations, provides to seek equality of opportunity to engage.

Using the 'wisdom of the crowd' has been in place for centuries. This activity can be traced to Aristotle in the 4th century, who explored the concept in his work titled *"Politics*" (Lord, 2003). This, writes Howe (2006), is the phenomenon where groups of people outperform individuals who work alone to solve a problem or design a product. Another significant pre-technology crowdsourced activity is the development of the marine chronometer by John Harrison in 1774, an innovation that came to fruition through the government-sponsored longitude prize (Hern, 2002). Nevertheless, crowdsourcing continues to evolve and, in the digital age, involves an open call through a participatory online activity, providing broader access to people internationally, in less time and at a reduced cost compared to traditional methods (Schenik & Guittard, 2009). This crowd work should not be confused with crowdfunding (raising monies via a crowd), crowdlearning and crowdtuition. Crowdsourcing approaches also differ from big data analysis, whereby Wynne et al. (2007) observe that unlike big

data analysis, where minority opinions or behaviour can get lost, crowdsourcing through the data analysis methods adopted often enables dissonant voices to be captured.

Brabham (2013) proposes four dominant problem-solving crowdsourcing classifications: knowledge discovery and management, broadcast search, peer vetted creative production and distributed human intelligence (HIT) – ***Table* 1.** Many of these types of crowdsource activities use commercial products.

Table 1. *A problem-focused crowdsourcing typology*
(Brabham, 2013)

Type	How it works	Kind of problems	Examples
Knowledge discovery and management	Organisation tasks a crowd with finding and collecting information into a common location and format.	Ideal for information gathering organisation and reporting problems such as the creation of collective resources.	See ClickFix *Seeclickfix.com*
Broadcast search	Organisation tasked crowd with solving empirical problems	Ideal for ideation problems with empirically provable solutions such as scientific problems	InnoCentive *Innocentive.com* Goldcorp Challenge *Defunct*
Peer-vetted creative production	Organisation tasks a crowd with creating and selecting creative ideas	Ideal for ideation problems where solutions are matters of taste or market support such as design or aesthetic issues.	Threadless *Threadless.com* LegoIdeas *ideas.lego.com*
Distributed human intelligence tasks	Organisation task, the crowd with analysing substantial amounts of information	Ideal for large scale data analysis where human intelligence is more effective or efficient than computer analysis	Amazon Mechanical Turk *MTurk.com*

However, it is worth noting that examples of applying this tool in the digital environment for UK health problem-focused projects often adopt a hybrid

approach. These crowdsourcing approaches include a mixture of a peer-vetted creative production approach whereby an organisation tasks a crowd to create and select innovative ideas and knowledge discovery, and a management approach whereby an organisation tasks a crowd with finding and collecting information into a shared location. Examples include the *"Allied Health Professions into Action: Using Allied Health Professions to transform health, care and wellbeing*" online resource (NHS England, 2016) and the *"Mind the Gap"* project (Health Education England, HEE, 2017). The Academic Health Science Networks (2018), writing about patient public engagement in a digital age, cite two further examples. One with the company 'Designability' based in Bristol who worked with healthcare professionals, the public and designers to co-create new products and devices for those with challenging health conditions to improve independence and quality of life. The other project worked with those in South London with dementia to identify initiatives improving dementia services, the challenges, viable solutions and any opportunities to improve health outcomes, care experience or reduce costs. Here the Academic Health Science Network concludes that both case studies demonstrate the pioneering use of crowdsourcing by health organisations to reach out and engage with large numbers of the public.

This link to a hybrid approach becomes apparent when these projects are explored in detail. For example, for *"Allied Health Professions (AHPs) into Action",* 1,949 healthcare practitioners and members of the public across diverse geographic locations were involved in the resource design through the sharing of 16,128 ideas, comments and votes. Contributors were also asked to share case studies of local best practices. Subsequently, the publication highlighted the transformative potential of AHPs, examples of innovative AHP practice and a framework to develop local delivery plans. From here, the national NHS England strategy for AHPs (2016/2017 – 2021/2022) was formed, and a repository of best practice clinical practice case studies were created.

Nonetheless, crowdsourcing is not without challenges, with the term crowd historically conjuring negative meanings, e.g., riots, mob mentality and looting (Pripic et al., 2015). Thus, administrators of a crowdsource need to be aware of

crowd-hijacking where a group respond to the initiative to pursue its own agenda (William et al., 2016). An example of this in popular media is the Natural Environment Research Committee (NERC), requesting that the public name their new research vessel with the most popular name being ‘Boaty Mcboat Face’ (Wilson, Robson, & Botha, 2017). Despite these challenges, carefully executed crowdsourcing campaigns can be valuable exercises that allow organisations to engage with stakeholders to elicit current ideas (Taeihagh, 2017).

In chapter one, we considered the JISC (2016) definition of curriculum design which describes the activity as a high-level process that defines the learning within a specific programme of study, leading to a specific unit(s) of credit or qualification. Within the JISC report, it was acknowledged that since the introduction of fees for degree education in England, the cost of curriculum design processes and their outcomes had been brought into focus. Here it was observed that established traditional methods of curriculum design work against the agile, responsive curricula required by 21st century institutions, students, and employers. The report notes that enhancing aspects of the curriculum design process can help universities gain a competitive advantage, and they recommend using technology to realise this. Not only are there cost-benefit opportunities of using technology, but they note an opportunity to harness new ways of visualising, capturing and discussing designs that may bring originality and collaboration. The latter is important as JISC writes that their experiences indicate that curriculum design has historically been a risk-averse, insular process. Another advantage they note is how we engage stakeholders in this activity, whom they believed can only enrich designers’ understanding of what makes a design effective and help institutes recognise and address broader challenges. This is coupled with new ways of enabling conversations that can be commenced and sustained from a distance.

Of course, championing technology in this way will be of interest to JISC (2016). They are a not-for-profit organisation whose role is to support higher education institutions and research, including post-16 education, by providing network and IT services, digital resources, relevant advice, and procurement

consulting while researching and developing new information technologies and modes of working. Yet, having explored traditional tools described in this section and explained what crowdsourcing is (and is not) it is possible that the advantages of crowdsourcing could potentially address the benefits described by JISC when seeking to enhance curriculum design with technology.

For this work, cross-referencing crowdsourcing to the language used for patient, public, and student involvement models is problematic because, as aforementioned, the tool originates from the disciplines of computer science, business, and social sciences. Taeihagh (2017), in their review of the literature of policy design, are clear to state that when crowdsourcing is mapped to every policy tool application according to Hood's NATO model (Hood, 1986), crowdsourcing should be considered a technological enabler rather than a definitive means of co-production in public policy development. Hood argued that governments have four resources at their disposal – nodality (meaning the resource that existed simply by nature of the fact that governments existed at the 'centre' of social and political networks, but which can be thought of as 'information' or 'knowledge', authority, treasure, and organisational (NATO) – and can utilise those resources for either of two purposes – to monitor society or to alter its behaviour. In Hood's scheme, instruments are grouped according to which of the NATO resources they rely upon for their effectiveness and whether the instrument is designed to effect a change in a policy environment or to detect changes in it.

Still, Taeihagh (2017) concluded that crowdsourcing as an enabler to participation is worthy of further research given the speed, ease and rate of participation and the ability to increase access to the dispersed knowledge of the crowd. Likewise, in reviewing the co-creation of services literature to form a definition of co-creation in the services sector, Oertzen et al. (2018) hold a similar view. They see crowdsourcing as a co-ideation and co-design tool within the wider co-creation model of co-ideation, co-valuation, co-design, co-test, co-launch, co-production, and co-consumption. I argue this would suggest that whilst crowdsourcing can fulfil the citizen participation component of Arnstein's

(1969) ladder of participation, it is likely to sit on rung five at the consultation and advisory board level.

2.9 Problem statement

The diagnostic radiography profession wishes to ensure a diversity of voices are captured in all education activities. Given the embryonic level of patient, public and student participation in the current local diagnostic radiography curriculum design processes, researching the role of a tool that could enable more expansive access is a worthy endeavour. JISC (2016) supports this viewpoint championing the role of digital tools within the curriculum design process as an opportunity to balance the benefit to the organisation, time, and speed, with capturing stakeholder voices that may bring new insights. Crowdsourcing potentially meets HCPC requirements and the JISC aspiration of involving numerous stakeholders in the curriculum design process. It also possibly supports the ambitions within wider education research to democratise innovation, thus eliminating inequalities in what we teach. This could be achieved through curriculum design processes that include a wider range of stakeholders. Thus together, these elements lend weight to researching crowdsourcing as a tool within the curriculum design process.

2.10 Chapter summary

Chapter one identified three groups of stakeholders that required further investigation regarding local diagnostic radiography programme curriculum design processes – students, patients, and the public. It is an opportunity to ensure training programmes reflect the diverse populations diagnostic radiographers work with. PPI in health professions education is a regulatory (HCPC) requirement. In diagnostic radiography education, PPI is also championed by the professional body, the College of Radiographers (CoR). The involvement of PPI can be considered across a spectrum from minimal

involvement to full partnership working. Models to support the engagement of this group are ladders, pathways, bridges, mosaics and EDGEs. The EDGE tool is adopted at UWE Bristol, and PPI is mapped as embryonic. Equally, the involvement of students is seen as good practice at UWE Bristol and within education policy. Indirect involvement is seen via termly nominated student group representatives' meetings. However, there is no formal structure when undertaking the five-yearly programme revalidations.

If the purpose of stakeholder engagement in health professions education is to provide a wide and diverse audience, I argue that there needs to be careful consideration of the strategies and tools associated with engagement. Traditional tools that support involvement include focus groups, the nominal group technique, world cafes and the Delphi method. However, designing and administrating these may exclude those who cannot 'sit at the table. A tool that could ensure a wider group of society engage in the design processes whilst decreasing cost and time is the technology enabler crowdsourcing. Chapter three seeks to develop an understanding of crowdsourcing as a potential tool to engage students, patients, and the public in curriculum design processes via a scoping literature review.

CHAPTER THREE: Literature Review

3.1 Chapter introduction

Chapter three offers a scoping literature review (St John Matthews et al., 2019) systematically undertaken in the Autumn of 2018 to inform the next research steps and the study design presented in chapter four. The starting point for the review was to consider how crowdsourcing research is undertaken in the disciplines of computer science, business, and social science: the main subject disciplines using crowdsourcing. From here, the review took a wide lens to learn where and when crowdsourcing is used in health professions education and then focused on curriculum design processes. Keywords were derived from the objectives using the SPIDER (Sample; Phenomenon of Interest; Design; Evaluation; Research) framework. Databases searched were listed, and justification for using these explored. An established crowdsourcing verification tool was applied to verify that the papers selected met the definition of crowdsourcing. The articles reviewed were finalised using the Medical Education Research Study Quality Instrument (MERSQI), and a rationale for adopting this appraisal tool was given. Papers from the search were themed, and the nuance of the individual crowdsources shared in the papers were scrutinised, including crowd size, crowd composition and crowd administration. The chapter concludes with the research question and objectives.

3.2 Crowdsourcing disciplinary divisions

Crowdsourcing is a tool that has evolved from the disciplines of computer science, business, and social science. Brabham (2013) elaborated on this, writing that research on crowdsourcing has blossomed in various academic disciplines, and each domain has approached the topic using different research methods. This broad range of approaches has led to some confusion and conflict about what counts as crowdsourcing research. In computer science crowdsourcing research, the focus has primarily been on crowdsourcing systems' design and technical aspects. Here crowdsourcing is sometimes

called distributed computing or human computation. Distributed computing involves distributing small parts of a single computing problem to different computers on a network. It works on the principle that one computer might not be able to manage a situation quickly for complex tasks. Hence the problem is broken into smaller parts, and a single computer completes each task. Each individual solution is shared back into the network, and all the micro-results are combined to give a single solution.

The following paragraphs draw from Brabham's (2013) seminal book on crowdsourcing research. This book is relevant because it was the first time several disciplines using crowdsourcing had been reviewed in a single source. Moreover, it represented a continuation of Brabham's doctoral work, which explored how online crowdsourcing communities could be leveraged for the public good (Brabham, 2010). Finally, I note the book was written just seven years after Howe (2006) had defined crowdsourcing; hence the applications of the tool were still emerging.

Brabham (2013) reported that research on crowdsourcing from a business standpoint has focused on the performance of crowdsourcing applications in terms of innovation, profitability, and efficiency. Business crowdsourcing research also explored the strategic and managerial dimensions of integrating crowdsourcing into a firm's operations. Hence, business scholars studied crowdsourcing to generate revenue, reduce labour or production costs, and innovate new products and ideas quickly for an organisation. Understanding motivations for why the crowd might participate in crowdsourcing was another area of interest for this discipline. Hence, there are quantitative and qualitative methods components within the literature, although a quantitative approach was more widely adopted.

Brabham (2013) continued by stating that in the social sciences, the research focused on the human dimensions of crowdsourcing, which is concerned chiefly with *"The Who", "The Why",* and *"The How"* of the crowd. Research in this field examined why people participate in crowdsourcing and issues such as labour exploitation and ethics; social science research also looked at the

demographics of the crowd and the digital divide issues as well as questions of amateurism versus professionalism. Interviews, case studies and surveys were the most common methods employed in this line of research. Again, quantitative and qualitative methods were employed. However, much of the research used qualitative methods.

Various applied professional disciplines in which crowdsourcing emerged had focused on using crowdsourcing for specific contexts. These disciplines included urban planning, public administration, nursing and medicine, journalism, national security, and library science. Some research in these areas had been speculative and proposed new applications for crowdsourcing in each industry, thus offering reviews of the tool. In comparison, other research projects presented single case studies of crowdsourcing in these contexts. Brabham (2013) continued by stating that as crowdsourcing grows in new disciplines, scholars in these fields needed to assess and experiment with the crowdsourcing process to improve its function.

Of course, there has been work conducted since Brabham's (2013) book was published, but these reviews focused on specific subject disciplines rather than a collection of fields together. The following are two papers particularly worthy of mention concerning this thesis. First, in a study of crowdsourcing in higher education, Llorente and Morant (2015) explored the tangential fields of 'crowdteaching', 'crowd learning', and 'crowdtuition' using a collection of international case studies. I note that their work adds nothing further to the observations in the previous three paragraphs, although their review did not mention crowdsourcing as part of the curriculum design process. Second, a review by Crequit et al. (2018) in healthcare research of 202 studies identified four types of crowdsourced tasks (problem-solving, data processing, surveillance or monitoring, and surveying) that could be applied in three categories of health (promotion, research, care). The main observation of this paper was the lack of reporting on participant demographics alongside the lack of descriptions of the crowdsource processes.

During this discovery phase, with support from the Swansea University library team, I could not identify a single review paper on crowdsourcing in health professions education; hence the following literature review sought to understand if and how crowdsourcing is used in health professions education research. This offered an opportunity to explore how research in this subject discipline has been undertaken and the types of topic areas that have adopted the tool, including the methods and methodologies used.

3.3 The literature search

A good quality literature review requires rigorous and transparent methods in its conduct to ensure that the results are trustworthy. Hence this section outlines the search strategy this scoping review used to retrieve relevant research. The literature review question was *"How is Crowdsourcing used in Health Professions Education"* and the accompanying objectives included:

1. Provide a synopsis of areas of practice in which crowdsourcing has been applied
2. Identify gaps in the literature
3. Examine how crowdsourcing research is conducted in health professions education
4. Explore and evaluate how others have administrated crowdsourcing in the subject discipline of health professions education

Using a framework to encapsulate the research question aids the researcher in finding relevant evidence alongside facilitating rigour in their research. Furthermore, using an objective tool helps to address bias and ensure trustworthiness. For this search, a SPIDER framework was adopted. SPIDER elements include Sample; Phenomenon of Interest; Design; Evaluation; Research type. SPIDER is considered a more inclusive search framework for qualitative and mixed methods research. There are qualitative alternatives to SPIDER- SPICE (Setting; Population; Intervention; Comparison; Evaluation) was developed in the context of evidence-based librarianship and subsequently promoted by the Joanna Briggs Institute (JBI) for systematic qualitative reviews (Booth, 2006). There is also the ECLIPSE (Expectation, Client group, Location,

Impact, Professionals, Service) search strategy, which was introduced to handle health management topics (Wildridge & Bell, 2002) and the Context-Intervention-Mechanism and Outcome (CIMO) developed from management questions but potentially of use in realist synthesis. However, Cooke et al. (2012) noted that none of these tools meets the complete requirements of the qualitative research paradigm, writing they are not suitable for use with more general qualitative research questions.

Keywords adopted were: crowdsou*; wisdom of the crowd; crowd capital, collaboration; education; radiography education. To increase the sensitivity of the search, Boolean logic was used linking words such as “OR”; “AND” and “NOT”. 2006 to 2018 was selected as the date for searching to reflect the identifiable date when crowdsourcing was first described as an online activity (Howe, 2006), thus distinguishing the tool from traditional outsourcing. The search was conducted using online electronic databases (Torgerson, 2003) subscribed to by the Swansea University medical school library portal. These included health, medical and education databases: Medline, the applied social science index and abstracts (ASSIA), the cumulative index of nursing and allied health (CINAHL), science direct and ProQuest education. Zero articles were returned relating to crowdsourcing in radiography education. This was deemed significant as it identified a gap in the literature. As it was considered that the findings from the education literature of other health professions could apply to radiographers, the search was broadened to include other nursing, midwifery, and allied health professions. Again, there were zero returns. Subsequently, the search was widened further to include medical education.

I completed a hand search in journals that would yield relevant articles to ensure a comprehensive approach. I also used a snowballing technique to identify relevant articles included in the reference list of assessed papers and electronic citation tracking. Greenhalgh and Peacock (2005) wrote that this is particularly helpful for identifying sources in obscure locations and research that spans subject disciplines, thus helping to recognise articles that may have been previously missed. This action resulted in two further articles being located. Literature searching was not confined to published reports and included

information from non-research papers, editorials, letters to the editor, discussion documents and previous theses. Given the nature of crowdsourcing as an open-source tool, Google Scholar and ResearchGate were also utilised. This approach yielded two unpublished theses: one doctorate and one MPhil. Google Scholar was also used to ascertain where papers identified had been cited since publication. The overall search resulted in 69 papers.

Two papers were removed as they were review papers of a collection of individual papers on crowdsourcing assessments within health professions education, Dai et al. (2017), Katz (2016) - ***appendix* 3**. The remaining 67 abstracts were screened. 49 were discarded as the content was not relevant to the review objectives or articles would use the term crowdsourcing, but this was not the case with papers instead describing crowd learning, crowdtuition or crowdfunding on further analysis. As documented in chapter two, these represent diverse ways of working with the crowd. Also discarded was the MPhil, as only an abstract could be located, and despite contacting the author, I could not retrieve the full text (Evans-Cowley, 2011). Finally, the doctorate thesis was not included as it was embargoed (Grichanik, 2017). From here, 17 articles were assessed using a critical appraisal tool to evaluate the quality and utility of published research reports, ***Figure* 11**.

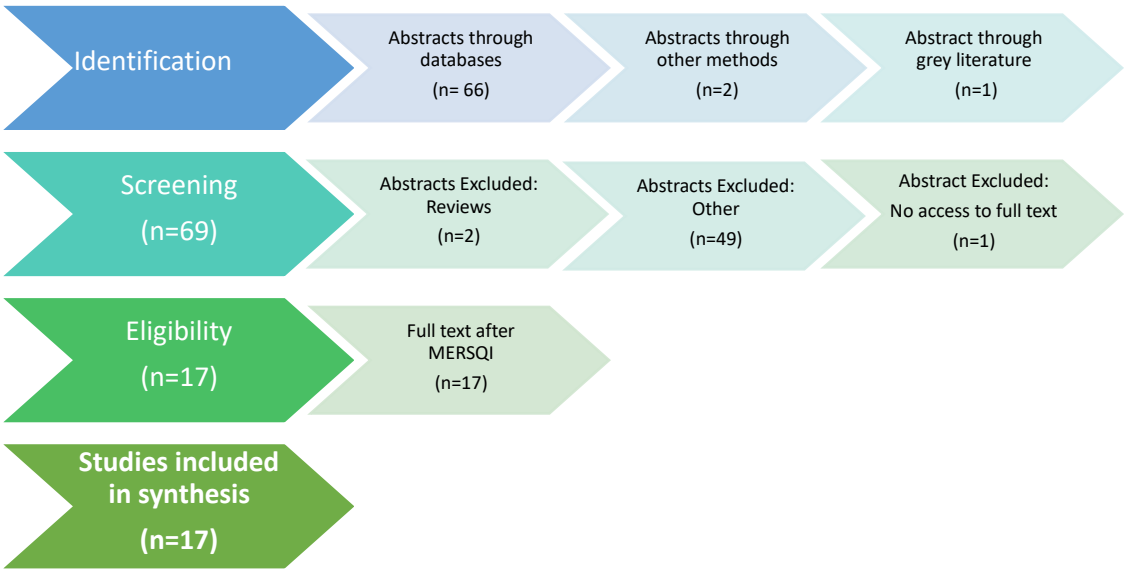


Figure 11*. Studies to be included in the literature review: decision tree (St. John-Matthews et al., 2019)*

Crowdsourcing is a recent concept, and as aforementioned, as the tool evolves, varying definitions exist. Keating and Furberg (2013) acknowledge that whilst researchers were increasingly adapting this commercial marketing tool to support the research process, these had different degrees of success. At the time, they linked this to a paucity of literature on 'the doing', thus limiting investigators' ability to replicate successful interventions. They write that in the absence of a guiding framework to help researchers design successful approaches, the method represented a higher risk, trial and error proposition. Therefore, using three case studies, they proposed five components to crowdsourcing – ***Figure* 12**.

FIVE-STEP METHODICAL FRAMEWORK FOR CROWDSOURCING

- Establish the goal of the research
- Define the target audience
- Identify a suitable engagement mechanism
- Determine a technical platform to support the activities
- Create an inventory of data quality standards

Figure 12. *A five-step methodological framework for crowdsourcing Keating and Furberg (2013)*

Estellés-Arolas and Gonzaléz-Ladrón-de-Guevara (2012) present a more detailed crowdsourcing verification tool – ***Figure* 13**.

EIGHT-POINT CROWDSOURCING VERIFICATION TOOL

About the crowd

- Who forms the crowd?
- What the crowd must do
- What the crowd gets in return

About the initiator

- Who is the crowdsourcer?
- What the crowdsourcer gets in return for the work of the crowd

About the crowdsourcing process

- What type of process is it?
- What type of call is it?
- What medium or platform is used

Figure 13. *An eight-point crowdsourcing verification tool (Estellés-Arolas and Gonzaléz-Ladrón-de-Guevara, 2015)*

This verification tool was developed following the systematic review of six scientific databases. From the 209 documents reviewed, forty unique definitions of crowdsourcing were identified and used to create a final 8-point verification instrument. This described three elements: the crowd, the initiator, and the process from which eight characteristics are extracted. In 2015 Estellés-Arolas and Gonzaléz-Ladrón-de-Guevara revisited their proposed verification tool by conducting the same literature review again reviewing a further 28 articles. None of these papers identified a new element or characteristic.

For this review, the Estellés-Arolas, and Gonzaléz-Ladrón-de-Guevara (2015) verification tool was used, as it was deemed robustly created compared to the tool developed by Keating and Furberg (2013) - ***Table* 2**. Nevertheless, I note they are similar in creating a methodical approach to integrating the method within a research project. Furthermore, the Estellés-Arolas and Gonzaléz-Ladrón-de-Guevara (2015) verification tool also offered detailed steps and areas for consideration of how to create a crowdsource for a novice crowdsource initiator, as outlined in the methods section of chapter four. This decision was necessary given the variation of the language used when describing what crowdsourcing is and is not, as articulated in chapter two.

Table 2*. Assessment of papers*

First Author	Year	Defined Crowd [a]	Clear Goal [b]	Reward [c]	Identified Crowdsourcer [d]	Online Process [e]	Open call [f]	Internet [g]
Bow	2013	Y	Y	Peer learning	Y	Y	N	Y
Chen	2014	Y	Y	Payment	Y	Y	Y	Y
Penciner	2015	Y	Y	Peer learning	Y	N	N	Y
White	2015	Y	Y	Payment	Y	Y	Y	Y
Holst	2015	Y	Y	Payment	Y	Y	Y	Y
Agadashi	2015	Y	Y	Payment	Y	Y	Y	Y
Malpani	2015	Y	Y	Payment	Y	Y	Y	Y
Blakewell	2016	Y	Y	CPD	Y	N	N	N
Polin	2016	Y	Y	Payment	Y	Y	Y	Y
Deal	2016	Y	Y	Payment	Y	Y	Y	Y
Powers	2016	Y	Y	Payment	Y	Y	Y	Y
Ghani	2016	Y	Y	Payment	Y	Y	Y	Y
Kowalski	2016	y	y	Payment	Y	Y	Y	Y
Lewis	2017	Y	Y	Payment	Y	Y	Y	Y
Yeung	2017	Y	Y	Payment	Y	Y	Y	Y
Vernez	2017	Y	Y	Payment	Y	Y	Y	Y
Lee	2017	Y	Y	Payment	Y	Y	Y	Y

Characteristics of the definition, to be evaluated in each case:

a) There is a clearly defined crowd
b) There exists a task with a clear goal
c) The recompense received by the crowd is clear
d) The crowdsourcer is clearly identified
e) It is an online assigned process of a participative type
f) It uses an open call of variable extent
g) It uses the internet

3.4 Applying an appraisal tool

Katrak et al. (2004) highlight that appraisal tools provide an opportunity to conduct analytical evaluations of the quality of a study, particularly the methods applied to minimise biases in a research project. They continue by stating there are hundreds of tools to choose from with no named *"gold standard",* concluding that consumers of research should carefully select the critical appraisal tool that fits their needs. I note three scales exist to evaluate medical education, all of which partly reflect Kirkpatrick's (2007) hierarchy of educational outcomes:

1. Medical Education Research Study Quality (MERSQI) (Read et al., 2007)
2. Best Medical Education Evaluation Global Scale (Wolf, 2004)
3. The Newcastle-Ottawa Education Scale (NOS-E) (Shea et al., 2004)

The MERSQI scale was chosen for this scoping review. It included a comprehensive list of review items and was validated as a reliable means for appraising the methodological quality of experimental, quasi-experimental and observational medical education research (Cook & Reed, 2015), ***appendix* 4**. When compared to the Newcastle-Ottawa education scale (NOS-E), it had more specific definitions, thus decreasing the requirement for individual subjective rater judgements and subsequently poorer inter-rater reliability (Hartling et al., 2013). Moreover, it adopted the four levels of the objective Kirkpatrick four-level training evaluation, also represented by MERSQI as ten cluster items within six domains.

Created by Dr Donald Kirkpatrick and originally envisaged for corporate training, the model measures training and development effectiveness (Kirkpatrick & Kirkpatrick, 2007). The first level (reaction) focused on the participant's perception of the intervention. The second level (learning) evaluated knowledge, skills, and attitudinal change. The third level (behaviour) measured behavioural change, and the fourth level (results) focused on the organisation benefits resulting from the intervention. Hence the tool offered an opportunity to systematically explore study design, sample sizes, specialities where the research was undertaken and how the research mapped to Kirkpatrick's evaluation tool - ***appendix* 5 and 6.**

3.5 Scoping review findings

The following provides a synthesis of the research identified via the literature search. I start with a general overview of the articles, and from here, the three-element headings from the Estellés-Arolas and Gonzaléz-Ladrón-de-Guevara (2015) crowdsourcing verification tool are applied to understand how crowdsourcing is administrated within health professions education.

One paper examined lesson planning (Penciner, 2015), three addressed instructional teaching material design (Bow et al., 2013; Blackwell et al., 2016; Lewis et al., 2017), eleven concentrated on the role of crowdsourcing in the assessment of basic non-complex surgical skills (Agadashi et al., 2015; Chen et al., 2014; Holst et al., 2015; Malpani, 2015; White et al., 2015; Deal et al., 2016; Ghani et al., 2016; Kowalski et al., 2016; Polin et al., 2016; Powers et al., 2016; Lewis et al., 2017; Yeung et al., 2017). Two studies focused on the recruitment onto a surgical training programme by assessing the technical skill of potential candidates (Lee et al., 2017; Vernez et al., 2017). No papers on the use of crowdsourcing in health professions/ medical education curriculum design processes were returned. All research was conducted within a single institute or for a single organisation or event. Fifteen of the crowdsources identified were conducted in the USA, and two were undertaken in Canada. As only articles written in English were listed as an inclusion criterion for the

search, this is to be expected. However, it is worth noting that no articles were identified from the United Kingdom.

About the crowd

Whilst the number of crowdworkers (4 to 409) was recorded for most papers (n=15), specific demographics of the workers such as age, ethnicity and gender were not. This lack of demographic reporting reinforces Crequit (2019) and Brabham's (2013) observations around reporting gaps in the crowdsourcing literature. For the articles linked to surgical skills assessment (n=11) and surgical programme recruitment (n=2), the crowd were Amazon MTurk (2020) crowdworkers. Some papers (n=5) referenced a learning community for surgeons called C-SATS – Crowdsourced Assessment of Technical Skills (2020). However, I noted that this is a Johnson and Johnson owned company that outsourced crowd tasks to Amazon MTurk crowdworkers. Amazon Mechanical Turk (MTurk) is a freelance crowdsourcing marketplace whereby individuals and businesses can outsource their processes and jobs to a distributed workforce who perform the delegated tasks virtually. Twelve papers used this company directly or indirectly, with some papers reporting on how much they paid crowdworkers. This was mostly recorded as a per task rate ($0.35 to $0.75), although two articles recorded how much each crowdworker earned ($10 gift voucher to $31.50 cash) - ***appendix* 7**. Of the remaining papers (n=4), three assessed qualified practitioners, lesson planning and instructional materials, and one paper focused on medical students in a peer learning setting.

The task for the crowd was clearly articulated for every study. The largest yield of papers addressed the assessment of surgical simulation skills through crowdsourcing (n=11). Here trainee surgeons performed simulated surgical tasks, including open square knot tying, surgical drills, laparoscopic peg transfer and robotic suturing. These were recorded, and crowdworkers reviewed the videos. These research papers took a computer science discipline approach where each crowd member worked individually on their task, and their results were merged for one final report. The individuals in the crowd were coached on what they needed to review via short demonstration videos and

supplied with a checklist of activities they needed to observe. Their individual assessment grading outcomes were merged and compared to expert (surgeon) assessors. Lee et al. (2017) and Vernez et al. (2017) used a similar approach when addressing learners' recruitment onto a surgical training programme. Here aspiring surgical trainees completed basic surgical skills, which were videoed. Crowdworkers watched these videos, and the individual crowd results were collated for one single outcome. This type of assessment was not a replacement but an adjunct to traditional selection techniques of academic qualifications, personal statement writing and interviewing.

In the lesson paper, Penciner (2017) described how crowdsourcing had been used at an international emergency medicine conference to guide a group conference session delivery. Traditional conference proceedings assume that a single presenter has knowledge to share with the group. Hence conference session titles and content are predetermined by a single expert or narrow group of individuals. In this instance, the crowd attending the session were asked to submit three problems, controversies, or questions to be discussed at a timetabled session. During the session, the facilitator posed questions from the submitted lists. Rather than teach, the researcher facilitated the discussions. The study concluded that facilitated crowdsourced discussion could harness collective wisdom and expertise from the crowd.

Two of the three educational instructional material design papers developed a pool of teaching resources through national networks for a national audience. Lewis et al., (2017) developed a national bank of RadExam questions for the American College of Radiology (ACR), and Blackwell et al., (2016) developed the neuroscience curriculum materials, which forty medical schools access. Crowdworkers for Bow et al., (2013) created learning materials, specifically flashcards for preclinical trainees, related to a graduate-entry medicine training curriculum. For the four papers linked to crowdsourcing lesson planning and development of teaching materials, the crowd contributed voluntarily and free of charge. Two articles, Bakewell (2016) and Lewis et al. (2017) cited an opportunity for continuous professional development credits as a reason for the crowd to engage. Lewis et al. (2017) noted that because RadExam is a peer-

reviewed, nationally distributed radiology education opportunity, contributions by the crowd needed to be recognised by academic departments and promotions committees. Hence, they introduced award levels to acknowledge the contributions to the activity from participants. Bow et al. (2013) used a pre and post-test medical knowledge quiz to demonstrate increased knowledge by participants through engaging in the activity.

About the crowdsourcer

The identity of the crowdsourcer was documented in all the papers and was always the article authors. It is noted that some of the research papers were funded by the CSTAT's company, and some of the authors of these specific papers were part of the company. This commercial link was declared within the articles. The main advantage cited for undertaking a crowdsource was Kirkpatrick's level four (2017) and organisational benefit to crowdsourcing (n=15). This was recorded as a time saving and financial benefit. For the surgical assessment and recruitment papers, crowdworkers scored similarly for the accuracy of their feedback when compared with surgeons.

About the crowdsourcing process

All papers used an open, voluntary call for participants to engage. However, these were offered as self-selecting opportunities to a specific group of participants, the most common being the Amazon MTurk crowdworkers. For example, Bow et al. (2103) invited all pre-clinical graduate entry medicine students to engage. Penciner (2017) approached attendees who had signed up to attend a conference session, as did Blackwell et al. (2016). Lewis et al. (2017) put a call out to anyone registered with the American College of Radiologists (ACR).

Fifteen studies were online, and two studies, Blakewell et al. (2017), Penciner (2017), used a face-to-face conference approach. All studies used commercially available software. Most of the fifteen studies conducted online used the Amazon MTurk (2020). Crowdsourcing platforms are an online venue or a website that provides an interface between crowdsourcers and crowdworkers and manage the life cycle of tasks (Howe, 2006). As previously

noted, some papers cited CSTATs (2020), but this organisation outsources their work to Amazon MTurk workers. Bow et al. (2013) used Google Drive within their higher education institute, a cloud-based storage solution that allows the saving and sharing of files. Finally, Lewis et al. (2017) used the Knack™ database to support contributions. This web-based customer relationship database allows individuals or groups to store, organise, and access data (Knack, 2020).

Comparable to the surgical skills assessment papers, Blakewell et al. (2016), Lewis et al. (2017) and studies into teaching material generation highlight the speed of this approach. Of note is the RadExam work by Lewis et al. (2017). Previously it had taken seven and half years to collate 2,500 questions. Using crowdsourcing, 2000 test questions were developed in six months.

3.6 Scoping review discussion

Identifying gaps in the literature

There is literature in crowdsourcing in health professions education but not in curriculum design processes. Expanding the search to all subject disciplines bore one MPhil thesis, which engaged the public in the design of a town planning degree in the USA. Unfortunately, only the abstract was retrieved; hence this was not included in the scoping review. However, it is worth remarking that there is a tradition of public participation in the wider subject discipline of town planning. In fact, Arnstein's (1969) ladder of citizen participation (

Figure 3) was first described in the *"Journal of the American Planning Association".* This tacit knowledge of participation is because this discipline embraces an ethos whereby those affected by a decision have a right to be involved in the decision-making process so that their contribution will influence the decision (Barlow, 1995).

Given a similar quest to include the public in the subject discipline of town planning, it was deemed valuable to review the available abstract by Evans-Cowley (2012). Their reasoning for using crowdsourcing was two-fold: the need to engage the public in the process and the growth of internet-based tools to harness crowd wisdom. They found that crowdsourcing was a successful model for generating creative ideas to support curriculum revision. The abstract states that people chose to participate for altruistic reasons, such as an opportunity to contribute to the community, to contribute their knowledge, and that they wanted to be part of a conversation on the topic. Based on this finding and the evidence gap in the literature on the topic, I believe researching the role of crowdsourcing to support patient, public, and student voices is an appropriate area to study and one that is worthy of pursuing in this thesis.

Whilst applying the Estellés-Aroloas and Gonzaléz-Ladrón-de-Guevara (2015) verification tool was helpful in clearly articulating what constitutes a crowdsource, it resulted in three papers (Bow et al., 2013; Blakewell et al., 2016; Pencier et al., 2017) not meeting the full definition of crowdsourcing. (studies shaded grey in table 2). It became apparent through this exercise that the term crowdsourcing in health professions may not strictly meet the definition when this tool was applied. This review used databases focused on healthcare or education. These were: Medline, ASSIA, CINAHL, science direct and ProQuest education. In comparison, Estellés-Aroloas and Gonzaléz-Ladrón-de-Guevara (2015) used Sage, Science Direct, IEE, Association of Computer Machinery (ACM) and Emerald databases. Thus the Estellés-Aroloas and Gonzaléz-Ladrón-de-Guevara (2015) definition of crowdsourcing was drawn from computer science, business, and social science literature. Estellés-Aroloas and Gonzaléz-Ladrón-de-Guevara (2015) also acknowledged that most of their returned papers were from computer science. This may account for the online component being identified as necessary.

Given the maturity of these disciplines in researching crowdsourcing, the fact that the subject disciplines of computer science, business and social science formed the basis for the design of this verification tool was foreseeable. Hence, it is evident that the nuances of crowdsourcing for the evolving health

professions education evidence base may potentially be lost, i.e. the space in which the crowdsource happens; the composition of the crowd and the motivation of the crowd. A couple of points are worth mentioning here from chapter two. Firstly Brabham's (2013) typology of crowdsourcing places the tool in the arena of a problem-solving instrument. Yet for the healthcare crowdsources presented, *"AHPs into Action"* (2017) and "*Mind the Gap*" (2017), both mapped to a hybrid of these approaches combining a knowledge and discovery management and peer vetted creative production approach as previously documented. Secondly, as evidenced by social policy and product design research, crowdsourcing is a co-design rather than a co-production tool. My view was that if this is the case, the tool would reach level five of Arnsteins' (1969) ladder of citizen empowerment, but not the higher rungs of patient public partnership. These two points strengthen the argument that this research offers an opportunity to refine a set of crowdsourcing design principles to support collaborative stakeholder engagement in health professions curriculum design processes. In addition, these design principles would provide practical steps for others seeking to use crowdsourcing in future healthcare curriculum co-design.

Examining how research is conducted in this area

What is certain is that the research within this cluster of health professions education papers maps to the business subject discipline highlighted by Brabham (2013), with the surgical assessment papers using a computer science approach to generate their outputs. For these papers, there were many members of the crowd looking at a task individually and then these being averaged to produce a single outcome, i.e. the final grade awarded to each learner rather than the process of crowdsourcing. Viewing crowdsourcing through an institutional 'benefits-based' lens aligns with the norms of evidence-based medicine, with crowdsourcing as an intervention offering potentially measurable effects (Russell et al., 2020). Banks and Brydon-Miller (2019) noted that funders, academics, researchers, and professionals often work in a cost-benefit system logic where efficiency, productivity, and utility are the driving forces. They framed this point using the perspective of Habermas (1987) and his theory of communicative action between the 'system' and 'life-world'. Habermas (1987)

argues that the ‘life world’ is based on communication, agreement and consensus, while the ‘system’ concentrates on the economy, market and state.

Yet, the ‘system’ approach may conflict with the ‘life-world’ and the reproduction of values, meaning, motivation, and communication action. Furthermore, as noted previously in chapter two, a benefits type approach may encourage a certain kind of person to participate, namely white middle-class, educated males (Cowden & Singh, 2007). None of the papers reported on crowd diversity. This may be related to the discipline-base of business rather than social science. Since this project aims to increase the diversity of participation, it will be essential to capture such demographics.

When the reviewed papers were assessed using Kirkpatrick’s (2017) training evaluation criteria, as mapped to the MERSQI, 15/17 of the studies reported a level four, organisational benefit, to using crowdsourcing. Using this approach, studies within the review highlighted how the intervention (crowdsourcing) led to better productivity or reduced cost for the same output. The surgical skills assessment papers were measured by comparing the cost of crowdworkers assessing skills versus the standard approach of using surgeons. Although the reimbursement of the surgeons to complete the task is not recorded in the papers, the cost of crowdworkers was reported, and it is hinted in these papers that the work they produced was cheaper. Yet, Lewis et al. (2017) caution on what time can be genuinely saved, stating that there were hidden administration costs in their work to cover editing. This reflection was significant given the volume of content generated for RadExam, which was often submitted in rough form and needed checking for scientific accuracy.

With a ‘benefits based’ lens, a reoccurring theme in this thesis’s introduction and background chapters is the cost of collaborative working in curriculum co-design. In the introduction, time and financial resources were listed as enablers to collaborative curriculum design for all programmes of study, not just healthcare programmes (Usher & Farmer, 2018). On the other hand, in the background chapter, time and funding were listed as barriers to patient and public involvement (Downe et al., 2007). Given the case JISC (2017) put

forward that technology-enabled curriculum design could support a marketised higher education in both more cost-effective for this research, it would have been worth conducting some mapping of the cost of the current curriculum design process. At UWE Bristol, a workload model meant that staff time was quantified. Here one workload bundle equals one-hour teaching preparation, one-hour teaching and thirty minutes assessment, so costing this activity would be achievable (UWE Bristol, 2013). However, while examining this aspect of crowdsourcing in curriculum design processes would be interesting, a comparison was not made for this thesis for reasons explained in chapter four.

Whilst the lack of published literature relating to the use of crowdsourcing in the curriculum design process suggests that this research is innovative and novel within health professions education, a fundamental aspect of doctoral research (Vitea, 2011), it meant there was limited information on how the research strategy for this research could be conducted. All the studies reviewed were undertaken within a single organisation or institute, and many studies used a mixed-methods approach recording quantitative and qualitative data. The most common study design was a non-randomised comparison of two groups comparing anonymous crowdworkers ('amateurs') outputs to experts (professionals). Two of these used a single group with pre-and post-testing. The abstract by Evans-Cowley (2012) mentioned a case study approach to designing a planning curriculum using crowdsourcing. Blakewell et al. (2015) offered an exemplar of local work to show how crowdsourcing could be used.

Lewis et al. (2017) indicated that they would be rerunning the scheme, and they described how they would improve their approach, which could be loosely considered an evaluation of the process whereby the programme activities, goals and outcomes would be designed to improve the next iteration of the activity. This reflects educational research and hints at an action research approach. This point follows the earlier observation by Brabham (2013), who stated that emerging disciplines using crowdsourcing need to consider assessing and exploring the crowdsourcing processes to improve its function. It also adheres to the observation by Crequit et al. (2018) within healthcare research that concluded that the steps involved in delivering a crowdsource are never reported,

thus making replication difficult. Indeed, this was the rationale Furberg and Keating (2013) gave for developing their crowdsourcing framework to support other researchers in replicating crowdsourcing procedures in their research. There was one published paper in the curriculum development of a radiography degree programme in the UK (Burchell, 2000). Although this reported on the role of the facilitator when using an action research approach, the aim of the work does align with this thesis, i.e. a review of the curricula and training of radiographers at a UK Higher Education institute. However, this research looked specifically at the development and assessment of competence in the clinical education of student radiographers, and the stakeholders were exclusively hospital-based radiographers who supervised students on placement and university lecturers who supported student learning in both the hospital setting and university settings. In addition, the engagement tool used for this research was face to face focus groups. Whilst this indicates that action research may be an approach, other research approaches are considered in chapter four.

Understanding the key features of a crowdsourcing platform

Brabham (2013) stipulated that a crowdsourcer must provide the proper motivation to attract a crowd to a crowdsource. Most papers in this review used Amazon MTurk workers who were paid either per HIT or per session, which is expected given the aforementioned business approach to this research. Therefore, an observation of whether the payment was a critical reason the Amazon MTurk crowd was engaged cannot be made. If pay was the deciding factor, Ndubisi and Nygaard (2018) highlight that there has been some controversy of the unethical aspects of payment and treatment of crowd workers, as tasks are often completed by a small set of workers who spend long hours on the website, many with low incomes. Furthermore, there is no way of asserting the work environment at the vendor location.

Examination of the papers that did not use HIT activities shows that participants were not paid to contribute to the crowd. This raises the question: Is this not a form of exploitation if the crowd shares their knowledge without payment? For crowdworkers in the studies by Blakewell et al. (2017), Lewis et al. (2017) and Penciner (2015), mutual benefit is a proposed reason the crowd engaged,

either to secure CPD credit or to develop their understanding of a subject area. Arguably, this mechanism offers a benefit in kind to the participants. Interestingly Bow et al. (2013) write that although they would like to extend the work outside their HEI, some medical schools may be uncomfortable sharing their teaching materials based on their proprietary curriculum. Moreover, they note that whilst their medical school fostered an environment of collective working amongst their learners to support each other's successes, other medical schools may have a more competitive approach to external student collaboration. This statement highlights the challenges of this type of co-creation with students and echoes the framing of students as consumers and Universities as businesses.

Linking with patient public participation research, Brodie et al. (2011) stated that participation should be voluntary. Their study showed that patient, and the public tended to participate to different degrees over their lives and that this may not necessarily be linear. This means being flexible and differentiating the levels and types of support required over time for the practitioner. For every study in this review, the crowd worked voluntarily on the task. Online volunteering is a broad term derived from prosocial motivation (Amichai-Hamberg, 2008). Prosocial behaviour refers to voluntary actions intended to help or benefit another individual or group (Elvira De Caroli et al., 2014). Different motivations can characterise these: altruism, egoism, collectivism and principles (Batson et al., 2002). For this unfunded research, participants needed to engage voluntarily without payment.

The size of the crowd for the non-human intelligence crowdsources varied from 13 to 120 (Bow et al., 2013; Lewis et al., 2013; Penciner, 2015). For Penciner (2015), thirteen out of the 70 delegates generated 27 different topics. With Lewis et al. (2013), 80 people developed 2,154 questions. No notes were made about the total contributions within each of these studies. The literature on public participation in policy development showed a mixed picture of what is reported from crowdsourced activities. Sometimes this was the number of participants who registered or contributed; other times, the number of contributions, was the sum of ideas, comments, and votes. Occasionally all this data

was reported. My conclusion from these insights is that statistics such as the number of ideas, comments, and votes will also need to be recorded alongside reporting how many people registered and contributed. Widening our lens to the policy literature highlights a similar theme whereby different data is captured. Work by the Icelandic government to crowdsource legislation did not report how many people engaged, rather how many ideas (360) and comments were made (36,000). This was from a crowdsource of twelve iterations, with each iteration being reviewed by 25 elected non-professional politicians (Ginsburg & Elkins, 2014). At the time of this research, Iceland had a population of 365,000 people. This compares with similar work in Finland (which had a population of 5.5 million), whereby a two-phase approach was used. Here 500 ideas were generated, with 4,000 comments and 25,000 votes; 14,000 citizens visited the website. There were 731 users, with 20% described as 'active' participants (Altamonte & Landemore, 2013). As this work seeks to gain insights on this underreported area, I believed it essential to gauge the potential crowd size.

What I observe emerging from this review is that in the absence of using a readily available crowd such as Amazon MTurk, networked practitioners were critical to the success of developing a community of people to work on a task. Linking this point back to this research, Oliver and Pitt (2013) added that this is essential in patient, public involvement work, as networked practitioners have both knowledge and understanding of services and organisations, what these organisations do and how they work, and this is a valuable resource when growing a community. Equally, Brabham (2013) acknowledges that any crowdsourcing application is only as vibrant as its online community. Furthermore, Aitmaurto (2012) reminds us that crowdsourcing is not an automated process that always takes off quickly when launched online. On the contrary, awareness of the opportunity to participate must be spread and continually communicated throughout the process. Hence, I needed to consider how I recruited and maintained crowd engagement throughout the research process. Otherwise, there might have been no participants, and consequently, a failed crowdsource.

In section 2.8, the anonymity of crowdsourcing was emphasised as a positive for using the tool, as it allows participants to contribute without being identified, thus mitigating the biases that could be introduced based on the assessments of knowledge and credibility when the individual contributing is known. Whilst the Amazon MTurk workers were anonymous by the nature of how the company operated, the other studies made no mention of this detail or how this was managed. For this research, establishing anonymity was deemed necessary, as in cases where anonymity was not given, Hackman and Kaplan (1974) observed that there was the risk that individuals will conform to the majority view as they may have worried about what other people thought of them. Common sense suggests that this may have impacted the student group the most as they knew each other. Jeppesen and Lakhani (2010) wrote that with anonymity, individuals are more likely to provide personal experiences with the problem, and therefore they can offer solutions without worrying about the feasibility or cost. Furthermore, as those contributing to the crowdsource are impacted by the challenge presented by the crowdsourcer, they are more likely to solve the challenges due to a personal pressing need; this affects both the student and patient and public group within this research. Additionally, Majchrzak & Malhorta (2020) claim innovative ideas may be stimulated to a greater degree with those without formal expertise.

Whilst Penciner (2017) describes their crowd as one of experts when discussing the Delphi method in chapter two, I argued that the division of experts is complex with participants self-reporting their level of expertise, a point noted in Penciner's (2017) work. In the early days of crowdsourcing, one of the appeals of using the tool, as described by Howes (2006), was that they believed that many crowds consisted of amateurs. However, empirical research into crowdsourcing over the years has shown that often these are not amateur crowds (Brabham, 2013). This aligns with the previously discussed concept of students and patients as experts with lived experiences of how healthcare curricula should be shaped, albeit through different lenses. Brabham (2013) contended that the low-cost, high-quality creative work crowds produce threatens the very notion of professionalism. This viewpoint challenges the idea that knowledge generated should be restricted to the anointed few. They refer

to work by George Ritzer (1975), who wrote that there is power in professionalism, and in some ways, professionalism is a grab for power. A profession achieves a monopoly by convincing the state and the public that they need and deserve such a right. Brabham (2013) goes as far as saying that research into the professional crowd is something that management scholars may wish to explore, given the potential opportunity for making a living from contributing to several crowdsources. This research further strengthened the need to capture crowd worker demographics to map the crowd's diversity and ascertain who contributed.

Crowdsourcing is deemed more inclusive than face to face alternative techniques, including focus groups, nominal group technique and interacting groups. However, there will be some groups who prefer and are better suited to face to face activities. However, Penciner (2017) notes the challenges with ensuring all voices are heard, which is evident in their study when a comparison was made between the number of contributors to the crowdsourcing activity and this frequency of their contributions, with some being more active than others. The 'power law distribution' or group dominance described by Shirky (2008) is important to highlight, as one of the advantages cited for crowdsourcing as a co-design technique is that it does not adopt a hierarchical management process. McKenzie and Skrla (2011, pp.11-20) frame this as equity consciousness, meaning

> *"……. A person's awareness of the level of equity and inequity present in behaviours, policies, settings, organizations, and outcomes. In other words, equity consciousness refers to how aware or mindful people are as to whether others around them are receiving fair and equitable treatment, how well they understand the phenomenon of inequity, and how willing they are to become involved in solutions.*"

This is important for this research, raising how equitable conversations could be managed i.e. the facilitator's role. Within the patient public participation literature, Oliver and Pitt (2013) called these active practitioners translation agents, helping people to talk and work together when there are difficulties relating to language and assumptions. They help people navigate their way. Brabham (2013) caution that moderation within crowdsourcing can be tricky as

a moderator will not want to stifle creativity. Equally, as per traditional tools such as focus groups, nominal group techniques and global cafes, there is a need to monitor when individuals are overwhelming the conversation. In other words: when a crowdsource is being hijacked. Hence, they suggest the potential for a new profession in online community management. Conversely, I note the need to monitor a crowdsource to monitor and support any software glitches and provide broad support. This research offered an opportunity to better understand and report on the role of the facilitator when crowdsourcing with students, patients, and the public. Hence when selecting a crowdsourcing tool, the ability to facilitate was critical.

While a lot of the health professions education literature is anchored in the business discipline, there are some aspects of social science research approaches in the reviewed papers. Two studies did consider the participant experiences of using crowdsourcing, also aligning with Kirkpatrick (2017) level one evaluation of participant reaction to the intervention. Bow et al. (2013) and Penciner (2017) achieved this via the use of a post-task survey.

Given that most of the papers in this review used a human intelligence task approach, whereby contributions were made individually and then collectively aggregated, it is not surprising that the concept of constant visibility of knowledge is only discussed in a few health professions education papers. Constant visibility is described by Bailey et al. (2012) as the ability for all participants to have continuous access to the knowledge shared by other participants. It is worth noting that this is not available on all commercially available crowdsourcing platforms, a personal observation when reviewing the example platforms shared previously in ***.***

Table 1. Nicolini et al. (2012) write that sharing contributions means that others may be inspired by what they read and thus provide new knowledge and recommendations of the knowledge they have read posted by others. In this instance, individuals can reflect on what they have read and recalibrate their thoughts before posting.

They continue stating that this self-paced asynchronous personal mental dialogue encourages participants to think of the knowledge they are reading. Furthermore, to be influenced by others' knowledge requires individuals to read the posts. I note this contrasts conversation seen in the traditional curriculum design tools discussed, such as focus groups, nominal group technique and global cafes. With these tools, time is limited to the session and contributions, which subsequently limits time for reflection. Logic would therefore suggest that if constant visibility is deemed an advantage of crowdsourcing when looking at the curriculum design process, this research needed to ensure this option was available on the crowdsourcing platform used for this work. However, this raised another issue of how the online space remained safe.

Attending to the four review objectives, this chapter has highlighted that crowdsourcing in health professions education is an emerging research area. As the application of the tool in this subject discipline is novel, there were several opportunities and areas that could be researched. Brabham (2013) provides a roadmap of how the evidence base could be built, starting with producing a review of where the tool could be applied in a discipline, then producing case studies of applying the tool, and reviewing multiple studies carried out in the same area. They also suggest a requirement to scrutinise crowdsourcing for emerging disciplines to establish how the tool can achieve optimal performance. This trend around the type of research that warrants undertaking in an emerging field can be seen in the surgical skill assessment paper groupings. Within this review were papers applying the tool; however, looking at the two review papers omitted from this review, ***appendix* 3**, these supported the notion of the value of writing reviews of how crowdsourcing could be used. Here Katz (2016) writes of the potential role of crowdsourcing in surgical assessment, and Dai et al. (2017) offer a review of crowdsourcing studies in the area of surgical skill assessment until April 2017.

The literature review results presented in this chapter have given a helpful insight into how and where crowdsourcing is being used in health professions education. For example, when investigated, participants' perceptions of the intervention concerning satisfaction were rated highly, although this was only

explored in a few papers. The review also offered an opportunity for a novice crowdsourcer to establish the methodological approaches used within these studies and the methods applied. This was important as this review has highlighted that there is no published research on the use of crowdsourcing in the curriculum design process and, therefore, no roadmap for this specific work.

There was a requirement to consider how the crowdsourcing tool adopted would be implemented in the health professions education subject area. As a result, the robustly created Estellés-Aroloas, and Gonzaléz-Ladrón-de-Guevara (2015) was chosen to explore further how crowdsources within the retrieved papers had been administrated via three key areas: who the crowd are, who the initiator is and the process of crowdsourcing. Subsequently, to ensure continuity in the thesis presentation, the headings from this verification tool were adopted in the methods section of chapter four to provide evidenced structure on how the crowdsource for this research was administered.

This research will also determine who the crowd are, thus addressing the proposed advantage of increasing the diversity of stakeholders involved in the study. Finally, as an emerging area of practice and in keeping with a professional doctorate requirement, this work aims to provide practical guidance for those who wish to use the tool in their practice alongside recommending areas requiring further research.

3.7 Research question, objectives, and enablers

This research sought to add to the limited evidence base on using crowdsourcing in health professions education. The programme chosen to explore this was a pre-registration diagnostic radiography degree programme. The research question was:

"Can a crowdsource be deployed to support stakeholder (student, patient, and the public) involvement in pre-registration diagnostic radiography curriculum design processes?"

Three research objectives sought to investigate the research question were:

1) Explore the design of a crowdsourced activity to support stakeholder involvement in a pre-registration diagnostic radiography curriculum design process.
   I. Capturing demographic data of participants
   II. Considering how to grow a community of users (recruitment)
   III. Choosing the challenge questions
   IV. Facilitation of the crowd
2) Critically evaluate the ideas proposed by the crowd in the context of relevant radiography and health professions education literature
3) Develop a set of design principles for future health professions curriculum design projects

The focus of the research was a BSc (Hons) Diagnostic Radiography degree programme. The following actions were deemed enablers to the research:

- Consider the research approach to enable this research
- Secure a crowdsourcing platform that supports anonymity
- Secure ethical approval
- Set up a crowdsource to include capturing participant demographics
- Invite students to participate
- Invite patients and the public to participate
- Analyse and critically evaluate the crowd comments and ideas
- Evaluate the research approach

3.8 Chapter summary

From this literature review, there is no doubt that the evidence base for crowdsourcing within health professions education is new and still emerging. I could find no published research on using crowdsourcing as a tool in health professions education curriculum design. Given this gap, mapping the review findings to more established subject disciplines offered insights into how

research on curriculum design processes could be conducted. The review also contributed towards the evidence base for health professions education as this chapter has been published in an international peer-reviewed journal demonstrating how crowdsourcing could be used within radiography education (St. John-Matthews et al., 2019). The chapter was also presented as an oral poster at an international conference (St. John-Matthews et al., 2020).

CHAPTER FOUR: Methodology and Methods

4.1 Chapter introduction

The literature review indicated that there was no published research on using crowdsourcing in health professions curriculum design processes. However, crowdsourcing was being used in other areas such as assessment feedback, recruitment activities, instructional material design, and lesson planning. Hence, this research sought to build upon the evidence base in crowdsourcing in health professions curriculum design processes through a 'benefits led' lens in the absence of published literature. The specific health professions programme under investigation was a pre-registration diagnostic radiography degree.

This chapter is divided into two parts. The first part (4.2 to 4.3) considers the methodology and the research strategies that could have been applied to address the research question. The rationale for choosing action research is discussed, and the historical perspectives of action research are reported. The section also addresses my assumptions about the research setting, reality, the research purpose, and my role as the researcher. The second part (4.4 to 4.7) outlines the research methods adopted. The reader is introduced to the crowdsourcing platform used whilst considering participant recruitment, ethics and how the data collected was analysed in relation to the research question. As the research included a three-cycle action research approach, the complete cycle questions to support adjustments to the crowdsourcing process between each cycle are shared.

4.2 Scientific knowledge production

Research paradigms are a set or system of beliefs that guide how to conduct a study. Therefore, in any research, it is crucial to identify within which paradigm the methodology sits (Keeney et al., 2011). The term research paradigm, coined by Kuhn (1962), is understood to mean:

"patterns of beliefs and practices that regulate inquiry within a discipline, doing so by providing the lenses, frames and processes through which investigation is accomplished" (Weaver & Olson, 2006, p.460).

Johnson and Christensen (2012) defined a research paradigm as a perspective about research held by a community of researchers based on shared assumptions, concepts, values, and practices. Two fundamental paradigms have dominated social science: positivism and constructivism (Burrell & Morgan, 1979). Positivism sees research and scientific knowledge as deductive, objective and value-free. Conversely, constructivism sees knowledge as inductive and subjective and is influenced by the idea that knowledge cannot be separated from the knower (Steedman, 1991). Both paradigms are often seen as opposites, with positivists seeking one truth compared to the multiple truths of constructivism. However, Dewey (1925) argued that both come from the same paradigm family as both seek the truth.

Pragmatism has gained traction as a research philosophy that prioritises resolving the dualism of positivism versus constructivism. In the pragmatist tradition, the search for valid or absolute truth is less important than the adequacy of the method to answer the research question (Feilzer, 2010). Hence, I decided to explore the application of crowdsourcing using a pragmatic research approach as this meant that there was no commitment to a particular epistemological or ontological assumption. Instead, a key belief of a pragmatic approach is that research is designed on the individual research project's circumstances (Savin-Baden & Major, 2013).

For these reasons, this paradigm sits well with 'practitioner-based' research, including professional doctorates. This observation encompasses the aims and objective of this research as the outputs were helpful to the curriculum design team and those seeking to crowdsource their health professions curriculum. Furthermore, the study was defined by practical, real-world circumstances, thus fulfilling research objective three. This explanation is captured in the QAA professional doctoral degree characteristic statement (QAA, 2020), which states that these qualifications are designed to meet the needs of the professions they are rooted in, including business, creative arts, education,

engineering, law, nursing and psychology. This level of qualification can advance professional practice or use practice as a legitimate research method. In practice-based and professional doctoral settings, the candidate's research may directly result in organisational or policy-related change.

As identified in the literature review, there was no roadmap for this research as there were no previous published papers on crowdsourcing in the context of pre-registration curriculum design processes in any discipline. Furthermore, as Eklund et al. (2019) demonstrated, research on the methodological underpinning of new digital data collection methods such as crowdsourcing is sparse, although work is emerging. Hence using a pragmatic approach meant the focus of this research would be on developing the most suitable procedure to answer the research question by continually questioning, critiquing, and improving what was being carried out to reach the most appropriate knowledge on which to act, thus fulfilling the research objectives.

Pragmatic research has drawn criticism due to its perceived lack of theoretical and philosophical rigour, with the suggestion from some (Hodkinson, 2004) that pragmatic methods are not aligned with high-quality research. To address some of the criticisms levelled at pragmatism, Caelli et al. (2003, p9) proposed key areas which a researcher can consider to enhance the credibility of pragmatic research. These include:

> *"… the theoretical positioning of the researcher; the congruence between methodology and methods; the strategies to establish rigour; and the analytic lens through which the data are examined."*

Clarke and Visser (2018) pointed out a need within the pragmatic stance to acknowledge the researcher's influence on the data as pragmatism also aligns to the feminist epistemology, where personal history, social background and cultural assumptions influence research (Morgan, 2007). They continue by highlighting the need for the researcher to strike a balance between recognising one's influence and the bias this brings whilst not making the research too personal, something they note is challenging without the direction offered by pure methodologies, which help to guide against these eventualities by

following stringent procedures. Hence this thesis hosts a reflective chapter, chapter nine, which includes a researcher positionality statement and a narrative of the reflexive practice conducted throughout the research.

4.3 Research strategy

Fulton et al. (2012) wrote that for practice-based research such as professional doctorates, several strategies could be applied: action research, theory of change, autoethnography and case studies. Action research contains a robust reflective component and captures what happens in the workplace. Theory of change (Weiss, 1995) facilitates reflection within a project and can link a series of disparate projects to a common goal or framework. Case studies are an in-depth examination of a particular area. These can be either descriptive or exploratory (Yin, 2009). Finally, autoethnography is a process that focuses on the individual's subjective experience through exploring the context of their experiences (Ellis & Berger, 2003).

Two methodological approaches were identified in the health professions education crowdsourcing literature: action research and a case study approach. Arguments against case studies are that they lack rigour and provide little basis for generalisation (Yin, 2009). Similar arguments are put forward for action research with it seen as a time-consuming activity, the results can be subjective alongside being personal to the action researcher rather than the organisational needs (Bradbury, 2015). However, many of these disadvantages can be addressed for both methods. This includes articulating the reasons for choices made during the research process and being transparent through describing in detail the steps involved. Other activities include being explicit about how interpretations and conclusions were reached to help readers judge results and findings (Cresswell & Cresswell, 2018).

The research strategy that allowed me to address research objectives one, two and three was action research. Action research is a form of critical inquiry that uses a reflective process that is orientated to some action or cycle of actions

that an individual, organisation or community have taken, are taking, or wish to take to address a particularly problematic situation (Munn et al., 2013).
The theoretical roots of action research are located in the early 20th century, whereby a group of educational researchers believed in the role of practitioners as leaders and inspired them to research their own settings. Dewy (1929) recognised the central position of teachers in education reform. He urged teachers to become reflective practitioners and make independent judgments based on interrogating their practice. While John Collier (1945) coined the term action research (Nielsen, 2006), it is Kurt Lewin (1946), a German social psychologist who is credited as the founder of this approach. Lewin argued that action research should be conducted with the participation of the members of the social group who are part of the situation to be changed. The action research model he developed was based on the cyclic process of fact-finding, planning action, acting and evaluating the action results.

Action research in education has a long history, with Stephen Corey and others applying the methodology for researching educational issues in the 1950s. Corey (1953) identified similar cycles of research that could be changed due to the reflective nature of the research process, with each cycle affecting previous and subsequent cycles. The most cited proponent of action research in the UK has been Lawrence Stenhouse (1975), whose work: *"An Introduction to Curriculum Research and Development"* added to the appeal of action research for studying the theory and practice of teaching and the curriculum. In the 1970s, Stenhouse coined the phrase 'practitioner-researcher' to describe teachers engaged in action research to improve their practice (Koshy, 2010)

Using action research is further justified when this research commentary is mapped to the unique characteristics of action research described by Efron and Ravid (2020): it is situational, it is practical, it is systematic, and it is cyclical.

- **Situational.** Action research aims to understand the unique context of the studies and the participants involved. The conclusions of these inquiries should be understood within the complexity, ambiguities, and nuances of the setting where an investigation is undertaken.

- **Practical.** Action researchers choose the questions they plan to investigate based on their concerns and professional areas of interest. Thus, the results of these studies are immediately relevant to the improvement of their practice.
- **Systematic.** Action research is intentional, thoughtfully planned, systematic and methodical. It needs to be this way to produce trustworthy findings.
- **Cyclic**. Action research starts with the research question and ends with applying the knowledge gained that leads to new questions in the new cycle of research.

Kemmis and McTaggart (2005) expand on this idea of a cycle, stating that action research involves a spiral of self-reflecting changes, namely:

- Planning a change
- Acting and observing the process and consequence of the change
- Reflecting on these processes and outcomes and then re-planning
- Acting and observing
- Reflecting
- And so on……

There are three main approaches to action research: qualitative, quantitative and mixed methods. The decision to use a mixed-methods approach for this study was determined based on the focus of my research, the nature of the research question and the setting where the research was conducted. Furthermore, as explored later, the data generated by the crowdsource could yield both quantitative data in the form of voting and qualitative data in the form of written ideas and comments. With mixed methods, three effective methods could have been used: an embedded, a two-phase, or an integrated design (Efron & Ravid, 2020). The embedded approach is applicable when both data paradigms are available, quantitative and qualitative (Bazley, 2018; Cresswell & Plano Clark, 2018; Teddlie & Tashakkori, 2009). The same question is answered with integrated research (triangulation) by placing equal weight on the quantitative and qualitative methods. The findings of both data sets are

compared and contrasted to determine if they yield the same results (Teddlie & Tashakkori, 2009; Cresswell & Plano Clark, 2018). Two-phase research addresses different questions within the research problem in a two-phase study. The qualitative and quantitative methods are employed separately, simultaneously, or sequentially (Cresswell & Plano Clark 2018; Teddlie & Tashakkori, 2009).

For this research, the qualitative and quantitative data were collected concurrently and independently in each action cycle, thus using an embedded mixed methods design – ***Figure* 14** . The following segment explores the data collection tool, crowdsourcing, as applied to this research project.

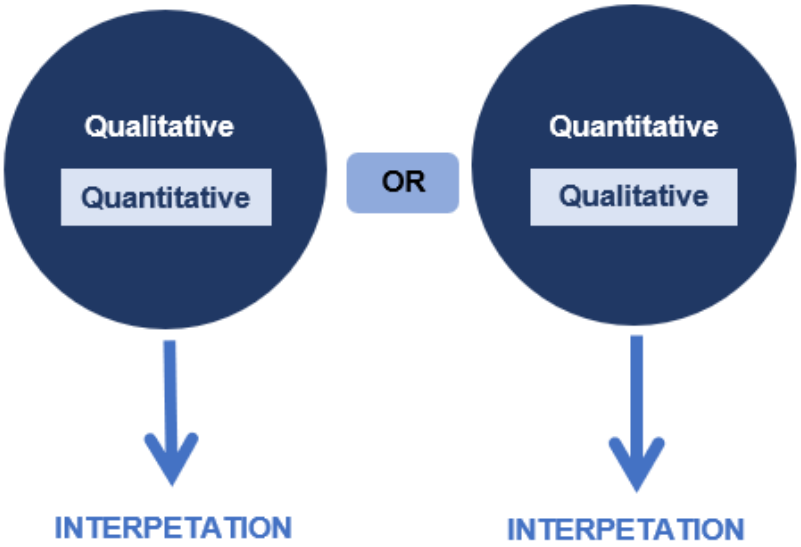


Figure 14*. An embedded mixed methods action research design*

4.4 The data collection tool and data collection process

This section starts with the data collection tool to establish how this research was conducted. As highlighted in chapter two ***Table 1,*** Brabham (2013) proposed four dominant problem-solving classifications specific to crowdsourced work: knowledge discovery and management, broadcast search, peer vetted creative production and distributed human intelligence tasking (HIT). All their examples provided were commercially available products. Likewise, in chapter three, it was identified that commercial crowdsourcing tools

were commonly used within the health professions literature, with Amazon MTurk being the most popular of these. A ‘knowledge discovery and management’ crowdsourcing was deemed appropriate for this research to support information gathering, organising, and reporting problems, supporting data collection for the three research objectives.

There are a plethora of commercial tools available to support crowdsourcing activities. A significant challenge of deciding which commercial tool to adopt was the ethical considerations of knowing how participant consent would be achieved and how and where data would be stored and used. A definition of internet research ethics (IRE) was originally written been by Ess and the Association of Internet Researchers (2002). As social media and big data activities have developed, IRE has been expanded, resulting in IRE 2.0 and IRE 3.0. Nevertheless, the fundamental concept remains:

> *“IRE is defined as the analysis of ethical issues and application of research ethics principles as they pertain to research conducted on and in the internet. Internet-based research, broadly defined, is research that utilizes the Internet to collect information through an online tool, such as an online survey; studies about how people use the Internet, e.g., through collecting data and examining activities in or on any online environments; and uses of online datasets, databases, or repositories (IRE 1.0, p2, 2002).”*

This research needed to secure a crowdsourcing tool that would support participant anonymity and ensure these anonymous comments and ideas were visible to everyone who joined the online conversation. The reason for this requirement was so participants could comment on each other’s posts. Jeppesen and Lakhani (2010) wrote that with anonymity, individuals are more likely to provide personal experiences with the problem, and therefore they can offer solutions without worrying about the feasibility or cost. They are also more likely to comment on postings made by others. I also needed a platform that allowed me to facilitate the conversation.

For this research, a symbiotic opportunity arose to use the commercial Clever Together Lab Ltd. tool free of charge, a platform that met several criteria listed above. As noted in chapter two, the company has worked with health and social care organisations in England, including NHS England and NHS

Improvement (NHSEI), Health Education England (HEE), NHS Trusts (NHS Health Boards), local councils, and integrated care services (Clever Together Lab Ltd, 2020). The company was interested in extending its reach. Supporting this research offered an opportunity to build evidence and a real-world example of how their tool could be used in higher education. This research would be added as a case study on their company web pages in return for free access to the crowdsourcing platform. Throughout the study, I retained complete control over the research direction.

In total, three two-week workshops were hosted - ***appendix* 8**. The first was with UWE Bristol diagnostic radiography students and ran in June and July 2019. The second was in September 2019 and was open to those living in the City of Bristol, as was the third (final) crowdsource was hosted in October 2019.

Action cycle one. **UWE diagnostic radiography students**	24th June - 7th July 2019
Action cycle two. **Bristol patients, and the public**	10th - 22nd September 2019
Action cycle three. **Bristol patients, and the public**	08th - 21st October 2019

Following each crowdsource closure, the data generated by participants (crowdworkers) was analysed, and I shared the analysis with the central curriculum design team. Also, at the end of each action research cycle, I applied Wadsworth's (2011) complete cycle questions to consider adjustments I needed to make between the cycles to the crowdsourcing platform.

- What is happening now? (observe)
- Would something else be better? (reflect)
- How could it be tried? (plan)
- What would it take to implement it? (act)

Following this sequence after each crowdsource meant that the approach of each cycle was an evolution of the one before (Wadsworth, 2011). This technique aligned with research objective one, the notion of exploring the

application of crowdsourcing in a new subject discipline. The complete cycle questions offered a structure to conduct this part of the research. The findings of this activity are further explored in chapters five, six and seven – ***Figure* 15**. In this figure, activities in yellow were conducted by the researcher. Those in blue represent crowdsource one (with the internal crowd of students), two and three (with the external crowd of patients, and the public).

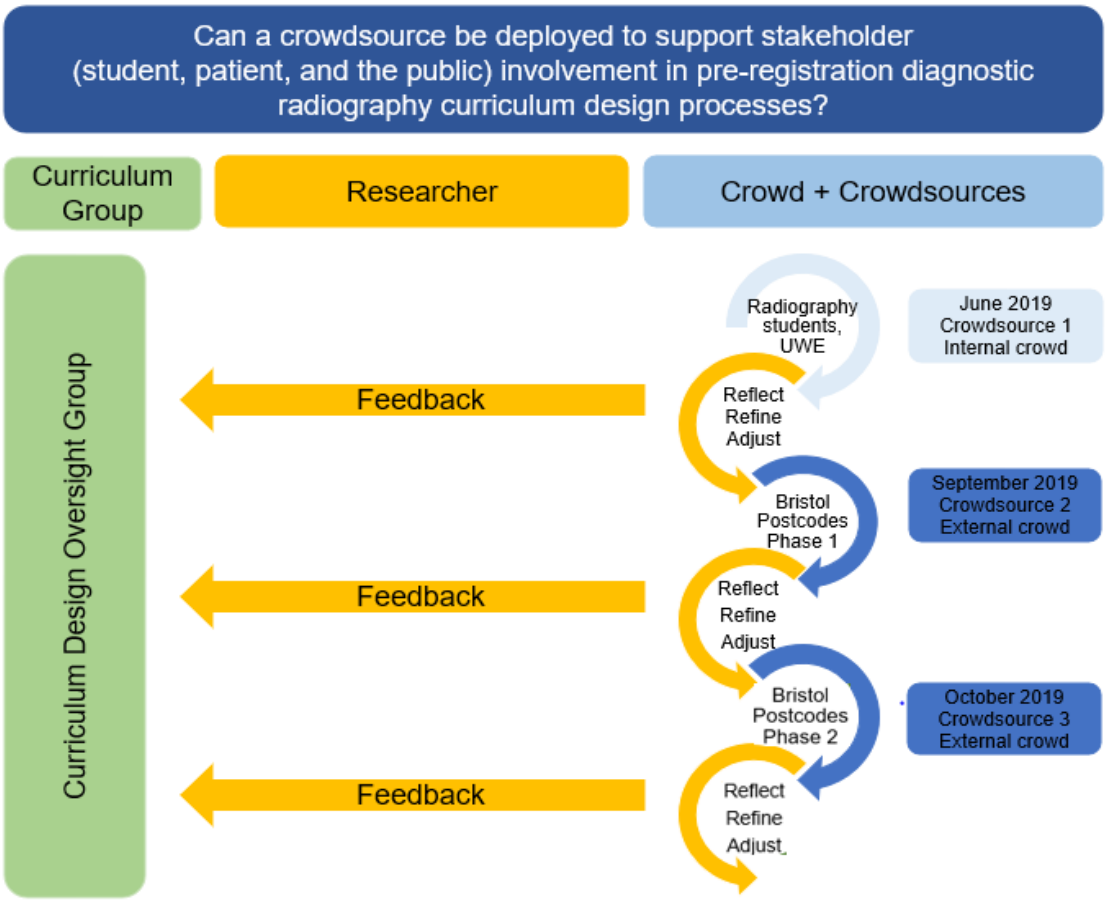


Figure 15. *Overview of the action cycles and crowdsource design*

As previously noted, if crowdsourcing is not carefully planned, it can result in large amounts of data that does not help solve the problem (Brabham, 2013) and may lead to the project's failure. Therefore to support reader navigation headings from the Estellés Arolas & Gonzaléz-Lardon-de Guevara (2015), crowdsource verification tool were adopted to explain the details of how each cycle was conducted – ***Figure* 13**.

EIGHT-POINT CROWDSOURCING VERIFICATION TOOL

About the crowd

- Who forms the crowd?
- What the crowd must do
- What the crowd gets in return

About the initiator

- Who is the crowdsourcer?
- What the crowdsourcer gets in return for the work of the crowd

About the crowdsourcing process

- What type of process is it?
- What type of call is it?
- What medium or platform is used

Figure 13 (Chapter three): *An eight-point crowdsourcing verification tool (Estellés-Arolas and Gonzaléz-Ladrón-de-Guevara, 2015)*

About the crowd: Who forms the crowd?

As noted in chapter three, the demographics of individuals within the crowd and crowd composition are underreported in health professions education and wider healthcare research (Crequit et al., 2018). Hence a short demographic questionnaire was added alongside the consent section to each cycle before participants could access the crowdsourcing page to add their contributions. This was important for this research to establish if the approach would lead to more diverse participants with the curriculum design process as per research objective one. Reporting this information alone would give insights not previously available in the literature. A participant was defined as someone who completed the demographic questionnaire and consented to participate in the research. They did not have to contribute to the crowdsourcing. This field was mandatory, and participants could not proceed further into the site without these being completed. How many participants dropped out at this point was not recorded. As presented in later sections, the demographic questions asked evolved with each cycle as informed by the conclusion drawn following the application of Wadsworth's (2011) complete cycle questions sequence.

About the crowd: What the crowd must do

The crowd was asked to discuss the local diagnostic radiography programme could be updated. To start the conversation, the problem, updating the current diagnostic radiography degree, was, as Majchrzak and Malhotra (2020) described, broken into smaller problems for the crowd to work through. This is a common approach in crowdsourcing in cases where the problem is significant and is likely to be misunderstood. Adopting this approach potentially helps participants focus on the part of the problem for which the organisation wants input. Moreover, using these smaller problems ensured structure to the conversation, so the data set did not become overwhelmed with unrelated comments and ideas. It has been observed that dealing with comments within the crowdsource is not only extremely time-consuming and costly, it also biases how ideas are selected (Piezunka & Dahlander, 2014). When crowdsourcers receive too many ideas, they focus on ideas already familiar to them.

Action cycle one used different questions compared to cycles two and three, acknowledging the differences in understanding between students, patients, and the public. Before finalising the questions for each round, two separate critical friend conversations were held. One with the Clever Together team. and the other a separate meeting with my supervisory team. The term 'critical friend' within action research was first used by Stenhouse (1975), who proposed that these individuals or groups are defined as those who listen when you talk about your study, ask you to clarify your ideas, and provide constructive feedback on your work. How critical friends were harnessed to support reflexivity as this research progressed is explored further in chapter nine.

Action Cycle One: UWE Bristol diagnostic radiography learners

As noted in chapter one, the goals of a programme of study and the content to be taught are crucial questions when designing a curriculum (Williamson, 2013). Of course, for health professions curriculum design, this will be guided by the regulator, in this instance, the HCPC (2013) *"Standards of Proficiency for Radiographers"*. However, as already mentioned, there is scope for individual institutes to develop unique learning activities and opportunities within their local context.

The findings from a national survey of UK radiology managers were consulted to support an evidence-based approach to creating the questions for action cycle one (Sloane & Miller, 2017). The survey sought to ascertain the 'fitness for purpose' of recent diagnostic radiography graduates in the UK. In addition, this work aimed to identify areas of practice that radiography programmes needed to focus on to ensure graduates were ready for the world of work through a grounded theory approach. The study presented both a looking back and looking forward lens on the skills and attributes of past and future graduates. The resultant themes from this survey were: the current curriculum content and structure, diversification in the radiographer's role, professionalism, and the need for improved resilience. Whilst this yielded graduate attributes employers across the UK deemed necessary, the list was generic to all diagnostic radiography graduates and not specific to UWE Bristol. Furthermore, the paper reports from a deficit model, i.e. what is missing from training programmes, rather than considering what should stay.

I discussed my concerns about this deficit lens with the UWE Bristol diagnostic radiography curriculum design team, and it was agreed that although the themes presented a starting point for engagement with the students, they needed to be presented as follows:

1. Is there anything we should stop, start or do differently in an updated programme?
2. What does UWE Bristol need to include in an updated diagnostic radiography programme to support your career aspirations?
3. What technical skills should a newly qualified diagnostic radiographer have?
4. How can a diagnostic radiography training programme help you support your mental health?

Action cycle two: Bristol residents

There was no literature outlining what areas I should use to construct the patient and public-facing questions. Subsequently, I worked with Clever Together to establish how they approached this task to encourage conversations on the platform. Based on their experiences of running crowdsourcing activities, it was

agreed that these questions would be broad and uncomplicated, with participants drawing on imaging experiences.

1. Please tell us about your imaging experience.
2. What worked well for you?
3. What did not work well for you?
4. What skills do you think a diagnostic radiographer should have?

Action cycle three: Bristol residents and those imaged in Bristol

Anyone who had participated in the second crowdsource could join the third crowdsource. Equally, new participants could join the conversation. For this final round, participants were asked for their thoughts on the four proposed modules within the programme. The choice of these four modules was requested by the UWE Bristol curriculum design team, who had developed fifteen modules for the new curriculum. The complete details of these challenge questions can be found in ***appendix* 9**. Two of these modules were clinical placement modules, and two were new to the curriculum.

1. Year 1 Module: Diagnostic Radiography Clinical 1
2. Year 2 Module: Professional Behaviour and Health Psychology (New)
3. Year 2 Module: Diagnostic Radiography Clinical Practice 2
4. Year 3 Module. Healthy Futures (New)
5. Any other ideas?

About the crowd: What the crowd gets in return

The crowd consisted of self-selecting unpaid volunteers. The sole reward was the opportunity to take part in the shaping of an updated pre-registration diagnostic radiography curriculum. Hence this research approach relied on participants volunteering their time to contribute. This was such as those that engage with crowdsourcing outside of paid human-intelligence tasks will often do so as they are motivated to help others and share their knowledge (Amichai-Hamburger, 2008). The time commitment for the activity by participants was as long as they wished to engage with the discussions. Participants were able to log in as many times as they liked. They could add their ideas and comment on

other participants' ideas. They could also vote on ideas and comments made by fellow participants. All of which was anonymous.

About the initiator: Who the crowdsourcer is

An initiator can be any given entity that has the means to conduct the initiative, whether it is a company, institution, non-profit organisation or an individual (Estellés-Aroloas & Gonzaléz-Ladrón-deGuevara, 2012). This was me acting on behalf of the UWE Bristol BSc (Hons) Diagnostic Radiography programme team. Just as in chapter one, where I explored the organisation's details where this research was undertaken, UWE Bristol, I explore who I am in chapter nine. I also consider the potential impact of my experiences and values on this work and how I have sought to address these through considering my positionality and practising reflexivity. I was not part of the 2020-2025 programme development curriculum review group. However, I had previously taught on the programme as a senior lecturer and was part of the 2010 and 2015 programme curriculum reviews. As this research could not replace the standard UWE Bristol curriculum approval processes, which were established evidence-based approaches enshrined in the institute's curriculum design policy used for every programme validation across the University, the crowdsource ran in parallel with the standard process - ***Figure* 15**.

About the initiator: What the crowdsourcer gets in return

The crowdsourcing tool enabled data collection for this thesis. From a pragmatic viewpoint, the crowdsourcer and curriculum team benefited from the crowd's work, experiences, and knowledge. UWE Bristol gained by using a potentially faster and cheaper tool to collect stakeholder input. The research also supported the submission of a professional doctorate. If I had not been looking for a topic for my thesis, the work might not have happened.

About the crowdsourcing process: What type of process is it?

As previously noted, an online data acquisition approach was adopted for this study and data was acquired using the Clever Together crowdsourcing platform (Clever Together Lab Ltd, 2020). In addition, the Clever Together platform also captures participant demographic details. Therefore I could map daily

participation rates as the research progressed, thus allowing me to proactively add marketing interventions if participation rates were low.

About the crowdsourcing process: What type of call is it?

Whitla (2009) explained that there are three types of calls within crowdsourcing: an open call allowing anyone to participate; a call limited to a community with specific knowledge and expertise; or an open call with limitations on the number of participants. The approach differed between the first cycle and cycles two and three for this research. The first action cycle encompassed a local community of diagnostic radiography students, and the second and third calls were open calls to everyone over 18 living in Bristol. The third cycle had an amendment that included anyone outside of Bristol who had received medical imaging in Bristol. An advantage of crowdsourcing over the Delphi method, noted in chapter two, is that participants could hop on at each stage.

Action Cycle One: UWE Bristol Diagnostic Radiography Learners

All 172 students enrolled on the pre-registration BSc (Hons) Diagnostic Radiography programme at UWE were invited to participate in the first crowdsource. This is considered an internal crowd in crowdsourcing research- a crowd within an organisation (Zuchowski et al., 2016). Thus those who did engage were self-selecting. For this cycle, participants were only asked which year group they belonged to, and no other demographic data was captured.

This group were chosen for the first action cycle for two reasons. Firstly learners were identified as stakeholders who were not fully embedded in local diagnostic radiography degree design processes. Secondly, it offered an opportunity to add to the evidence base. This research contributed to research student involvement in curriculum and pedagogy design. Healy and Harrington (2018) wrote that this is one of the least developed areas of student partnership activities. Moreover, in keeping with how Brabham (2013) said to approach building the crowdsourcing evidence base in an emerging subject discipline, action cycle one provided a real-world example of applying the tool in health professions education. The research was then published in an international peer-reviewed journal (St. John-Matthews et al., 2020).

Action Cycle Two (Main Study): Bristol Residents

An open call was made inviting anyone over 18 living in Bristol, living at pre-determined postcodes, to participate – ***Table 3***.

Table 3. *Bristol postcodes included in action cycle two*

POSTCODE	AREA OF CITY	COUNTY
BS1	Bristol city centre, Redcliffe	Bristol
BS2	Kingsdown, St Paul's, St Phillip's, St Agnes	Bristol
BS3	Bedminster, Southville, Bower Ashton, Totterdown, Windmill Hill	Bristol
BS4	Brislington, Knowle, Knowle West, St Anne's, part of Totterdown	Bristol
BS5	Easton, St George, Redfield, Whitehall, Eastville, Speedwell, Greenbank, Barton Hill	Bristol
BS6	Cotham, Redland, Montpelier, Westbury Park, St. Andrew's	Bristol
BS7	Bishopston, Horfield, part of Filton, Lockleaze, Ashley Down,	Bristol / South Gloucestershire
BS8	Clifton, Failand, Hotwells, Leigh Woods	Bristol / North Somerset
BS9	Coombe Dingle, Sneyd Park, Stoke Bishop, Westbury on Trym, Henleaze, Bristol	Bristol
BS10	Brentry, Henbury, Southmead	Bristol
BS11	Avonmouth, Shirehampton, Lawrence Weston	Bristol
BS13	Bedminster Down, Bishopsworth, Hartcliffe, Withywood, Headley Park	Bristol
BS14	Hengrove, Stockwood, Whitchurch, Withywood	Bristol / Bath and Northeast Somerset
BS15	Hanham, Kingswood	Bristol / South Gloucestershire
BS16	Downend, Emersons Green, Fishponds, Frenchay, Pucklechurch, Staple Hill	Bristol / South Gloucestershire

There was no limit on numbers who could participate. In 2019 there were 380,000 individuals aged over 18 who lived in the area defined as the City of Bristol who was eligible to engage as per the inclusion criteria. There was no limit to the numbers who could participate - ***Table* 2**. However, the research opportunity was not extended to those under 18. The reason was that I recognised extra support would be needed to activate this with the consent of a

child and parent required to achieve this. This viewpoint reflects that of the British Sociological Association (BSA, 2017, p6), which advises that:

'Special care should be taken where research participants are particularly vulnerable by virtue of factors such as age, disability, their physical or mental health.'

This decision to focus on the City of Bristol only and not have a national call was a pragmatic choice made on two premises. Firstly, as Acar (2019) advised, the intrinsic and extrinsic motivations of the crowd needed to be considered. Although radiography pre-registration programmes train for a national workforce, linking the local UWE Bristol programme to the public of Bristol might have encouraged individuals to make a personal local link and engage. I deemed this important as there was no financial incentive to engage. Furthermore, given that UWE Bristol serves Bristol, and students undertake at least one placement within the city, graduates are more likely to secure their first post in the area. Hence hearing from those living in Bristol would be more beneficial than hearing from people in, for example, Newcastle. Secondly, there is no previous work in this area from a pragmatic viewpoint, so I did not know if anyone would participate or whether I would be flooded with engagement and potentially a data set that would become unmanageable. Blohm et al. (2013) observe that the sheer volume of solutions generated in crowdsourcing can be overwhelming for many organisations. Acar (2019) concurs, stating that sorting through the submissions and evaluating them consumes substantial resources and prevents the crowdsourcer from implementing solutions quickly.

Inclusion criteria (living in the City of Bristol) were confirmed via the gateway questionnaire, with participants logging their postcode to access the online space. This data was gathered through capturing the following information:

1. Name
2. Email address
3. High-level location (first three/ four characters of the postcode)
4. Demographic data (gender, age, ethnicity)

Clever Together provided reports every three days on the crowd composition. Access to these reports meant I could carry out targeted activity to encourage traffic to the website. This intervention included posting the opportunity in Facebook groups linked to a particular postcode that were not engaging.

Action Cycle 3: Bristol residents and those imaged in Bristol

It became apparent during action cycle two that there were voices using the platform that used the language of informed healthcare professionals; however, there was no way of identifying if they were indeed part of the crowd or separating them from the wider public. Therefore, following action cycle two, further gateway questions were added, and supplementary ethical approval was sought by returning to the ethics committees between cycles two and three. This adjustment allowed this suspicion to be explored further. Of course, professionals engaging could also offer their experiences as patients. Nevertheless, I deemed it essential to gather this information to build a demographic profile which added to the knowledge base on public patient crowdsourcing in health professions curriculum design. This decision is also explored further in chapter nine. The added questions were:

5. Do you or have you worked in health and social care? (No/ Yes)
6. If yes, are you currently:
   An academic
   Working in a health and social care setting
   A student
   No longer working in health or social care

Crowdsource three was also extended to those living outside of the city of Bristol. This change was initiated as I was emailed by several interested participants who had seen the advert for the study. They had had medical imaging at locations within Bristol but could not be included as they lived outside of the advertised postcodes. I contacted the individuals to encourage them to join the third and final conversation. However, I chose not to broaden my recruitment strategy at this point of the research as I had no additional financial or time resources to take this action.

About the crowdsourcing process: What platform is used?

The platform offered an asynchronous online engagement, open 24 hours a day, seven days a week, with each workspace opened for two weeks, whereby participants could join the conversation as many times as they wished. Once participants clicked on the study advert, ***appendix* 10**, they were taken to a landing page. Included in this page were the project information, a participant information leaflet, ground rules and additional reading resources - ***appendices* 11, 12, 13**). In addition, written information (HCPC, 2013; SCoR, n.d) and a video (The WOW Show, 2019) about the role were available on the landing page to support the public's understanding of who diagnostic radiographers are. However, these were not mandatory to watch, and when this research was conducted, the Clever Together platform did not provide a way of logging how many crowdsource participants watched these – ***Figure* 16**.

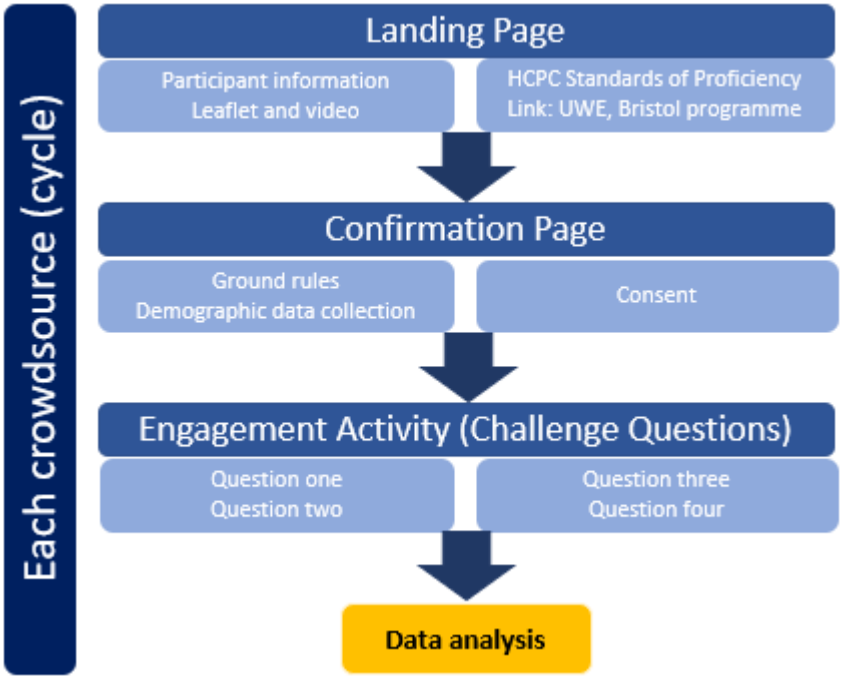


Figure 16. *Process for participants accessing each crowdsource (each action cycle)*

The page also included a 'sign up' function, a gateway questionnaire to capture demographic information and a tick box to confirm participants had understood the participant's information leaflet, thus consenting to be part of the study alongside abiding by the ground rules. Participants were then taken to the page which contained the challenge questions on which they were asked to

either add an idea or leave a comment on the ideas posted by others. Any participant could create ideas. From here, comments were added as per a discussion board thread. Votes could also be given to an idea. Using a ‘thumbs up’ or ‘thumbs down’ button for each idea. Once registered, participants could enter the crowdsource as many times as they liked whilst it was opened and leave multiple ideas, comments, and votes (Brabham, 2013) – ***Figure* 17**.

Whilst contributions to the platform were visible to other contributors, personal details were anonymised. In other words, participant information was not shown next to an idea, comment,or vote. This ensured that others treated ideas on merit, not on the person expressing them. In online spaces, there is always the challenge of participants sharing identifiable information, including unexpected confidential information; and this is no different for crowdsourcing. Whilst this can be kept confidential from outside the group, this is not the case for inside the group. An option on the platform was to blank out such identifiable information. This guaranteed that the wider comment remained available for later analysis. This was not used for this research as no occasion arose to apply it.

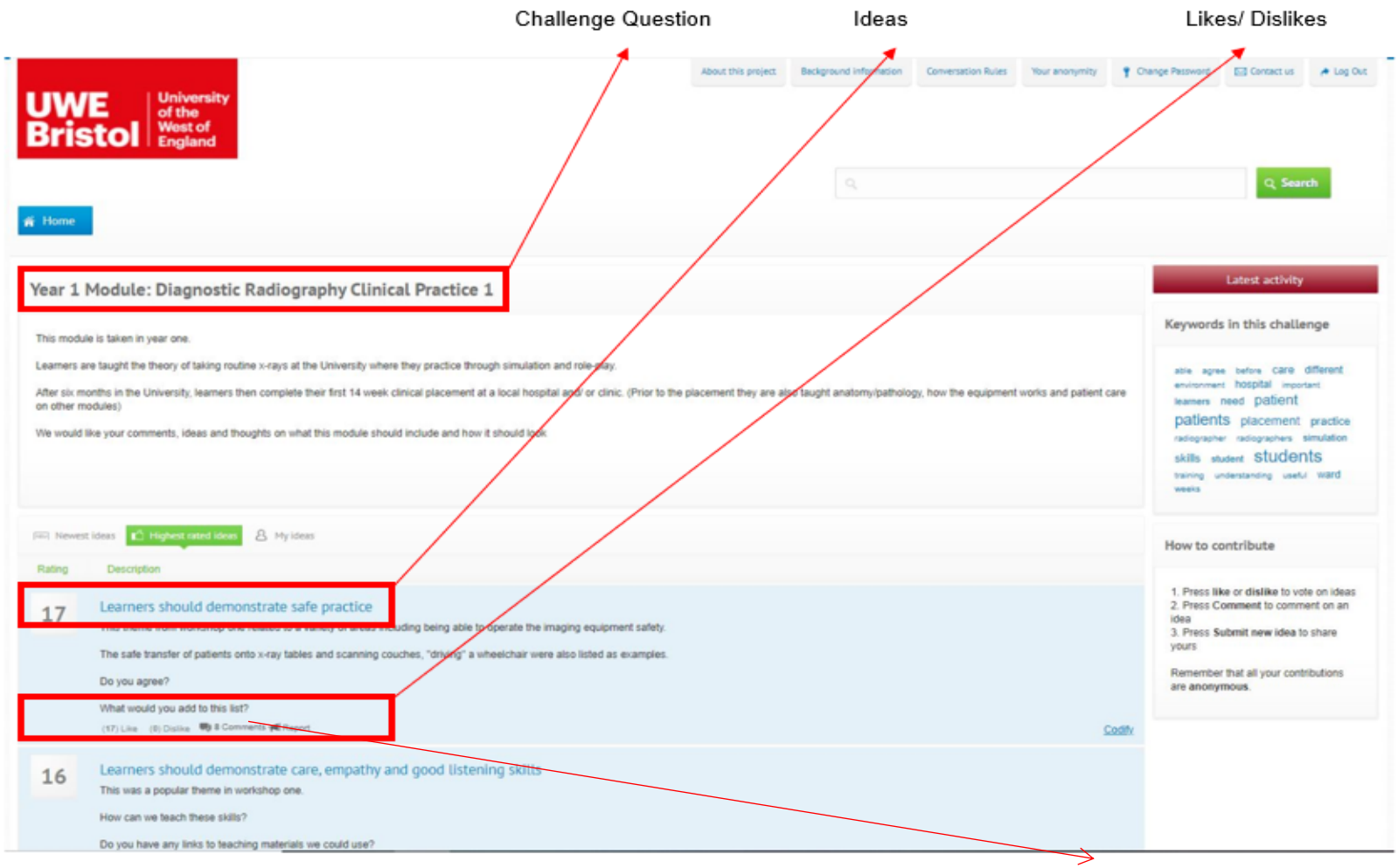


Figure 17. *Sample of online workshop page*

4.5 Ethics

As the research was an open call to the public living in Bristol and participants were not recruited from the NHS, ethical approval from the NHS Research Ethics Committee (NHS REC) was not deemed necessary (Banks & Brydon-Miller, 2019). However, since the work did involve human subjects/ participants, approval from the local University's Ethical Review Panel was required from the institute where I was a Doctorate Candidate, Swansea University Medical School (SUMS 2019-0013), to ensure participants and their data were protected. This was then ratified by the Faculty of Health and Applied Sciences at UWE Bristol (HAS.19.05.185), where the research was undertaken. An amendment to the original ethics submission was requested between action cycles two and three and agreed upon by SUMs (SUMS-2019-2013a) and HAS, Bristol (HAS.19.05.185a) ethics committees - ***appendix* 14, 15.**

For this research, the Clever Together platform was considered a research venue the researcher was accessing to undertake the research (Buchanan & Zimmer, 2018). This meant all the data collected remained with the company. A copy of the company privacy policy was available to participants via the project landing page. In addition, at the end of each crowdsource cycle, Clever Together provided spreadsheets with participant email addresses and names removed. This was the information that was analysed. Upon completing the research, it was agreed that all parties would delete the data they held.

As observed in chapter two, crowdsourcers need to be aware of crowd hijacking. Wilson et al. (2017) advised crowdsourcers to anticipate the worst when conducting a crowdsource, stating managers should decide in advance of a campaign how much they are willing to tolerate participant behaviour and have a plan in place if participants cross this line. They continue by saying crowdsourcers should anticipate the possibility of content that is unflattering to their establishment. Foreseeing these contributions means a crowdsourcer can have a response strategy in place. While the project welcomed uncomfortable and controversial ideas, I acknowledged that the variegated nature of the spontaneous community developed in this research could lead to conflict. Hence

participants were asked to read the crowdsource ground rules before signing up (consenting) and entering the crowdsource platform – ***appendix* 12**. These rules highlighted that personal, abusive, or offensive content would not be tolerated. If these were breached, participants would be contacted without identifying who they were. This was achieved through a function available in the Clever Together platform, which supported contacting a participant. The message could be tailored to each person, dependent on their circumstance.

Monitoring the platform was an activity I needed to complete manually and required logging in once in the morning and once in the evening. This took an hour a day. The SUMS ethics committee agreed that I would action the following scenarios if participants:

- Identified themselves. In this instance, I could edit the post and then write to the participant to explain what I had done and why
- Named other people or described someone in such a way as they can be identified negatively. In this case, the post could be edited. Again I could write to explain what I had done and why
- Used abusive language/tone in the conversation. In this instance, the decision of what constituted was my subjective view or if another participant reported this.
- Mentioned, on the platform, that they were having difficulties. I could write to them via the forum, suggesting they email support@clevertogether.com

The Clever Together platform had a Frequently Asked Questions (FAQ) tab to support the final point further. Majchrzak and Malhotra (2020) write that using these can complement the role of the moderator. This section included answers to anticipated questions that the Clever Together team had encountered in previous campaigns they had run over the years. Answers provided related to:

1. Whom can I contact if I am having difficulties?
2. Will my comments be anonymous?

3. Will anybody within my organisation know if I participate in this workshop?

As the crowdsource was conducted online, e-consent was in place. Participants had a tick box to confirm they had read and understood the participant information sheet before entering the crowdsource. The NHS Health Research Authority (HRA, 2020) and the Medicines and Healthcare products Regulatory Agents (MHRA, 2020) recognise e-consent as a credible alternative to conventional face to face consenting processes. In a review of e-consenting, Skelton et al., (2020) write that the articles they reviewed indicate user experiences of the process were positive, with moderate to high levels of satisfaction. They noted that several papers included in their review also emphasised that e-consenting may also improve participant diversity by enabling underrepresented groups or participants in rural areas, who would not usually be able to participate in research, to join the studies remotely: Heller et al., (2014); Hamel et al., (2016); Khairat et al., (2018). As informed consent should be viewed as a dynamic process (Heinrichs, 2019), details for potential participants outlining whom to contact and how they could be contacted were included on the crowdsourcing landing page, participant information sheet and the debrief sheet.

4.6 Participant recruitment

Each individual who completed the demographic questionnaire ticked the consent box. And entered the webpage with the challenge questions was counted as a participant. This was irrespective of them contributing by adding a contribution (idea, comment, or vote). As outlined in chapter three, the crowdsourcer must know who their audience is and how best to reach them for a crowdsource to be successful. Therefore, it is essential to invite people who are likely to be ‘passionately engaged’ with or ‘deeply impacted’ by the problem presented (Shirky, 2008). In other words, to keep participants involved throughout crowdsourcing research, participants must perceive the problem being solved as high value to themselves and their community. Before seeking

subjects for the study, a recruitment plan was submitted to the SUMs ethics committee. This was developed against the backdrop of having no monies for the recruitment phase of the research and all recruitment activity being carried out by myself. Hence, I needed to access methods that had minimal costs. Again, this project phase targeted an internal crowd for action cycle one and an external crowd for cycles two and three.

Action cycle one: UWE Bristol diagnostic radiography learners

The call to participate was undertaken electronically via email, and notices were placed on the virtual learning environment (BlackBoard™). Flyers were distributed to the Year 1 students on placement, and they were verbally reminded of the activity by their clinical tutors during a June 2019 clinical link visit. Tweets to highlight the activity were sent via a personal (@jstjohnmatthews) and departmental (@UWE_AHP) Twitter accounts.

Action cycles two and three: Bristol residents

Majchrzak and Malhotra (2020) advise that organisations should consider individuals who already engage with the organisation when considering whom to invite to a crowdsource, i.e. an internal crowd. Dahlander et al. (2018) concur that it is difficult to recruit individuals with whom organisations do not yet have a relationship. Franke et al. (2013) are cautious about this approach. They write that recruiting individuals already working with the organisation means those individuals may already operate in the same domain as the organisation, working to their processes and procedures. Therefore, this may jeopardise the generation of new and novel approaches. Consequently, the inputs generated from this group of individuals may not lead to ground-breaking innovations (Burgelman, 2002).

A recruitment email was sent from the UWE Bristol Faculty public, patient, and involvement office. At the time of undertaking this research, this included one hundred patients who supported ad hoc teaching and learning activities at UWE Bristol. Whilst this group represents an internal crowd, and as pointed out above, this presents challenges, a critical point to bear in mind is that one stakeholder sits on the design team - a patient employed by the Faculty.

Working with a single patient meant that currently, 119 individuals are not involved directly with the diagnostic radiography degree curriculum design process. Thus a recruitment flyer was put in the group's bi-monthly newsletter. In addition, given the links with the Southwestern region of England, an email was also sent from the patient, and public involvement facilitator at the Southwest National Institute for Health Research (NIHR) applied research collaboration group to all patient public members on their mailing. This was because these individuals were known to contribute to various research activities within the department of allied health professions at UWE Bristol.

Once these groups had been approached, recruitment was extended to the internet. At the time of conducting the research, in 2019, Ofcom reported that 87% of the population in the UK were using the internet, and 78% had a smartphone (Ofcom, 2019). It was also reported that Google and Facebook were the two most popular online properties, each reaching over 95% of the digital population, with UK adults spending on average 49 minutes on social media platforms each day. For this research, I chose to use the social media channels Facebook and Twitter. These channels were adopted as I was already an active use of both, and was confident in how they worked. With Twitter, I had built a followership of 2,500 people, with many representing individuals and organisations within the Bristol area. A copy of the engagement strategy demonstrates how posting was cross-referenced to optimum posting times for each tool - ***appendix* 16**. In addition, HootSuite™ (2020), a social media management platform that supports social network integrations for Twitter, Facebook, Instagram and Linkedin, was employed to support these timed activities.

In a systematic review of the use of Facebook in health research, Whitaker et al. (2017) concluded that when compared with traditional recruitment methods (print, radio, television, and email), the benefits of using Facebook included reduced costs, shorter recruitment periods, better representation, and improved participant selection in young and hard to reach demographics. Ofcom (2019) write that 83% of smartphone owners use Facebook. Of the 83%, this ranged from 69% to the 16-24 year-olds to 91% for the over 65s. Facebook is

considered the primary social media account for most of those aged 35 or older by age, socio-economic group and gender. A ‘Crowdcurriuclum’ community page was set up on Facebook, and several Bristol Facebook groups were joined. A complete list is available in ***appendix* 17**, including membership numbers as of September 2019 and community page details. As advised by Colvin and Lanigan (2005) and supported by Barratt and Lenton (2010), permission from the Facebook page moderators was sought before posting recruitment announcements and flyers. Any notices posted in these Facebook groups highlighted that permission had been granted from the page moderator, and the deadline for the research cycles was noted. To ensure what Mendelson (2007) described as authenticity, details on how to contact the researcher and the name of the ethics boards were listed on the flyer.

My choice to use Twitter, alongside it being familiar to me, was that it offered a way to capture a different age demographic. Ofcom documented that 37% of social media users use Twitter, with 47% aged 16 – 24 23% aged over 65s. Hence, I concluded that using both mediums would include a range of people. Recruitment conducted via Twitter included scheduled tweets from a personal account (@jstjohnmatthews) to direct potential participants to the site to register. In addition, a hashtag to collate the tweets relating to this activity was created: #crowdcurriculum. For both social media approaches, I also set up pre-event messaging to increase the awareness of the research and develop an interest in the work, a crowdsourcing recruitment approach supported by Majchrzak and Malhotra (2020). In these instances, potential participants could register their interest in the platform and be emailed once it went live.

Although crowdsourcing can enable geographically diverse samples, accessing socio-demographically diverse stakeholders may be more challenging (Sood et al., 2021). Using an electronic-only recruitment method means this challenge is further compounded, as online recruitment can mean persons of low socioeconomic status may be underrepresented in this type of scheme. I did not set any recruitment targets as the aim was to see how representative the participants would be from this novel curriculum design tool. I did seek to place adverts in free newsletters for areas described as high on the England indices

of deprivation (Bristol City Council, 2019). Unfortunately, only three community newsletters replied. Subsequently, adverts were placed in the August and September 2019 editions of Winterbourne & Frampton Matters; Bishopston Matters; Little Stoke Gifford Community Matters. The newsletter editors posted on the newsletter Facebook and Twitter account alongside their print advertising.

Two sets of participation information and flyers were developed, each recognising the target audiences of students in action cycle one and patients, and the public in action cycles two and three- appendices ten and eleven. Both were reviewed for readability style, and general appeal. For readability, the Simple Measure of Gobbledygook (SMOG) was applied. Created by McLaughlin (1969), the SMOG Index estimates the years of education a person needs to read and understand a given text (Oakland and Lane, 2004). The SMOG index was created to improve upon other readability formulas and applies a set of rules to a piece of written text with a final score. Initially, both participant sheets scored a SMOG value of 19.2, and after reviewing the wording again, this was decreased to 15.7. These levels are described as complex to read texts for college-level entry readers.

Wray and Janan (2014) caution the use of readability scales as they sit in a positivist paradigm that views reading comprehension as an input and output process. On closer inspection, I would argue that this is not a problem as I needed to create information that would appeal to everyone. Despite this observation, it does require some consideration as research has shown that the conceptualisations of reading and reading comprehension has changed and are now viewed as a meaning-construction process. Meaning does not just come from the text but from readers who bring their social and cultural backgrounds into an interaction with the text (Ruddell & Unrau, 2004).

Therefore, before action cycle one, UWE Bristol diagnostic radiography learners (n=3) reviewed the participant information. As a result of this consultation, the wording was altered to state that UWE Bristol was refreshing the curriculum rather than redesigning it. Brett et al. (2014) highlight that

consensus has emerged regarding the benefits of involving PPI at this stage, i.e. creating user-friendly information and developing appropriate and effective recruitment strategies. Hence, for action cycles two and three, the flyer and participant information was co-designed with the UWE Bristol Health and Applied Science Faculty employed service user.

4.7 Data analysis

The Clever Together platform offered an opportunity to collect quantitative and qualitative data. Descriptive categorical data was collected and reported. This included participants' demographic details, as outlined in chapter 4.6 when they accessed the web page, and how many ideas, comments, and votes were cast. Using the voting tool enabled reporting the most discussed and the highest-rated ideas. Wynne (2007) cautions not to merge individual participant's entries (combining comments which may look similar) as this may lead to them being underestimated. They observed that, unlike in big data analysis, where minority opinions or behaviour can get lost, crowdsourcing often enables qualitative research that brings non-mainstream and dissonant voices to light. Hence while the votes were recorded within the thesis, they were considered within the context of the qualitative data.

The data generated from the challenge questions also included dialogue between participants as they commented on ideas posted on the site. This type of data offered the opportunity to explore objective two of the research. First, would the ideas and themes generated from the crowdsourcing be included in the new curriculum? Although Clever Together has developed an in-house data analysis method from their crowdsourced activity over several years, this is not published and available outside the company due to commercial sensitivities. Moreover, the purpose of this doctorate was not to critically evaluate the Clever Together approach to data analysis but instead to focus on the research question, which sought to consider how crowdsourcing could be delivered within health professions curriculum design. Accordingly, I needed to consider alternative ways to analyse the qualitative data.

The overall epistemological approach for this thesis was pragmatic – we have a tool (crowdsourcing); let us evaluate whether this tool can be used in this new context. Hence when analysing the qualitative data generated by the ideas and comments made on the platform, I opted to use thematic analysis (Braun & Clarke, 2006). Thematic analysis differs from other analytical methods that seek to describe patterns across qualitative data, such as interpretive phenomenological analysis (IPA), grounded theory (GT) and discourse analysis (DA). Whereas grounded theory analysis aims to generate a theory of a phenomenon grounded in that data (McLeod, 2001), IPA is about understanding people's everyday experiences of reality in detail to understand the phenomenon in question (McLeod, 2001). On the other hand, discourse analysis identifies themes, stories within data, and theorises language as constitutive of meaning and meaning as social. The analysis is undertaken line by line. These methods seek to search for patterns across a data set rather than within a data item. In this sense, they overlap with thematic analysis.

For all three action cycles, an inductive reflexive thematic analysis approach was applied, whereby the content of the data directs coding, category, and theme development. First codes were identified in the data. These were single words and phrases that represented a single idea. Next, categories were created by drawing together similar codes. Finally, themes were created to describe broader overarching ideas (Cresswell & Cresswell, 2019). This process was supported using the Braun & Clarke (2006) 15-point guide – ***Table* 4**. Worked examples can be found in ***appendix* 20**. Step one in the Braun and Clarke (2006) guide was not undertaken, as an advantage of using a digital data collection tool was that the data was already transcribed.

The qualitative data were analysed as one single data set rather than each challenge question being investigated separately. This ensured that no cross-over themes were missed. Once the analysis was completed, I critically evaluated the themes against the evidence base. The findings were then shared with the UWE Bristol diagnostic radiography programme design team, with the researcher acting as a one-way bridge between the crowd and the

design team, as previously demonstrated in ***Figure 15.*** Areas of the curriculum that would remain and changes made were documented.

Table 4. *A Framework for Thematic Analysis*
(Braun and Clarke, 2006)

PROCESS	STEP	CRITERIA
Transcription	**1**	The data has been transcribed to an appropriate level of detail, and the transcripts have been checked against the tapes for 'accuracy'.
Coding	**2**	Each data item has been given equal attention in the coding process.
	3	Themes have not been generated from a few vivid examples (an anecdotal approach), but instead, the coding process has been thorough, inclusive, and comprehensive.
	4	All relevant extracts for each theme have been collated.
	5	Themes have been checked against each other and back to the original data set.
	6	Themes are internally coherent, consistent, and distinctive .
Analysis	**7**	Data have been analysed, interpreted, made sense of rather than just paraphrased or described.
	8	Analysis and data match each other - the extracts illustrate the analytic claims.
	9	Analysis tells a convincing and well-organised story about the data and topic.
	10	A good balance between analytic narrative and illustrative extracts is provided.
Overall	**11**	Enough time has been allocated to complete all phases of the analysis adequately, without rushing a phase or giving it a once-over-lightly.
Written Report	**12**	The assumptions about and specific approach to thematic analysis are noted.
	13	There is a good fit between what you claim you do and what you show you have done, i.e. described method and consistently reported analysis.
	14	The language and concepts used in the report are consistent with the epistemological position of the analysis.
	15	The researcher is positioned as active in the research process; themes do not just 'emerge'.

As noted in the literature review, the lack of studies into crowdsourcing curricula meant there was no blueprint of the crowd's size that would join the conversation. Braun and Clarke (2019) make a valid point that determining sample size in qualitative projects is often a pragmatic activity shaped and

constrained by the time and resources available to the researcher. They note that whilst the obsession with qualitative sample sizes may exist in some quarters, it relies on interpretative, situational, and pragmatic judgements (Sandleowski 1995; Sim et al., 2018). Nonetheless, it was important to log the sample size of each crowdsource, given there was no curriculum design process data, as this was the first study of its kind. Although I had some indication within policy literature from Iceland and Finland of what sample sizes might look like. Hence the sample size was also reported as data as it answered the question of 'how many people showed up.

Pragmatically for this research, the sample size was the number of people who engaged with the crowdsource when it was open. This decision to stay open for two weeks was based on the limitations of the time and financial resources available. However, I note that collecting qualitative data through crowdsourcing did lower the costs compared to interviews or focus groups as interviewer time and transcription costs were not required. It could be argued that the concept of data saturation could inform the length of time the crowdsources stayed open. Yet Braun and Clarke (2019) write that this is problematic when using a reflexive TA approach.

For action cycle one, an experienced and published qualitative researcher and I separately blind coded the data and then came together for a consensus meeting. Our coding was similar, thus increasing confidence in the reliability of the codes generated. Due to time constraints, I acted as a single coder for action cycles two and three. Braun and Clarke (2019) observed that quality thematic analysis is not about accurate and reliable coding or achieving consensus between coders but about the researcher's reflective and thoughtful engagement with their data and the analytic process. As Yardley (2008) pointed out, all coding agreement demonstrates is that coders have been trained to code in the same way, not that coding is dependable or accurate. However, coder one and I had not coded together before, so this was not our experience.

The outcome of the first coding activity, i.e. agreement, provided personal confidence in my coding ability. Either way, there was a requirement to

consider the researcher's bias to the activity and their interpretation of the data, given that I solo coded two of the three available data sets. Subsequently, to ensure the rigour of the themes presented, as demonstrated in chapter nine, this activity represented another instance where reflexivity was observed. This was achieved through keeping diaries throughout the research process (sample entries in ***appendix* 18**) and holding critical friend meetings, which as Smith and McGannon (2018) wrote, offers an opportunity for dialogue and subsequent reflexivity.

4.8 Chapter summary

This chapter has outlined how a pragmatic, action research approach using an embedded mixed methods design afforded the ability to explore how a crowdsource would need to be designed to enable students, patients, and public involvement in a diagnostic radiography degree curriculum design process. Building on chapter three, further details have been shared on the specific commercial tool used for this research. Drawing on the discussions in chapters two and three, the crowd composition and crowdsourcing process for each action research cycle iteration were explored in detail. Additionally, the complete cycle questions applied after each action research cycle, before adjusting the next action cycle, were shared.

Areas such as ethics and participant recruitment have been considered in the context of using a digital data collection tool. This included e-consent and managing data alongside opportunities and challenges of recruiting for the research online. Given the qualitative data generated by the crowdsourcing platform, the data analysis section required me to revisit my epistemological stance. Both action research and thematic analysis are highly reflective approaches. In view of this, the reader has been introduced to chapter nine, which focuses on the reflections undertaken throughout this work. The following chapter presents the findings and critical evaluation of the first iteration of the research cycles in the interim.

CHAPTER FIVE: Action Cycle One

5.1 Chapter introduction

The previous chapter explored the methodology applied to this study, action research and adopted methods. The latter introduced the reader to decisions made about action cycle one, with students, and cycles two and three, with patients, and the public. In this chapter, I present and critically evaluate the findings of action cycle one. Focusing on the student stakeholder group allowed me to explore students as partners in a healthcare curriculum design process.

I start by sharing the demographic data gathered. Secondly, I report the categorical data, including ideas shared, comments made, and votes cast. Thirdly I present the qualitative analysis of the contributions made through students' comments. These critically evaluated themes were presented to the curriculum team, who decided how these suggestions would be incorporated in the updated UWE Bristol BSc (Hons) Diagnostic Radiography programme. Undertaking this work allowed me to map what would stay in the curriculum and what would be enhanced. For the final part of this chapter, reflecting on my crowdsourcing experiences, the chapter concludes by applying full-cycle action research questions. Simultaneously reporting and evaluating the first action cycle results allowed me to consider the required adjustments to my methods before moving to action cycles two and three.

5.2 Action cycle one: Participant demographic data

Action cycle one was hosted for two weeks between the 24th of June and the 7th of July 2019. The platform offered an asynchronous online engagement, open 24 hours a day, seven days a week. Each workspace opened for two weeks, whereby participants could join the conversation as many times as they wished and make contributions via an idea, comment, or vote. Participants could make more than one contribution; however, they were only allowed a single vote per idea or comment.

Categorical data captured included the number of students invited to participate, how many students completed the demographic questionnaire and e-consent) and how many contributed ideas, comments and votes. In addition, before entering the online space, participants were asked to identify their year group via the gateway questionnaire.

In total, 172 students were eligible and invited to contribute. When action cycle one was conducted, no learners were on the university campus. This decision was pragmatic as I needed to complete all three action cycles before the final updated curriculum paperwork was submitted for internal and external scrutiny in November 2019 – ***appendix* 1**. A delay to September 2019 would mean there was not enough time to run all three proposed crowdsources. The year one students (2018 intake; n=61) were on placement away from the University, and the dates fell outside the academic year for the year two students (2017 intake; n=61). The year three students (2016 intake; n=50) had completed the degree programme and were awaiting HCPC registration before their first posts. Some stayed in Bristol, some moved home, and others were on holiday.

27 students participated from across the UK and Ireland, which supported this observation, as during term time, they would, be based in Bristol and the surrounding area. Saleh and Bista (2017) and Vance (2011) highlight that seasonality impacts online survey response rates, and sending an email whilst students are on vacation or undertaking exams will impact response rates. This observation is certainly accurate for this action cycle and would explain the low uptake of the crowdsourcing activity. As no students were on-site, I could not promote the activity by in-person means. As noted in the stakeholder engagement plan, I also relied on electronic communications to encourage the students to engage, including emails and messages on the virtual learning environment. While we can assume this potentially impacted the uptake of the crowdsource, I argue it did replicate the recruitment approach with patients, and the public. Thus, the first action cycle timing offered an opportunity to explore what learning could be taken from cycle one and applied to cycles two and three concerning remote participant recruitment.

As discussed in chapter four, participants were presented with the following challenge questions from which quantitative and qualitative was derived. These questions had been themes from a paper by Sloane and Miller (2017) looking at the skill gaps in newly qualified radiographers as reported by clinical imaging managers (employers) and agreed by the UWE Bristol curriculum design team.

1. Is there anything we should stop, start or do differently in the updated programme?
2. What does UWE Bristol need to include in an updated diagnostic radiography programme to support your career aspirations?
3. What technical skills should a newly qualified diagnostic radiographer have?
4. How can a diagnostic radiography training programme help you support your mental health?

5.3 Action cycle one: Quantitative data

Twenty-seven (16%) learners completed the gateway (demographic) questionnaire. Eight participants were from year one, twelve from year two and seven from year three. Of these, five (highlighted in yellow in table five) did not contribute to the online space; acting as spectators, with the remaining twenty-two (13%) undertaking the role of active participants together, making 222 contributions in the form of votes (n=152), comments (n=46), and ideas (n=24) as highlighted in ***appendix* 19**. A breakdown of this information by year group is demonstrated in – ***Table* 5**. A single participant could join the conversation multiple times and make various ideas or comments during the two weeks the crowdsource was opened. However, they were only allowed a single vote per comment and idea post.

Table 5. *Crowdsource one. Student comments, ideas, and votes*

Year	Crowd	Logins	Votes	Comments	Ideas
Year 1	Eight	1	0	0	0
Year 1		1	6	0	0
Year 1		2	11	2	2
Year 1		1	0	0	4
Year 1		1	1	0	0
Year 1		2	2	0	2
Year 1		1	3	0	0
Year 1		1	0	0	0
Year one total			**23**	**2**	**8**
Year 2	Twelve	1	0	0	0
Year 2		3	9	1	0
Year 2		1	8	0	0
Year 2		1	4	9	0
Year 2		1	8	1	2
Year 2		2	13	0	1
Year 2		1	1	0	0
Year 2		11	18	2	0
Year 2		3	4	2	1
Year 2		1	3	1	0
Year 2		2	4	1	0
Year 2		1	0	0	0
Year two total			**72**	**17**	**5**
Year 3	Seven	3	15	1	4
Year 3		1	3	1	0
Year 3		2	2	1	1
Year 3		34	22	16	2
Year 3		3	6	1	1
Year 3		1	12	1	1
Year 3		1	0	0	0
Year three total				**21**	**9**
		TOTALS	**152**	**47**	**23**
			TOTAL CONTRIBUTIONS		**222**

***Chart* 1** demonstrates the number of contributions made per question. These contributions are further broken down into ideas, comments, and votes for each question – ***Chart* 2**. These charts are supported by ***Table* 6** provide further details on the wording of the ideas shared and the four themes these ideas mapped to.

Chart 1. *Crowdsource one: Sum of all contributions*

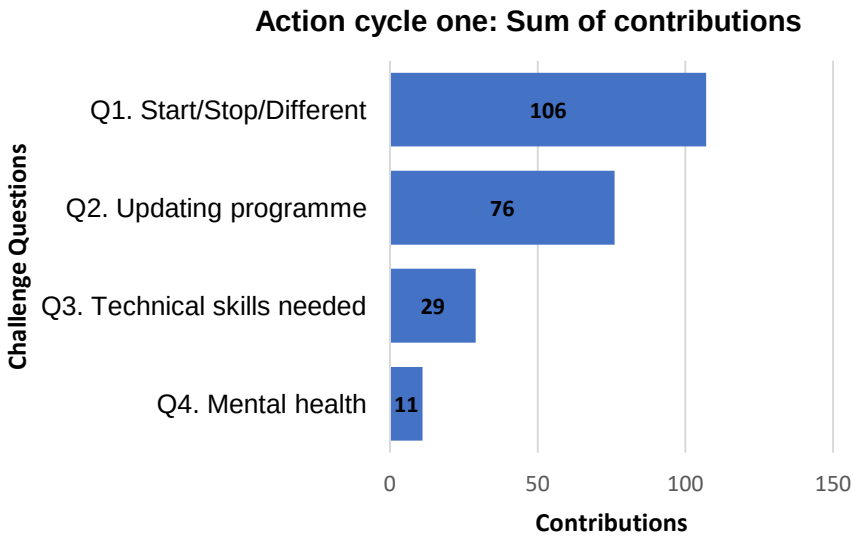


Chart 2. *Crowdsource one: Votes, comments, and ideas*

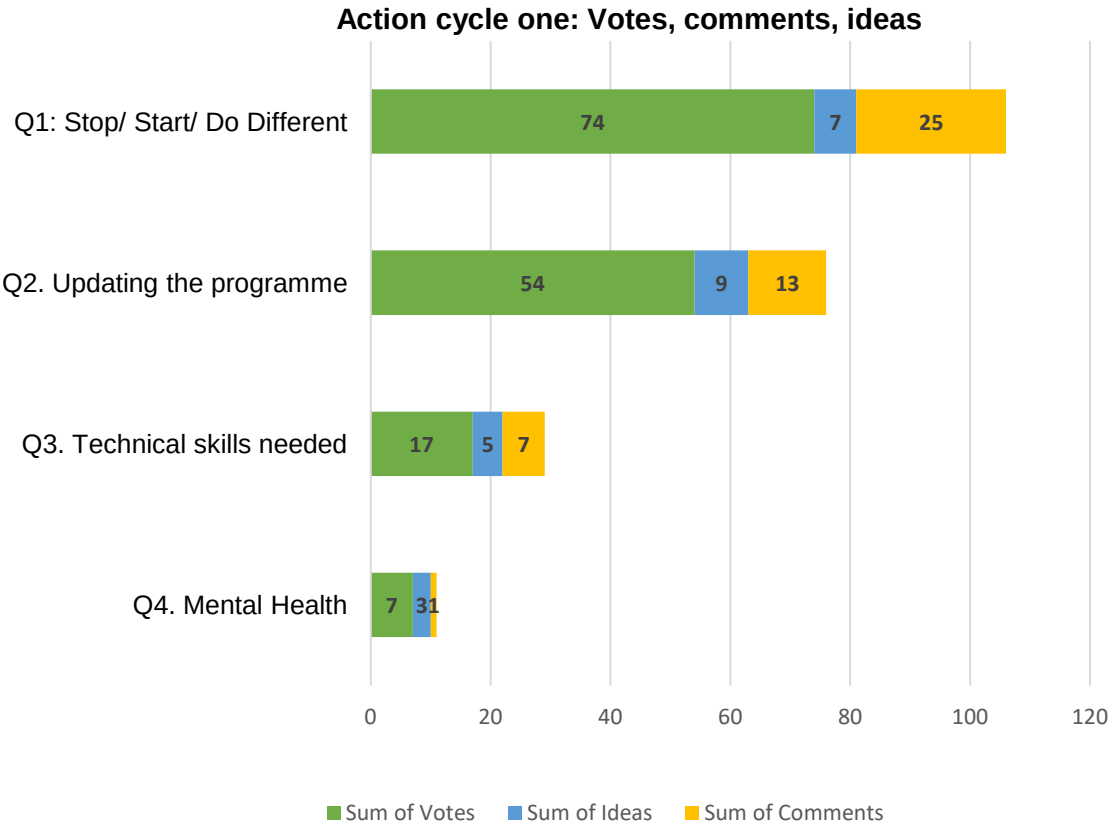


Table 6. *Crowdsource one: Ideas ranked by contributions made*

No	Challenge question. Crowd idea	Idea description	Total contributions
1	**Stop/Start/Different** Placement Module Grading	Placement should be focused on appraisal marks instead of just a pass and fail. Individuals who do not cope well with presentations found that their overall grade did not truly affect how they worked on placement, and they're in practice skills are not accurately represented.	43
		Assessment + Feedback	
2	**Updating Programme** Engaging Lectures	Some lectures are un-interesting, and I believe it would be quite simple to make them more engaging. For example, our anatomy and physiology classes had pre and post tests for us to complete at home. I personally found this very useful, and it helped me engage with the learning material. Work sheets, online tests, group work, etc. could make classes more interesting and therefore improve attendance.	25
		Learning Environment	
3	**Stop/Start/Different** General Imaging	We are ultimately going to be plain film Radiographers when we qualify. Some of us may never go into nuclear medicine, mri, etc. is there a need to spend so much time in lectures learning and studying these modalities in such depth?	20
		Syllabus Content	
4	**Stop/Start/Different** Obese patients	UWE should purchase a larger size dummy so that students can practice imaging larger patients and feeling for their bony landmarks before they go on placement. Or be able to practice on larger patients before placement.	17
		Syllabus Content	
5	**Updating Programme** Image Interpretation	Spend more time interpreting images, for example what different pathologies look like on a chest x-ray- do this in first year, even if brief, so that there's a bit more understanding before placement	15
		Syllabus Content	
6	**Updating Programme** Practical Skills	Even though we must take many classes and have a good background knowledge of Radiography as a whole, some newly qualified Radiographers do not perform as well in the field as they do in the class room. It is important to be able to communicate and adapt to real life situations and carry out examinations to the highest standard. More time in the X-ray room before going out on placement	11
		Learning Environment	
7	**Stop/Start/Different** Guidance after Dissertation	Maybe a quick email once we've passed our final module explaining how and when we can sign up the HCPC/SOR.	10
		Other	
8	**Stop/Start/Different** Behaviour in the x ray room	When on placement many Radiographers would come and go from the rooms opening the doors to the waiting room as they go. This is unprofessional in my opinion. It is import to treat each patient with the utmost respect and not have a crowd viewing them from behind the control panel	9
		Learning Environment	
9	**Technical skills Needed** Patience	We need to be able to accept that some patients will struggle or not understand what is asked of them to begin with, therefore we need to be able to remain calm and treat them with respect without getting annoyed or treating them differently.	9
		Syllabus Content	
10	**Updating Programme**	A deeper look into the different modalities and an opportunity to take a short elective placement in them	8

	Imaging Modalities		
		Syllabus Content	
11	**Stop/Start/Different** Placement Appraisal	Could more be done to try and get appraisals done on placement in a timely manner? Quite often, students are having to sacrifice time spent in one area to revisit another for the purpose of an appraisal. I have witnessed students missing appraisal opportunities because appraisers are on holiday/sick/different shifts. I would suggest liaising with placement sites to ensure that there are enough appraisers within the respective Trusts	7
		Assessment + Feedback	
12	**Updating Programme** Professionalism	Professionalism is more about an attitude and having the right mindset that we all want to strive and be better radiographers and have a reason why we want that strive. For me I want to be an amazing radiographer that always puts the patient first and provide the best care for patients. With the right attitude when radiographers set themselves such a standard it means that dignity and respect, good communication, good interpersonal relationships and all the other many necessary skills grow naturally from the right mindset.	7
		Syllabus Content	
13	**Technical Skills Needed** Interpersonal	The ability to communicate well with a variety of patients as well as colleagues	7
		Syllabus Content	
14	**Technical Skills** Communication	An ability to communicate with a range of patients including children and adults. Communication episodes in radiography are very short so an ability to build rapport with a patient quickly. Always using #hellomynameis when introducing one's self	6
		Syllabus Content	
15	**Updating Programme** More than a Uniform	Being a professional in your chosen field means much more than wearing a uniform. Professionalism is about how you conduct yourself in day to day activities. Key areas to consider include: being an expert in your field, behave morally and ethically, be structured and organised, do what you say you will do.	6
		Syllabus Content	
16	**Mental Wealth** More Time with Vulnerable Patients	The thing I found hard on placement that I carried with me and still often think about at home is the number of vulnerable patients who said that they "just wanted to die" or other things of the like – be it due to their illness or pain, or even possibly dementia related talk. I think that we should spend more time learning what to say to these types of patients and know exactly where we can refer them to in times like this, so that we don't go home wondering what might have happened to them once they have gone, knowing we could have done more to help.	5
		Syllabus Content	
17	**Technical Skills Needed** Confidence	I believe a skill newly qualified radiographers should have is confidence in themselves when in their working environment. Confidence not only in their ability to achieve a good diagnostic image, but also confidence in knowing when to ask for help or assistance from a more experienced radiographer. From my experience, when a radiographer speaks with confidence it shows the patient they can trust you and makes them more comfortable in an unfamiliar environment.	4
		Syllabus Content	
18	**Mental Wealth** Recognising student actions	A lot of students do some incredible work and it varies from whether that's getting a tricky radiograph or making a patient smile. To support other students and promote the little things demonstrates that we all make a difference to patients lives and sometimes it's the little things that keep us going. Getting good feedback whether that's through pebble pad or comments or a fist bump always means a lot to me because someone else has taken the time to point out the good things in practice that I may not be aware of. It's empowering to have another person celebrate the little things you do that make a difference! It really helps you mentally when you're recognized for something	3

		good and to be honest we should all strive to look out for the good little things that other radiographers and students do and tell them!	
Academic Support			
19	**Mental Wealth** Range of People Imaged	You meet so many new people everyday with different lives and from different walks of life, they have different stories, personalities, and humour. This means that everyday as a radiographer is different from the next and something new even if the job itself is the same, therefore aiding mental wealth	3
Academic Support			
20	**Updating Programme** Peer Assisted Learning	In year 1 we missed out quite a few lectures which would've been useful towards our exams. Have more PALS so that if lecturers can't rearrange these then there's an opportunity to ask any questions/consolidate.	3
Academic Support			
21	**Technical Skills Needed** Supportive	Professionals should support their Co-workers, including students. When patients see supportive networks within departments I believe it brings a more general supportive feeling to the environment, and this can impact the standard of care given to patients, and in turn how patients respond to the care they receive.	3
Academic Support			
22	**Updating Programme** Logbooks	Is there a way that a CRIS summary can supplement log books whilst on placement? When dept is busy, you either; forfeit working with the next patient to fill out the book, have unsigned entries because dept is crazy or work with a patient and lose track of logging numbers?	1
Assessment + Feedback			
TOTAL CONTRIBUTIONS: 222			

Rank	Theme	Total Contributions
1	**Syllabus content**	104
2	**Assessment and feedback**	51
3	**Learning environment**	45
4	**Academic support**	12
5	**Other**	10
	TOTAL CONTRIBUTIONS	222

***Chart 3**. Crowdsource one: Login times for each year group*

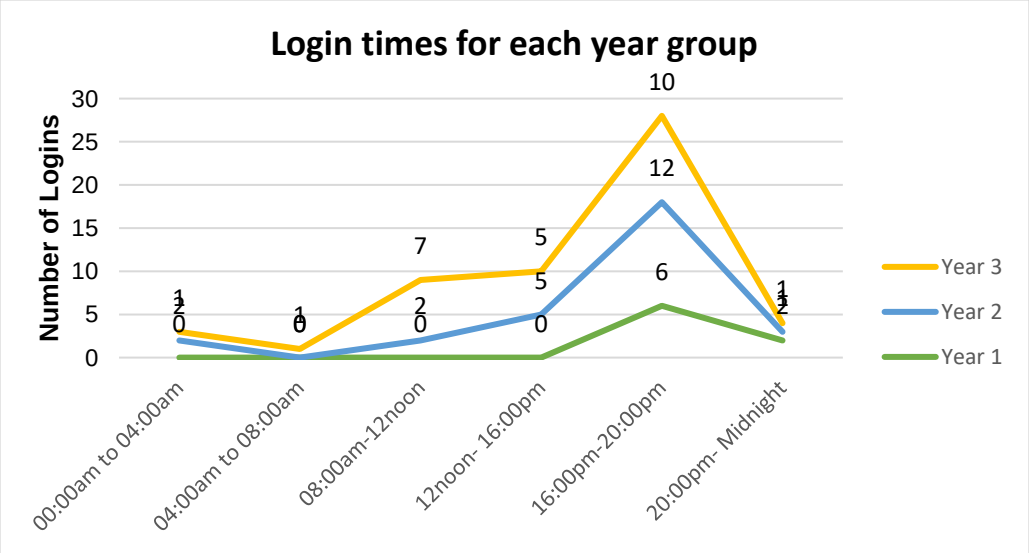


***Chart* 3** demonstrates the time frames students logged onto the crowdsource. A total of 84 logins (i.e. students accessed the challenge questions) were registered – ***Table* 5**. Regarding weekdays and weekends, Monday was the most popular day for log-ins (n=29) and Friday the least popular (n=3). A log-in was documented when a participant entered the challenge question page. The only significant pattern of days when log-ins occurred when cross-referenced to year groups was linked to the year one learners, who were on placement when the crowdsource was live. A third of their total log-ins were on a Monday. The year one learners only logged in after 16:00. A potential reason for this is internet access during the day as this year group were on their first clinical placements, so they may not have had access to computers during the placement hours of 09:00 to 17:00.

5.4 Action cycle one: Qualitative data

Five themes were identified for action cycle one: curriculum content, assessment and feedback, academic support, learning environment and other **– *Figure* 18.** The first four themes with corresponding categories and codes are supported by an individual thematic map whereby the theme is grey, the category is coloured green, and the code is blue – ***Figures* 19, 20, 21, 22.**

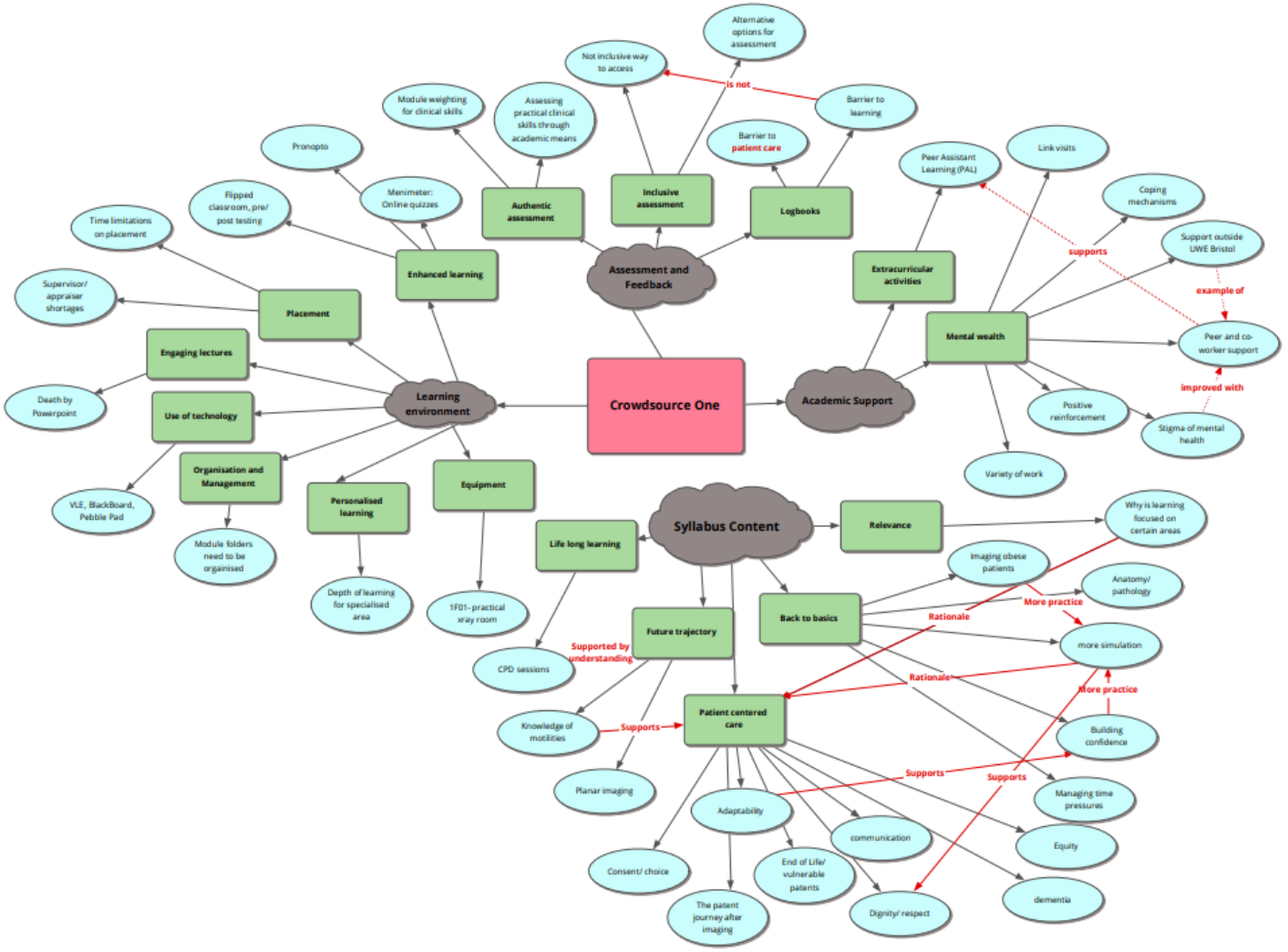


***Figure 18**. Crowdsource one (CS1): Qualitative data analysis*

In the following section, themes are presented in order of ranking as per the total number of contributions (ideas, comments, and votes) the theme received.

<u>Ranked Number One. Syllabus content.</u>

This theme had the most contributions (ideas, comments, and votes) at 104.

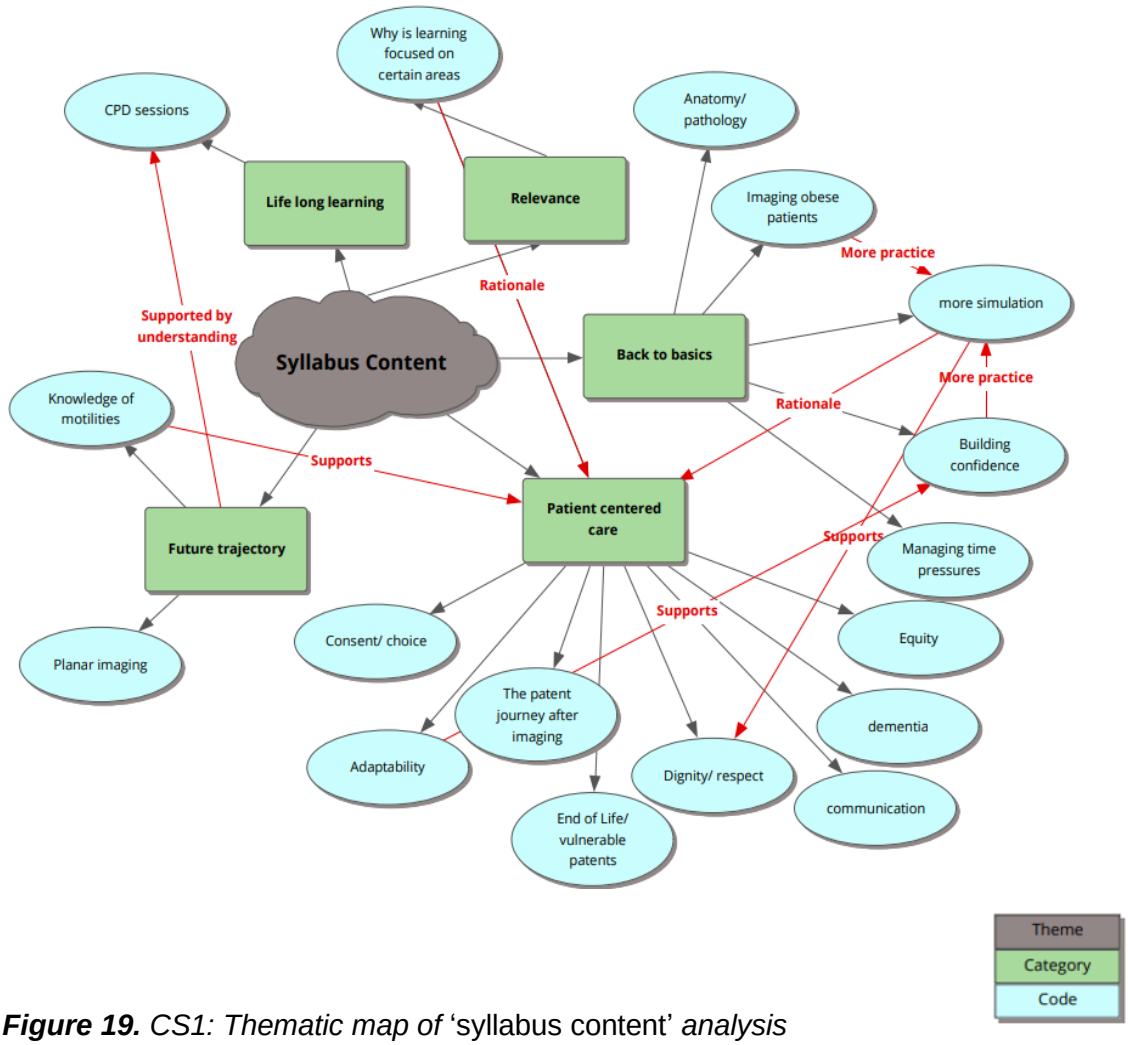


Figure 19. *CS1: Thematic map of* 'syllabus content' *analysis*

From the qualitative analysis of the comments made by the students, patient-centred care formed the largest category with codes including equity, showing dignity, offering patient choice, supporting patients at the end of life, those with dementia and spending more time with vulnerable patients. This category is also mapped to other themes and codes (through red lines in thematic maps).

YEAR ONE STUDENT: *"What can be appropriate for one patient does not mean it will work for another, so I guess it is about using good communication via treating patients as individuals getting to know them."*

Even when students disagreed on the depth to which some subjects were taught, i.e. training in CT, MRI and ultrasound, as they saw their immediate careers in plain imaging, students acknowledged that understanding these areas supported them in providing information to patients.

YEAR TWO STUDENT: *"Having an understanding of each modality is helpful when patients ask for information regarding them when they are in your care and for deciding if you would like to go into that pathway."*

Ensuring a pedagogy centred around compassionate care can be difficult in a technical and process-driven discipline such as radiography (Hendry, 2019). In addition, tension exists with an increased focus on technology and the academic aspects of education, potentially impacting the importance of 'softer skills' of caring in the curriculum (Bolderston et al., 2010). Care can be considered an intangible asset in a curriculum, i.e. a contributory aspect to higher education success deemed necessary, yet is not easily measurable or quantifiable (Robertson et al., 2020). Whilst it is beyond the objectives of this study to identify where exactly compassion is being promoted in the current curriculum, the crowd highlighted good practice. The existing diagnostic radiography programme emphasises reflective practice, using service user stories, standardised patients for imaging simulations, and role-modelling by academic staff. These activities are acknowledged in the literature as opportunities that enable compassion-focused pedagogy (Christianen et al., 2015).

Imaging obese patients was the fourth most discussed idea and the fifth highest-rated idea (17 contributions). Within the qualitative data, students also discussed the need to have more teaching opportunities on specific patient groups, including imaging obese patients, supporting patients with dementia and end-of-life patients, all mentioned in the comments.

YEAR THREE STUDENT: "*So that students can practice imaging larger patients and feeling for their bony landmarks before they go on placement. Or be able to practice on larger patients before placement."*

This observation is not unique to UWE Bristol diagnostic radiography students. Research has reported a range of difficulties for radiographers imaging obese

patients (Miller et al., 2017). The most commonly registered technical challenges include positioning the individual and selecting the most appropriate exposure factors to penetrate the tissues through higher-than-average subcutaneous tissues (deBoucourt et al., 2011; Dean & Scoggins, 2012; Smith et al., 2015). I note positioning can be difficult as diagnostic radiographers are taught to use bony landmarks to ensure a good quality image, and locating these is more difficult in larger patients. Equally, Miller et al., (2017) have explored communication techniques used by radiographers when imaging obese patients and how these techniques could be improved. They found that communication challenges particularly pertained to the patient's embarrassment and those undertaking medical imaging procedures.

Subsequently, it was agreed by the curriculum team that simple changes would be implemented to improve the syllabus content. In response to the students' comments about curriculum content relevance, diagnostic radiography students will be advised on how module learning outcomes and module content align with the specific regulatory requirements and proficiency standards for radiographers (HCPC, 2018). This action will be achieved through messaging in the virtual learning environment and making notes at the beginning of individual lectures. Teaching about specific patient groups will be further developed for all year groups in the theory and simulation activities already delivered in the academic setting. These changes will incorporate the involvement of patients, and the public in the design and delivery of individual practical teaching sessions – ***Table* 7**.

Ranked Number Two. Assessment and feedback.

Assessment and feedback accrued 51 contributions. Categories for this theme included: the need for authentic assessments, using an inclusive assessment approach, and replacing examination number logbooks – ***Figure* 20.**

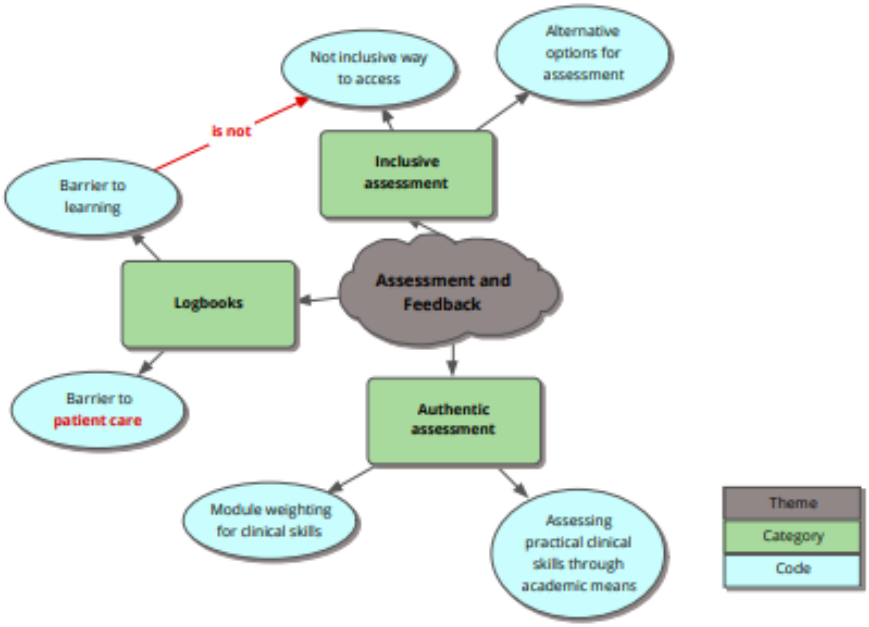


Figure 20. *CS1. Thematic map of* 'assessment and feedback' *analysis*

Students agreed they were unhappy with how time in clinical placement is currently graded. The current assessment mechanism is embedded in a thirty-credit placement module delivered in years one, two, and three. This module consisted of a pass/fail clinical portfolio alongside a graded presentation. Students did not believe the presentation was an authentic way to measure placement achievement.

YEAR THREE STUDENT*: "Students can excel in a placement which is reflected in the weekly comments and end of placement review. However, nerves on the presentation can yield an overall lower mark."*

YEAR TWO STUDENT: "*I understand it is hard to quantify placement, but there should be some weighting towards the final mark*."

Student concerns relating to grading in practice were highlighted as clinical placements are a core component of diagnostic radiography education. Students spend one-third of their time (42 weeks) in this setting, which equates to a pass or fail. In contrast, the remaining two-thirds (84 weeks) of coursework undertaken at university accounts for the classification of their degree. The literature pertaining to grading in practice highlights a balancing act between grading in practice and managing this against grade inflation within the university (Del Prato et al., 2021). As part of the conversations within the curriculum design team, it

was agreed that the reflective presentation would remain in year two, with a self-audit of practice being introduced in year three. Created with clinical partners, the new assessment has been aligned to Band 5 (first post) competency requirements. The self-audit of practice would be graded. Strategies to mitigate grade inflation linked to this assessed work will include establishing grading expectations and increasing pedagogical rigour with precise marking rubrics.

Ranked Number Three, Learning Environment

This theme accrued 45 contributions with seven categories were identified: placements, engaging lectures, technology use, enhanced learning, equipment, organisation and management, and personalised learning – ***Figure* 21**.

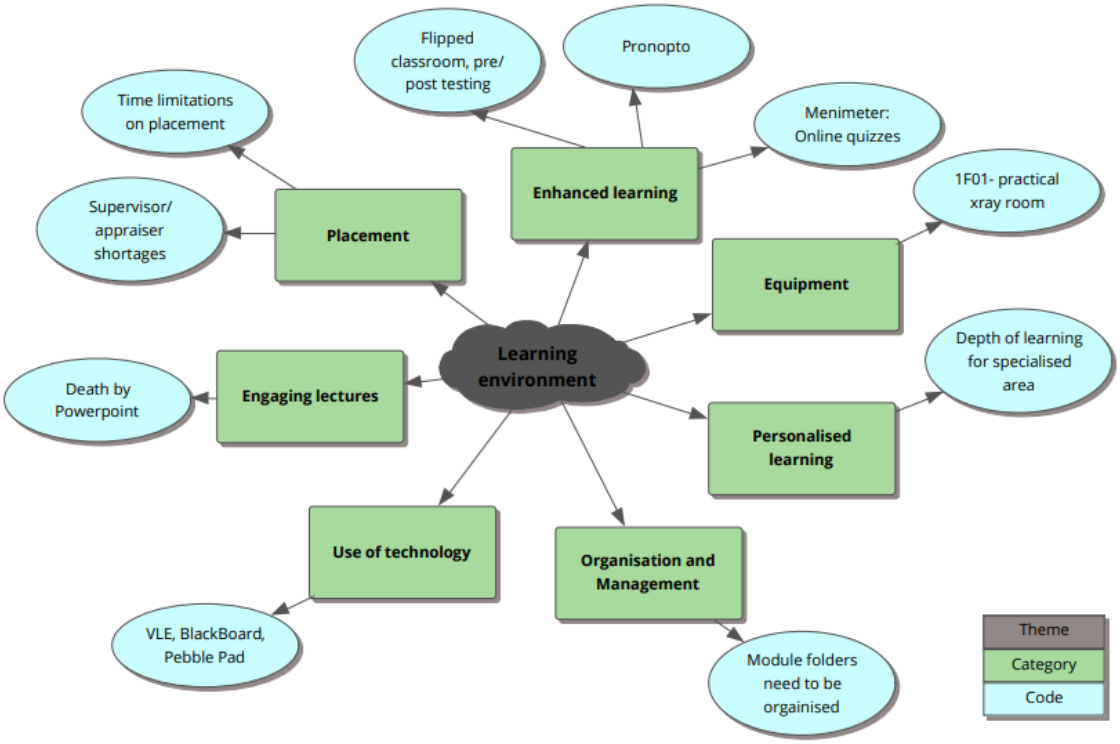


Figure 21. CS1: *Thematic map of* 'learning environment' *analysis*

Creating interesting lessons through technology-enhanced learning was the second most discussed idea and the third highest-rated crowd. Overall, the curriculum was deemed to have practices that learners found helpful, including recording lectures, flipped classrooms, and online quiz software to assess knowledge formatively. This approach has been part of the curriculum for several years, and previous satisfaction has been evidenced (St. John-

Matthews et al., 2013). However, there was a request from the learners to extend this to all modules.

YEAR THREE STUDENT: *"I believe it would be quite simple to make them [lectures] more engaging. For example, our anatomy and physiology classes had pre and post-tests for us to complete at home. I personally found this very useful, and it helped me engage with the learning material "*

The need for more simulation training was perceived to increase confidence whilst working with patients with the x-ray room in the University setting been cited as an area students would like more time. Of note, simulation had also been a code in the syllabus content theme.

YEAR THREE STUDENT: *"More time in the X-ray room before going out on placement would be beneficial for many."*

YEAR ONE STUDENT*: "To gain confidence not only in their ability to achieve a good diagnostic image."*

As previously observed in chapter one, diagnostic radiographers require a careful balance of technical and soft skills. Therefore, there is a need to include pedagogical approaches to support students in transferring theory learnt to practice (Hyde, 2015; Naylor etal., 2016). Furthermore, there is an acknowledgement that changes to the funding of courses have led to increased student numbers, which places additional pressures on short staff departments with finite imaging equipment to increase placement and supervisory capacity (Sloane, 2016). Simulation is considered an appropriate pedagogical approach to support learners transform theory into practice before entering a real-world clinical environment. Healthcare education literature suggests the term simulation is linked to broader use of simulation methods, for example, role play, task trainers, integrated simulation, computer-based systems, virtual reality, simulated patients and simulated environments (Bethea et al., 2014; Harvison, 2014; Mole & McLafferty, 2004).

A systematic literature review by Shiner (2018) revealed that simulation in diagnostic radiography education is being used across pre-registration programmes in the UK. The study identified three themes on the benefits of

integrating simulation in the curriculum. These benefits included improved technical skills, improved inter-professional working, and enhanced patient and practitioner interventions. The UWE Bristol team will also continue using patients within simulation sessions, alongside further developing staff to be confident in embedding simulation in their modules where appropriate. The team will also maintain the inter-professional simulation work already happening (The Guardian, 2018). A recent CT scanner installation at UWE Bristol means the programme will create enhanced learning opportunities via CT simulation alongside existing plain imaging simulation opportunities.

Ranked Number Four. Academic Support

Achieving 12 contributions, the theme of academic support centred around learning experiences in the clinical setting with two categories identified, mental wealth and extracurricular activities – ***Figure* 22**.

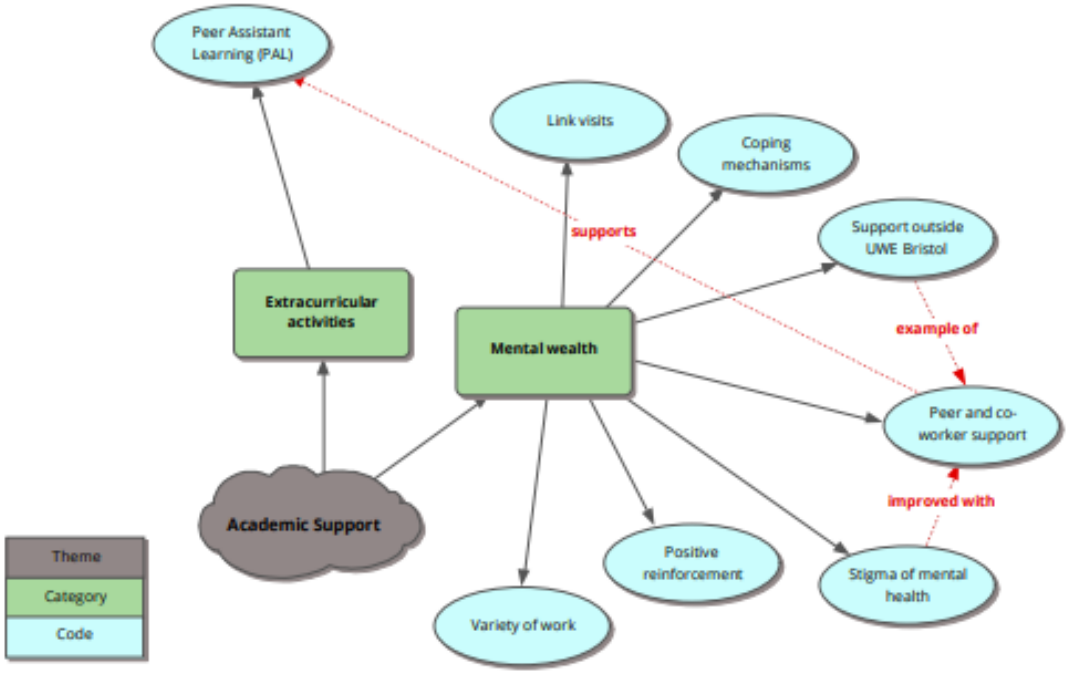


Figure 22. CS1: *Thematic map of* 'academic support' *analysis.*

In addition, the importance of link visits, peer and co-worker support, support outside the educational environment and variety to the work were captured as codes. Students noted support on placement varied and the need for trainees to develop their 'mental wealth' (a term coined by UWE Bristol, which encompasses mental health and resilience). As previously noted, students at UWE Bristol

spend 14 weeks per year in a single clinical placement block. These weeks away from the university campus are supported by a monthly visit from an academic staff member who travels to the placement site. The crowd highlighted the importance of positive feedback and support from peers and clinical colleagues in the learning environment. However, the group observed a stigma disclosing to the clinical placement and University if they were not coping.

YEAR ONE STUDENT: *"Getting good feedback, whether that is through pebble pad or comments or a fist bump, always means a lot to me because someone else has taken the time to point out the good things in practice that I may not be aware of. It is empowering to have another person celebrate the little things you do that make a difference!"*

YEAR TWO STUDENT: *"We have the three visits during the placement, but it is hard to tell them that you are finding difficult as they feel you are not fit to work."*

Previous research with UWE Bristol and London City University, therapeutic radiography students echoed mental health challenges on placement described by this group. A lack of communication, understanding, and consistency by clinical supervisors impacted support on placement. Armstrong-James et al., (2020) suggested that additional training for clinical educators on providing well-being support to students may benefit clinical supervisors. This intervention has since been developed as part of the Office for Students Strategic Interventions in Health Education Disciplines (SIHED) work (Office for Students, 2020). In the new curriculum, the programme team planned to access this resource and raise awareness of the University level *'Mental Wealth Strategy'* to students and clinical educators (UWE Bristol, 2022a). Another extracurricular activity is the Peer Assisted Learning (PAL) programme. The PAL programme was highlighted as good practice that needed to remain in the programme.

Other

A single item received ten contributions. The item did not match the four themes described above and related to the administration task of registering with the HCPC once all course work was completed. The item was quickly remedied and did not need the team to wait for the new curriculum to be in

place. However, it is an example of how crowdsourcing approaches differ from big data analysis. Here it was noted that unlike big data analysis, where minority opinions or behaviour can get lost, crowdsourcing through the data analysis methods adopted often enables non-mainstream and dissonant ideas to be captured (Wynne et al., 2007).

YEAR THREE STUDENT: ***"****Maybe a quick email once we've passed our final module explaining how and when we can sign up the HCPC/SOR."*

5.5 Action cycle one: Mapping to the new curriculum

Following the critical evaluation of each theme, a table was drawn up, mapping items in the current curriculum the local diagnostic radiography team would maintain and items under development for the refreshed curriculum – ***Table* 7**.

Of course, as was highlighted in chapter one, whilst a curriculum change may be documented on the curriculum design documentation, there may be a lack of buy-in from educators, which may mean the change is not actioned in practice (Brown et al., 2013; Taylor et al., 2013). Again, a before and after comparison of this research enquiry is beyond the scope of this research. Chapter eight's areas for future research section describes how this could be investigated. However, it would be interesting to establish if the suggestions made by the students will remain the same for action cycles two and three.

Table 7. *Crowdsource one: Contributions mapped to a new curriculum*

CROWD SAID (THEME)	PROGRAMME WILL MAINTAIN	PROGRAMME WILL DEVELOP
Syllabus content	*Reflective practice *Using pateint, and the public stories *Using standardised patients and service users for simulations *Role-modelling by academic staff	*Further develop patient, and the public input *Increase clinical practitioner involvement in practical teaching sessions at the University
Assessment and feedback	*Clinical portfolio consisting of weekly reflective logs, logbook *Assessed through reflection on practice through the medium of presentation with Q and A	*Reflective presentation will remain in Year two *A self-audit of practice being introduced in year three. This assessment has been designed with clinical partners and aligned to newly qualified radiographer competency requirements.
Learning environment	*****Current technology-enhanced learning and teaching activities *Current simulation activities within the programme for plain imaging, including inter-professional simulation opportunities	*****Use of lecture recording for all suitable teaching sessions *Integration technology-enhanced learning across more modules *CT simulations through the increased use of newly purchased CT scanner *Increased involvement of clinical practitioners in the delivery of simulation activities within the University
Academic support	*Academics supporting learners on 14-week clinical placement blocks	*Embedding the institutional Mental Wealth strategy into the curriculum *Using the toolkit being developed as part of the Office for Students SIHED project within the diagnostic radiography programme

5.6 Action cycle one: Complete cycle questions and adjustments

As mentioned in the chapter introduction, at the end of the first action research cycle, Wadsworth's (2011) complete cycle questions were applied to consider adjustments between this action cycle and the subsequent action cycles. These included observing my actions, reflecting on these actions, planning adjustments for the following action cycle, and considering what it would take to implement these changes. At the end of the action cycle, areas linked to research objective one were identified, the objective being: *"explore the design of a crowdsource to support stakeholder involvement in the curriculum design process."* These included:

- recruitment through growing a community of users
- facilitating the crowdsourcing community
- shaping the challenge questions
- considering the time between initiating each action research cycle

This first action cycle also offered an opportunity to consider research objective three, *'developing design principles for those wishing to employ crowdsourcing in future curriculum design processes.'*

Recruitment to the action cycle one crowdsource

I highlighted in the literature review that recruitment to crowdsourcing is a critical step in planning (Keating & Furberg, 2013). Keating and Furberg (2013) also stated that it is best to approach people familiar with the topic to generate interest. For the health professions, education literature review, the crowd was often readily available paid Amazon MTurk workers. Dahlander et al. (2019) declared that this tactic of approaching those already familiar with the offering being explored is a good option when an incremental rather than a radical innovation is the desired result. It is essential to point out that this familiarity was the case with this action cycle, as the UWE Bristol BSc (Hons) Diagnostic Radiography programme was undergoing a five-yearly review. In other words, an incremental change to the programme was being undertaken rather than designing a new programme. This was against a backdrop of a mature

diagnostic radiography degree programme that UWE Bristol has delivered for twenty-five years.

With the students being off-site during the data collection, the approach for patients, and the public was similar, with electronic means of communication being the sole recruitment tool used, including the virtual learning environment and emails. However, on reflection, collaborating with patients, and the public, in action cycles two and three would require more thought on the available tools and how to maximise these. Hence, a robust evidence-based recruitment strategy was drawn up. This strategy included considering how existing networks could be harnessed (Oliver & Pitt, 2013). In addition, the recruitment activity would require time to instigate, so I factored this into the Gantt chart for action cycles two and three.

The time between action cycle one and action cycle two

As noted in chapter one, UWE Bristol has its own individualised institution-wide approach to the curriculum design process (Cleaver et al., 2016). This design process is mapped to a fifteen-month timeline, ***appendix* 1**, and allows for moments of reflection, evaluating and coming together for the design team. In any action research, there must be a question regarding how much time to spend investigating the current situation and considering the data before starting the next action cycle (Burchell, 2010). Likewise, it is worth highlighting that one of the advantages cited when using crowdsourcing is the pace at which the tool can be deployed. This research was no different. For action cycle one, the crowdsource was open for two weeks. When pragmatically considering how much time to leave between cycles, I needed to allow time for data analysis and reporting to the programme team, including allowing the curriculum team to reflect on the first iteration of the work (crowdsource with students). I also had to build the second crowdsource and recruit to the second iteration (crowdsource two with patients, and the public).

Facilitation of the action cycle one crowdsource

Possibly because crowdsourcing was originally an idea-generating tool rather

than a collaborative space, there appears to be little literature supporting moderation when working in this capacity. However, I note a plethora of literature on moderation (facilitation) for more traditional collaborative tools. Majchrzak and Malhotra (2020) acknowledged that one of the significant considerations of undertaking a crowdsourcing activity is the level of crowd facilitation. They continue by stating that this consideration is applicable for both internal and external crowds. Majchrzak and Malhotra (2020) also noted that getting the appropriate level of moderation can be tricky as the crowdsourcer will not want to shut down any creative discussion. They continued by saying that collective production is a fragile process. Any directive input, pushing a particular agenda, or emphasising a specific suggestion can break down the whole crowdsourcing activity.

I observe that any intervention by the crowdsourcer with the crowd needs to be balanced in cases where one person or group of people has a majority voice, or there is the risk of a crowd hijack, as previously discussed. Hence my role for the first crowdsource was a ‘silent observer’ of the conversation. However, I did monitor the space for questions that might need an answer and was available to support technical issues. As agreed by the ethics committee, there was a list of reasons I would intervene where participants were not following the ground rules. This scenario did not happen for the first crowdsource, and daily logins ensured I was available if needed to answer these.

Messner and Rauch (1995) describe the role options open to a facilitator in action research settings in terms of three alternatives: adviser or expert, critical friend or observer, and stimulus or discipliner. Although this work was undertaken before the definition of crowdsourcing in 2006, it has relevance as it is specific to action research facilitation. For action cycle one, I occupied the space of expert, observer, and discipliner. This position was against the backdrop of me moderating the conversation. The decision not to facilitate the conversation was multi-faceted. By positioning myself in this thesis as an expert radiography educator, the risk was that the crowd might think that I had a hidden agenda as an expert and that I was steering the crowd in their conversation to areas of interest to myself and the curriculum design team

(Majchrzak & Malhotra, 2020). As I knew the students, it could be argued that this would impact how free the participants would feel with leaving negative comments (Galpin et al., 2017). Furthermore, there was a risk that if I over-contributed, it may have demoralised the crowd. On reflection, this stance worked well for action cycle one, and there was minimal intervention to the conversation process. Thus, I acted as an expert, observer and discipliner in action cycle two with patients, and the public. This positioning was then reviewed between action cycles two and three.

Shaping the challenge questions

The students in the action cycle one study were not explicitly asked about patient care, teaching, learning or assessments in the four challenge questions presented in the crowdsource. However, these formed three themes from the qualitative data analysis. As noted in chapter four, when designing the crowdsourcing platform, the main challenge, developing the BSc (Hons) Diagnostic Radiography degree, was broken into four smaller challenges to support current best practice guidelines from the crowdsourcing literature. The challenge questions adopted for action cycle one were derived from previous research undertaken by Sloane and Miller (2017). They interviewed radiology managers (future employers) across the UK to ascertain the skill gaps of newly qualified radiographers. I started with these themes to support an evidence-based approach to creating the questions. In the Sloane and Miller (2017) study, these included: the current curriculum content (technical skills), diversification of the radiographer's role, professionalism, and the need to improve resilience. The local UWE Bristol curriculum design team adapted these headings to include a broad question on what the UWE Bristol programme needed to stop, start or do differently. This final open question captured the three themes discussed in this chapter.

As an experienced health professions educator, I was not surprised by the themes of learning environment, assessments, and feedback. I would argue that learners commenting on these aspects of a pre-registration degree programme are to be expected given their lived experiences of their academic programme of study. However, the patient care element was an unexpected

finding. Furthermore, UWE Bristol learners requested more in-depth teaching regarding specific patient groups, such as imaging obese patients, patients with dementia and end of life patients. Work, published by Hyde and Hardy (2020, 2021a, 2021b), defined patient-centred care within the profession of diagnostic radiography. Their research was considered through the lens of service managers, patients, student radiographers and radiography academics. In the third paper of the series, Hyde and Hardy (2021b) noted the disconnect between service users' and service deliverers' perceptions of patient-centred care. In their findings, student radiographers (n=50) from across the UK placed a higher expectation on the patient care aspect of their degree. Their findings align with the results of this work, where UWE Bristol student radiographers articulated how learning on their degree directly impacted patient care.

Hyde and Hardy (2021b) rationalised that in the practice environment, the focus of qualified clinical radiographers remains efficiency, and in a time-pressured clinical setting, this is the element of the role that will be prioritised over patient care. In communicating with patients, Booth (2007) has previously researched this. Hyde and Hardy (2021b) concluded that radiography students were still new to the profession and often joined as they wanted to combine patient care and technology. Unlike qualified staff, they did not experience the same time pressures, and therefore student radiographers ensured equal focus was given to patient care and technology. Subsequently, the views of diagnostic radiography students could be more likely to align with patients, and the public rather than qualified staff.

From this perspective, I argue that my findings are broadly similar to the national research conducted by Hyde and Hardy (2020b), albeit my conclusions are linked to a local population of diagnostic radiography students. Thus explaining the disjoint between the views of radiology managers interviewed by Sloane and Miller (2017) and the student radiographers at UWE Bristol that have arisen in these results (St. John-Matthews et al., 2020). I also note from previous thesis chapters that only one study exists of lived experiences of the curriculum by diagnostic radiography students (Hyde, 2015) that I am aware of. Logic suggests that this action cycle adds to the argument that including

diagnostic radiography students further enhances the curriculum design process. This observation also indicates that student contributions to curriculum design are not just about their lived experience of undertaking the academic component of a diagnostic radiography programme. Compared to other stakeholders, students also bring a valuable and different viewpoint as they look at a wider breadth of professional practice compared with established clinical staff and radiography department managers. As the caring theme was primarily reported in the broad 'stop/ start/do differently' question, I decided to apply another set of broad questions for action cycle two.

Having applied Wadsworth's (2011) full cycle questions of observing, reflecting, and planning, the following actions were taken for action cycle two. A number of these areas have been further discussed in chapter four.

1. Focused e-recruitment was undertaken
2. An eight-week gap remained between the end of the crowdsource with students, and the start of the crowdsource with patients and the public
3. My role as a facilitator remained as an expert, observer and discipliner
4. Questions posed to patients and the public were broad in scope

5.7 Chapter summary

The approach taken for action cycle one aligned with research objective one, the idea of exploring the optimal design of a crowdsource within a new subject discipline. Using the complete cycle questions presented an opportunity to consider and propose the optimal time between the review period of action cycles one and two within the curriculum design process. I also thought about the practical considerations of what demographic data I should capture, how I would grow a community of users, and how to facilitate this community. Some of these decisions were described in chapter four, where further choice rationales are provided. Action cycle one also showed that the new curriculum paperwork included the students' contributions, meeting objective two.

This chapter has been published in the international, peer-reviewed journal ‘Radiography’. This article has added to the perceived limited research on students as partners in curriculum co-design and the evidence on students’ perceptions of a diagnostic radiography degree curriculum. Chapter six will explore action cycle two, which involves an external crowd of patients, and the public. Whilst the structure of the next chapter echoes this chapter, it aims to build on the research objectives through further reflection and adjusting.

CHAPTER SIX: Action Cycle Two

6.1 Chapter introduction

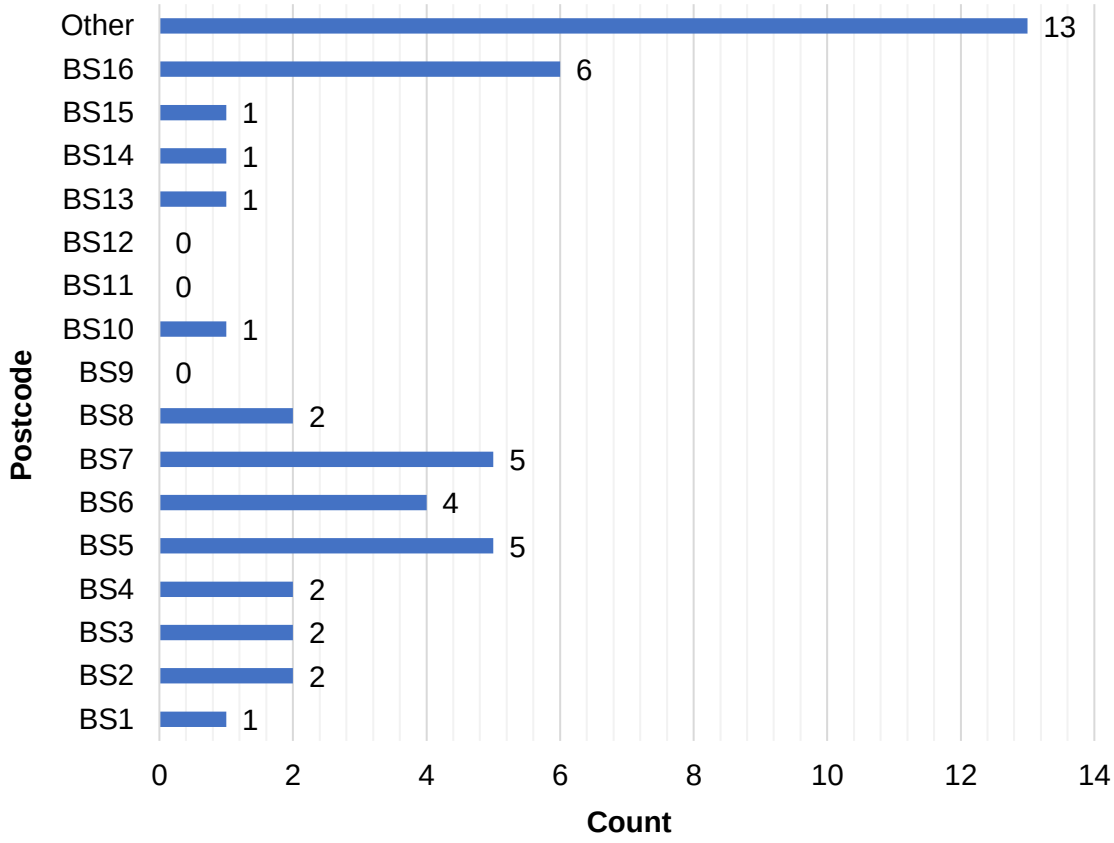
In chapter five, I shared the demographic details, quantitative data, and analysis of the qualitative data of the first crowdsource with the internal crowd of UWE Bristol diagnostic radiography students. The chapter concluded by applying a set of complete cycle questions, which informed the adjustments made before implementing the action cycle presented in this chapter. These critical reflections considered how recruitment would be conducted for patients, and the public (an external crowd) living in Bristol alongside the length of time needed to support both advertising action cycle two and action cycle one data analysis. I also examined my role as the crowdsource facilitator of the second cycle and the style of questions I would present.

Chapter six follows the same layout. Firstly, I share the demographic data for the second crowdsource, held between the 10th and 24th of September 2019. Following this, categorical data, including ideas shared, comments made, and votes cast, were documented. Then, I present the qualitative analysis of the contributions by patients, and the public. These findings were then mapped to demonstrate what would stay from the 2015-2020 UWE Bristol BSc.(Hons) Diagnostic Radiography degree curriculum and what would be added to the updated 2020 – 2021 curriculum. Again I applied Wadsworth's complete cycle questions identifying further adjustments to the crowdsource process before embarking on the ultimate action cycle and crowdsource three.

6.2 Action cycle two: Participant demographic data

Forty-six people (n=46) completed the demographic questionnaire, ticked the consent box and joined the second crowdsource, which was open to patients, and the public from the Bristol postcodes BS1 to BS16- ***Table* 4**. 75% (n=33) of the postcodes registered came from the BS1 to BS16 areas. Some postcodes (BS12, BS11, BS9) had no participants.

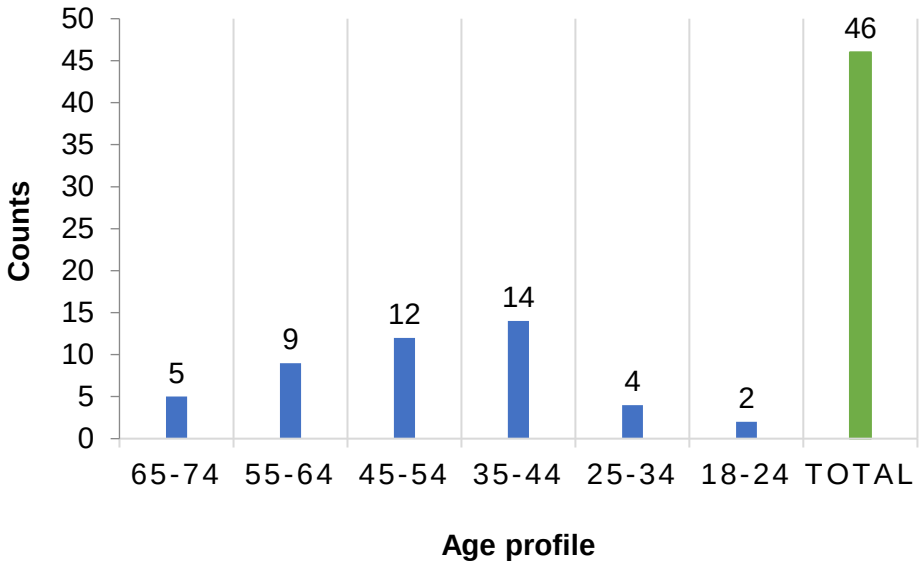
Chart 4. *Crowdsource two: Distribution of postcodes*



Twenty-five (25%; n=23) of registered postcodes were outside the stipulated postcodes, i.e. BS1 – BS16. These included postcodes in Gloucester (GL51), Swindon (SN14), Bath (BA17) and areas immediately outside of Bristol (BS41, BS27. BS36, BS32) - ***Chart* 4**.

The only age group not to participate were those over 75. Every other age group had representation – ***Chart* 5**. The most representative age group was the 35 – 44-year-old category at 30% (n=14). The least representative age range was the 18 – 24 group (n=2). The age data was gathered in these closed age groups segmentation as this scale echoed the segmentation used by Ofcom (2019) when they map online access by UK adults each year. Also, using exact age ranges instead of broad categories follows the American Psychological Association (APA) 7th style of referencing (Appearance Publishers, 2021) as used by Swansea University.

Chart 5. *Crowdsource two: Age profiles*



Seventy six per cent (76%; n=35) participants identified as female and twenty four per cent (24%; n =11) as male – ***Chart* 6**.

Chart 6*. Crowdsource two: Gender profiles*

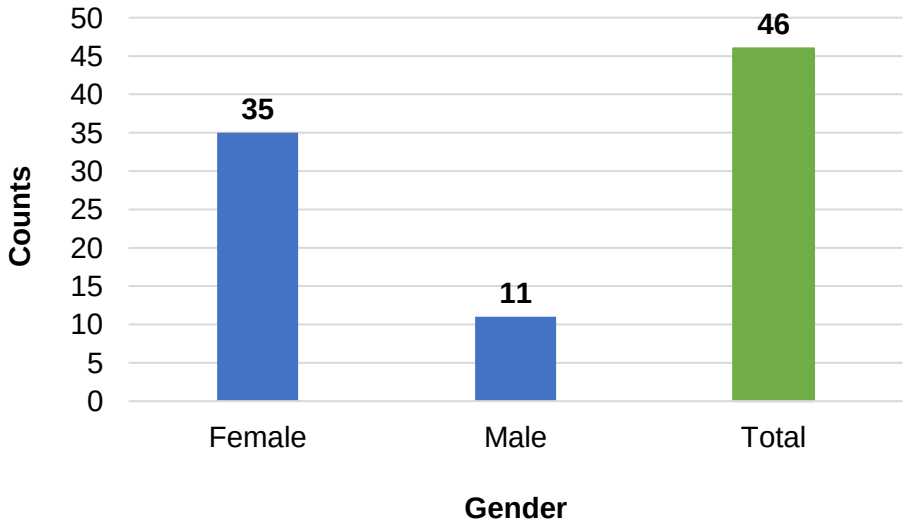


***Table* 8** demonstrates the ethnicity data for the population of Bristol beside the crowdsource ethnicity data collected. Of note is that Bristol has 78% of the population registered as White British. However, with 46 participants engaging in crowdsource two, I have not made any written comparisons between the data, especially as 28% (n =13) of participants left this field blank.

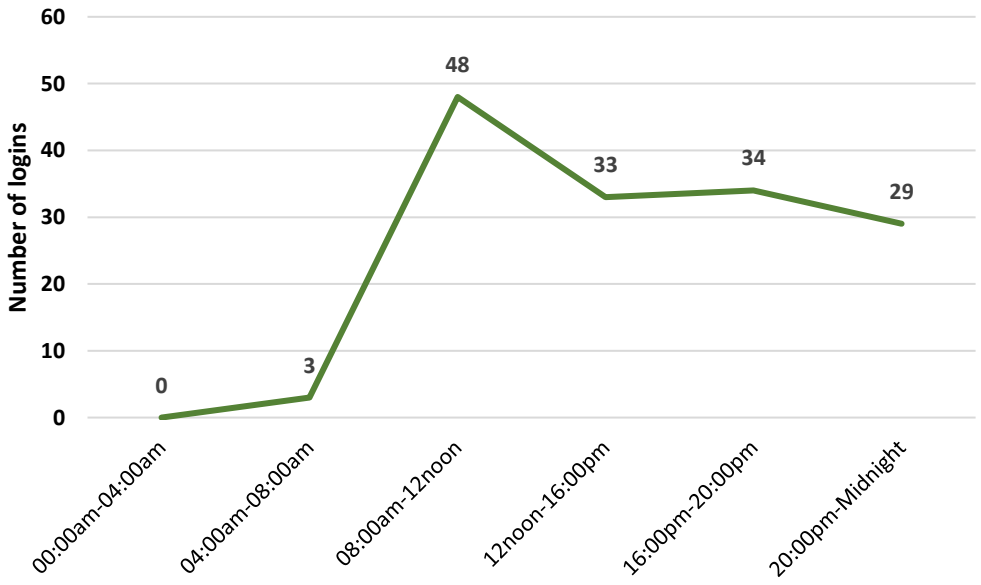
Table 8. *Crowdsource two: Ethnicity*

ETHNICITY		CROWD		BRISTOL
White	English/Welsh/Scottish/Northern Irish/British	27	57%	77.9%
	Gypsy or Irish Traveller	0	-	0.1%
	Irish	1	1%	0.9%
	Any other White background	1	1%	5.1%
Black	African	0	-	2.8%
	Caribbean	1	1%	1.6%
Asian	Chinese	0	-	0.9%
	Bangladeshi	1	1%	0.5%
	Indian	0	-	1.5%
	Pakistani	0	-	1.6%
Mixed other	Mixed Race	1	1%	3.6%
	Prefer not to say	1	1%	
	Any other ethnic group	0	-	1.6%
	Blank	13	28%	-
	Grand Total	**46**	100%	100%

6.3 Action cycle two: Quantitative data

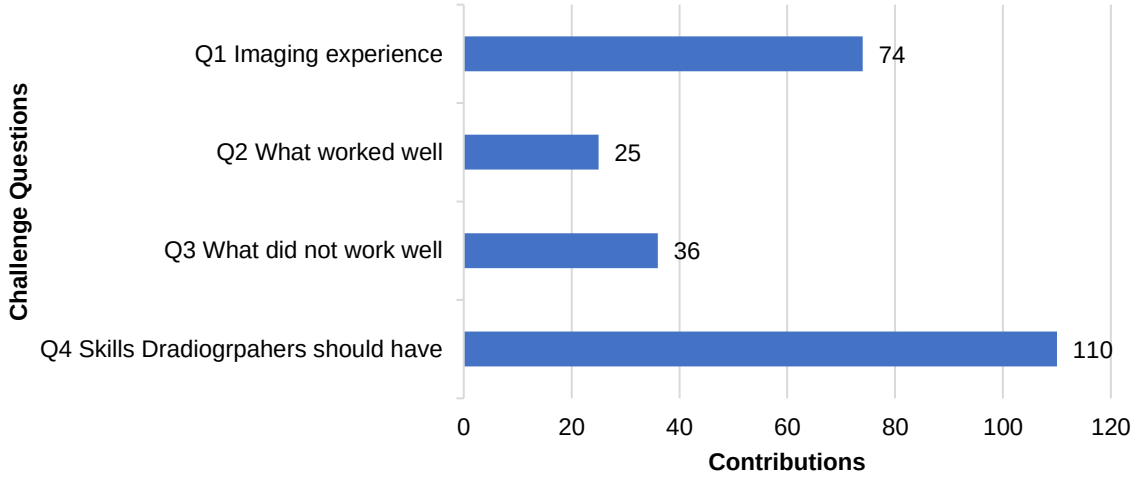
***Chart* 7** demonstrates the login times for those accessing the second crowdsource. Of note for this crowdsource was that there were no logins between midnight to 04:00 am, and the busiest time was 08:00 am-12 noon.

Chart 7*. Crowdsource two: Login numbers*



A total of 147 log-ins were made, and from this, 245 contributions (ideas, comments, or votes) were generated across the challenge questions – ***Chart* 8**.

***Chart 8**. Crowdsource two: Sum of all contributions*



These contributions have been further broken down into ideas, comments, and votes, as demonstrated in ***Chart* 9.** The ideas ranked by total contributions are in ***Table* 9**.

***Chart 9.** Crowdsource two: Votes, comments, and ideas*

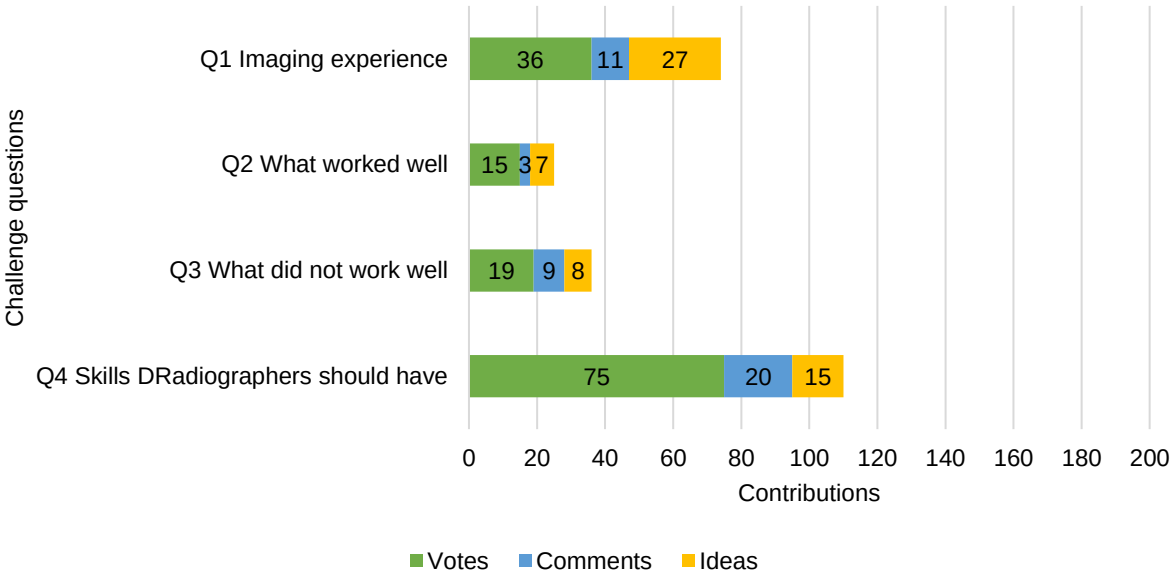


Table 9. *Crowdsource two: Ideas ranked by contributions*

No	Challenge question. Crowd idea*	Idea description	Total Contributions
1	**Radiographer skills** Essential skills	I know very little about their job but would imagine it involves good knowledge of anatomy and physiology along with technical skills to operative the machinery, health and safety for themselves and the patient.	**26**
		Other knowledge	
2	**Radiographer skills** Problem solving	When things don't go to entirely to plan, the radiographers need to be quick thinking, confident, with a broad enough technical, anatomical, and interdisciplinary knowledge to be able to problem solve / refer / create a solution or alternative, ideally without the patient having to go home and come back again. This of course need to be done whilst communicating well with the patient.	**25**
		Patient needs	
3	**Imaging experience** Types of imaging	I've had many scans, MRI, DEXA scans and mammograms to diagnose breast cancer. All staff were professional.	**22**
		Professional capabilities	
4	**Radiographer skills** Experience	Skill is perhaps the best thing to have: 1.Skill to be calm and calming. Speaking slowly, taking time with each procedure. Patient should be comfortable throughout and radiographer should ensure that by explaining things in advance and asking if they are okay before starting, and if possible during the procedure.	**15**
		Professional capabilities	
5	**Imaging experience** Confidence	When I'm worried about my daughter I want the people looking after her to have confidence in what they are doing and for that to be apparent to me. This means being able to operate the machines with confidence and not doubting themselves in front of me.	**9**
		Professional capabilities	
6	**Radiographer skills** Good understanding of other conditions	My Mum has Parkinson's and can't lie flat and can be in a great amount of pain from doing so. I have epilepsy and in the past have been concerned about having a seizure whilst in an MRI scan as I would hurt myself. I would hope that the radiographer had a good understanding of the implications that other issues can have and the concerns that they would raise for the patient. I don't expect them to be experts in anything other than their field but would hope that they have the awareness and ability to research the other issues that affect the patient	**9**
		Patient needs	
7	**Radiographer skills** Empathic and reactive	Being good at performing the scan is not enough, it's important that the profession attracts individuals with a passion to contribute the care of patients. They may be performing a scan but its more than just a procedure to the person having the scan. Good communication skills are essential but it's not just how you say it but what you hear and observe. Good listening skills is so important and patience to allow a patient to tell their story. The results of the scan may be life changing. Therefore having compassion and showing empathy is also essential	**9**
		Patient care skills	
8	**Radiographer skills** First priorty should be safety	We take it for granted that we are safe when we are having scans, but it has to be a key part of radiographer training.	**9**
		Professional capabilities	
9	**Imaging experience**	In my role as a learning disability nurse I have had to support adults with a learning disability (LD) access MRI, Mammography and X Rays. I have had mixed experiences in this role. Even though people are known to have an LD,	**7**

	Working with those with a learning disability and autism	radiographers are not always confident or competent in knowing how to support the person most effectively. Key in this is having enough time and information in the correct format to enable the person to understand what is happening to them, so that they feel reassured and able to give informed consent for what is required.	
		Patient needs	
10	**Did not work well** It is how you say at	"When I XXXX in the room for an MRI scan the first words the radiographer said were ""well you dont look like you are going to go through with this"".I was nervous and when I was on the table she was talking to the NA, and she said ""put her arms in pillow cases as she's so obese I dont want her skin catching and ripping"". I only managed 7 minutes until the paper towel that had been put over my eyes fell off. I pressed the button to come out. They had promised me the NA would press the button to bring me out straight away, but they didnt. I was screaming for help and sobbing. Had they got me straight out and covered my eyes I would have gone back in, but I couldn't. I was sent home and walked out of the department and hospital crying. Since then I have not been able to even get into a lift. Had the radiographer phrased things differently and been kind this experience could have been totally different. "	**7**
		Patient care skills	
11	**Worked well** Saying hello	I was quite scared at the time, but the radiographer introduced themselves to me and asked what I wanted to be called. He then explained what was going to happen. It really put me at ease	**7**
		Patient care skills	
12	**Imaging experience** Breast clinic	I had an experience of a breast clinic in XXXX a few months ago. I had to have a mammogram and ultrasound. The radiographers doing both scans were amazing. They were so friendly but professional. They explained what was going to happen and how I'd get the results. During the scans themselves they were obviously serious and concentrating. During the ultrasound scan she explained everything she was seeing.	**6**
		Patient care skills	
13	**Radiographer skills** Right first time	I'd like the radiographer doing the scan to be able to get the image first time and if they don't explain why we need to do a second image.	**6**
		Professional capabilities	
14	**Did not work well** Talk about what is wrong with me	I would like to have had more of a conversation with the radiographer about my health problems and what had happened to me. The procedure was very formal and rigid, and I would have liked to have had some time to explain how I was feeling. For example, there was a miscommunication, and they were about to scan the wrong leg. I kept telling them which one it was, but they weren't listening and kept reading the referral letter/notes. I am the best person to ask about which leg it is!	**6**
		Patient care skills	
15	**Did not work well** Warm and welcome reception to build a rapport	Sometimes the person performing the scan doesn't introduce themselves but goes straight into what they want you to do. If the radiographer says who they are and tries to put you at ease relaying instructions it will make the whole experience a lot better.	**5**
		Patient care skills	
16	**Your imaging experience** Technical skills not enough	Being good at performing the scan is not enough. Important that the profession attracts individuals with a passion to contribute the care of patients. They may be performing a scan but its more than just a procedure to the person having the scan. Good communication skills are essential but it's not just how you say it but what you hear and observe. Good listening skills is so important and patience to allow a patient to tell their story. The results of the scan may be life changing.	**5**
		Patient care skills	

17	**Imaging experience** Good communication skills	Sometimes the person performing the scan doesn't introduce themselves but goes straight into what they want you to do. If the radiographer says who they are and tries to put you at ease relaying instructions it will make the whole experience a lot better.	**5**
		Patient care skills	
18	**Did not work well** Try the experience yourself (if possible)	I had an MRI scan which took approximately 30 mins. I was told by the radiographer that I would hear music to help drown out the noise, but I wasn't sure what was music and what was the equipment. Either it was forgotten or poor choice of music with lots of bass. I was also given the buzzer but when you are in the tunnel there is not much slack, and it was awkward to hold. If the radiographers at least tried the position themselves they would appreciate what the patients go through and what small changes could improve the experience	**5**
		Patient care skills	
19	**Did not work well** Ask permission	My husband broke his wrist, and the radiographer moved his arm and manipulated the joint without asking permission or saying that is what they needed or we're going to do. He is a healthcare professional and considered this poor practice,	**5**
		Patient care skills	
20	**Radiographer skills** Student training	As a radiographer myself that didn't train at UWE, I believe UWE students lack the ability to analyse their images critically – they have no idea of how different pathologies are shown on an X-ray until after their 3rd year placement	**5**
		Professional capabilities	
21	**Radiographer skills** Reporting skills	I think it must be possible to train radiographers to report – even if it is within a limited scope of practice. Would save more expensive doctors reporting on simple fractures that even a lay person could spot.	**4**
		Professional capabilities	
22	**Worked well** Explain what is happening	When I broke my leg the radiographer explained what was going to happen when I first met them and then continued to tell me step by step what was happening all the way through. She warned me that there were times that she was going to hurt me due to the positions she needed to put me in. Knowing that was helpful as I was prepared.	**4**
		Patient care skills	
23	**Imaging experience** More reporting radiographers	I have had numerous X-rays/ scans over the years for wrists, knee, bowel. All radiographers I have encountered have been helpful and respectful. My son has also had x-rays, which was in itself fine, but as he is a child the follow up appointment needed to be at another hospital (Children's hospital). Have also experienced issues re reporting and was once sent home with a broken wrist only to be called a few days later to have it cast once a radiologist had looked at the report.	**4**
		Professional capabilities	
24	**Worked well** Kindness	I remember having ultrasound treatment for an episiotomy scar, it was performed with great care and compassion. I also had a mammogram and biopsy all in one sitting and was impressed by the care and kindness I received.	**4**
		Patient care skills	
25	**Radiographer skills** Adapting technique	Be prepared to be adaptive, if a patient needs additional support transferring to the position for the scan, and assessing if a patient is well enough to stand for an x-ray for example.	**3**
		Patient needs	
26	**Imaging experience** How you communicate	At a recent scan I felt like I was being made to "fit the machine", rather than the concern being about the best way to get a clear scan. This could be resolved by looking at how we communicate with people and the order the information is given. Honestly my chest x-ray with my fractured ribs was one of the most uncomfortable experiences I've ever had. No time was given to explain how to stand so it was right first time and little compassion given when the position I have to stand in caused intense pain and a 10 minute coughing fit.	**3**
		Patient care skills	

27	**Imaging experience** Results straight away	I had a fall and hurt my ribs. I had to have an x ray. It would have been really great to get the results there and then rather than wait for the Nurse Practitioner to give me the results.	**3**
		Patient care skills	
28	**Did not work well** It's my body	It's important to be professional and not falsely reassure patients. However it's my body and it's important for me to know what you see, I might not always understand it fully but having an opportunity for someone to explain what they see helps me understand why a diagnosis might be difficult or treatment might be challenging. ''ve been lucky to have seen radiographers who are understanding and take the time to explain what they are doing and what they are looking for.	**3**
		Patient needs	
29	**Worked well** It's my body	It's important to be professional and not falsely reassure patients. However it's my body and it's important for me to know what you see, i might not always understand it fully but having an opportunity for someone to explain what they see helps me understand why a diagnosis might be difficult or treatment might be challenging. I've been lucky to have seen radiographers who are understanding, confident and take the time to explain what they are doing and what they are looking for.	**3**
		Patient needs	
30	**Worked well** Professional on all occasions	Have always been treated in a kind respectful manner even though the department was very busy.	**3**
		Patient care skills	
31	**Worked well** It is how you say it	With the xrays in A&E the technicians were very polite and talked me through each step while also being mindful of my pain.	**3**
		Patient needs	
32	**Did not work well** Don't ignore me	I had a scan where I had to lay in the scanner for 2 hours, having a scan 15 minutes. No one really talked to me during that time and the person in the room with me was playing solitaire on the computer!	**3**
		Patient care skills	
33	**Imaging experience** Work with the person for the best outcome	I have had multiple scans and xrays, and I also work within orthopaedics, so I am lucky enough to understand a lot of it. However most people do''t. You do''t always get told what they are doing just''stand her'' move her''''hold your breath'' (although some are amazing at explaining what is being done). But we must not forget the pre and post scan. You are sometimes sat in a room in a gown with two doors waiting to be called and I have been left there for ages as they forgot. you do''t know if you need to go somewhere, where do you put your belongings. Once the scan is done what next? The whole treatment pathway needs consideration not just the time in the scan room..	**2**
		Patient care skills	
34	**Radiographer skills** Advice to GPs regarding advice + referrals	I feel strongly that the person carrying out the scan/x ray/mri should be able to advise the referrer of a possible next step. I had a really positive experience when having an ultrasound scan, with the health care professional writing her findings for me (I am a healthcare professional myself) and I understood my shoulder problem. I just wish that action was taken quickly afterwards by my GP.	**2**
		Professional Capabilities	
35	**Imaging experience** Bad experience	My daughter (8) broke her arm badly on holiday and went to A+E. Waited 2.5 hours for triage and X-Ray and a further 5 hours (until 1.30am) to be told that there was only one doctor for A+E , who could not review the x-Ray, so we would have to return next day. She spent the night in a tent, in significant pain with a broken arm before the-visiting waiting again and being cast. So I think it's very important that hospitals are using radiographers' expertise for this, not waiting on doctors.	**2**

		Patient needs	
36	**Imaging experience** Same day service	When ''ve been to the breast clinic–- ''ve seen the doctor had an ultrasound, mammogram, and biopsy all at one visit. When ''ve been to gynaecology, ''ve been sent to the ultrasound department by the GP then the GP refers me to gynaecology. Why can radiographer been working with all specialities?	**2**
		Professional Capabilities	
37	**Did not work well** Some points to ponder	I knew the scan was very important. Because of the discomfort I found it difficult to do what the radiographer requested me to do, and I could tell she was getting slightly exasperated but it was just too painful. On another occasion I need a scan that required a full bladder. I had just had a urinary catheter removed that day. There was a delay in having the scan and found it very embarrassing to be slightly incontinent when climbing on to the x-ray table. It may have helped if the ward staff let the X-ray department know about catheter removal?	**2**
		Patient needs	
38	**Imaging experience** Each day I wanted empathy	My next experience was at 17 years old when i found myself with an unexpected pregnancy. I was referred to the pregnancy clinic and the ultrasound was carried out in a doctor's consultation room and i was told how many weeks i was and what my options were. There was very little empathy or compassion by the person carrying out the scan or the doctor discussing the options. No one makes the decision to end a pregnancy without emotion, upset or doubt. i did''t feel judged but i also did''t feel supported–- the procedure was more than just a dating scan; it was a life changing event.	**1**
		Other knowledge	
39	**Worked well** Community help	I have always felt that I am not alone when being attended to by a Radiographer. I hope the Radiographers feel that to in their supports from fellow colleagues.	**1**
		Other knowledge	
		Total contributions	**245**

Rank	Theme	Total Contributions
1	**Patient care skills**	82
2	**Professional capabilities**	78
3	**Patient needs**	57
4	**Other knowledge**	28
	Total Contributions	245

6.4 Action cycle two: Qualitative data

As per the critical reflections in chapter five, participants were asked the following challenge questions.

1. Would you please tell us about your imaging experience?
2. What worked well for you?
3. What did not work well for you?
4. What skills do you think a diagnostic radiographer should have?

Some general observations of the data were that patients, and the public who contributed to the crowdsource mentioned various imaging experiences, including general imaging, mammography, ultrasound, CT, MRI, and DEXA scanning. They spoke of experiences as patients themselves and supporting others as carers to children and family members. Several participants shared details of multiple episodes of medical imaging. Most participants used the phrase radiographer, although a couple used the word technicians. Other healthcare professionals' participants named linked to a medical imaging episode were doctors, radiology support staff and ward staff.

Thematic analysis was undertaken as per action cycle one to extract the themes from the ideas and comments shared. As a result, four themes were identified: patient care skills, patient needs, professional capabilities and other knowledge needed to practice as a diagnostic radiographer– ***Figure* 23Error! Reference source not found.** Each theme map is presented separately alongside an overall thematic map - ***Figures* 24, 25, 26, and 27**. Following the thematic maps presented in the previous chapter, themes are coloured grey, categories are green, and codes are blue.

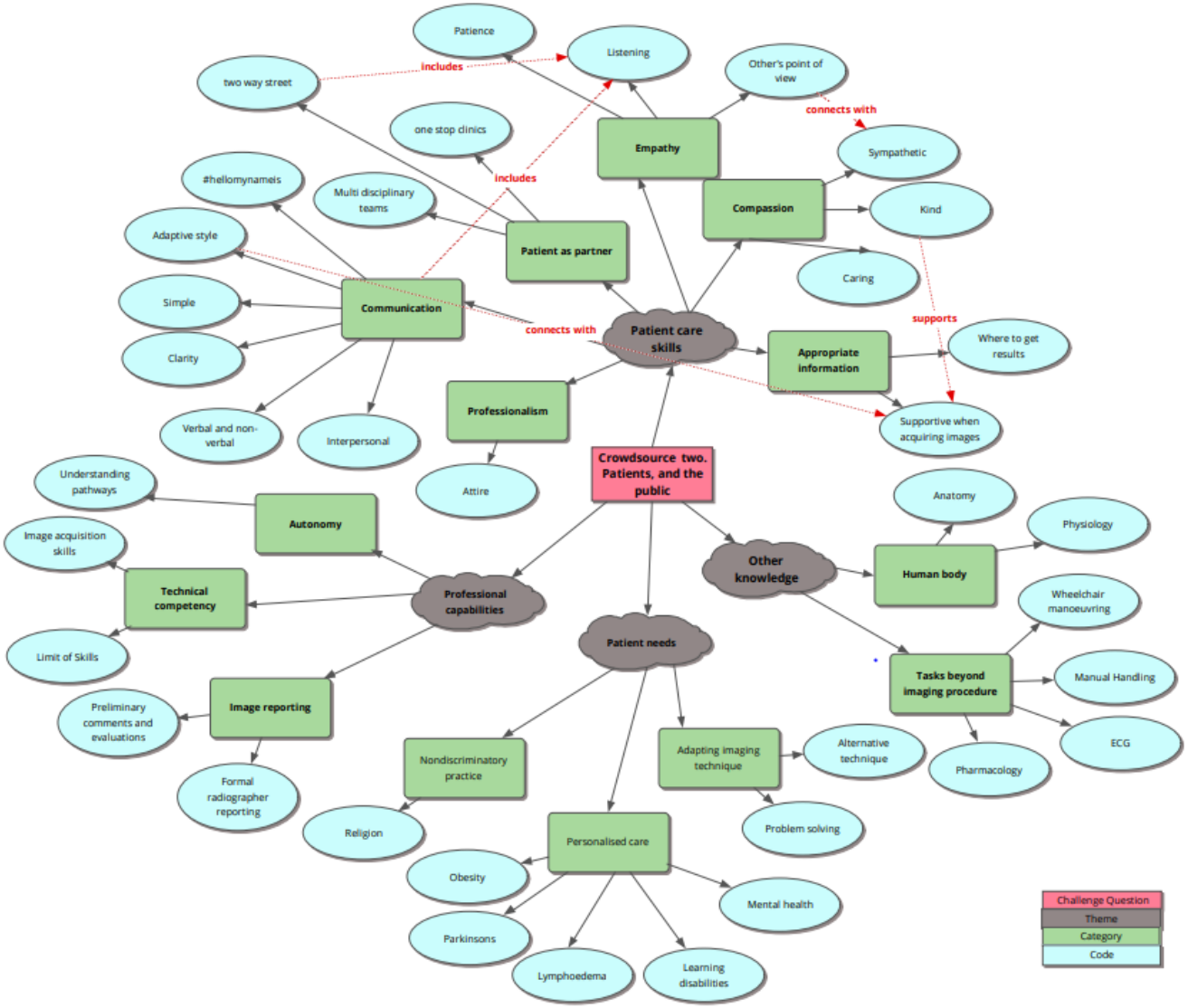


Figure 23. *Crowdsource two (CS2): Qualitative data analysis*

In the following section, themes are presented in order of ranking as per the total number of contributions (ideas, comments, and votes) the theme received **– *Table* 9.**

Ranked Number One. Patient care skills

This theme had the most contributions (n=82). Categories from the qualitative data included empathy, compassion, communication, sharing appropriate information, professionalism, and the patient as a partner during the imaging episode – ***Figure* 24**.

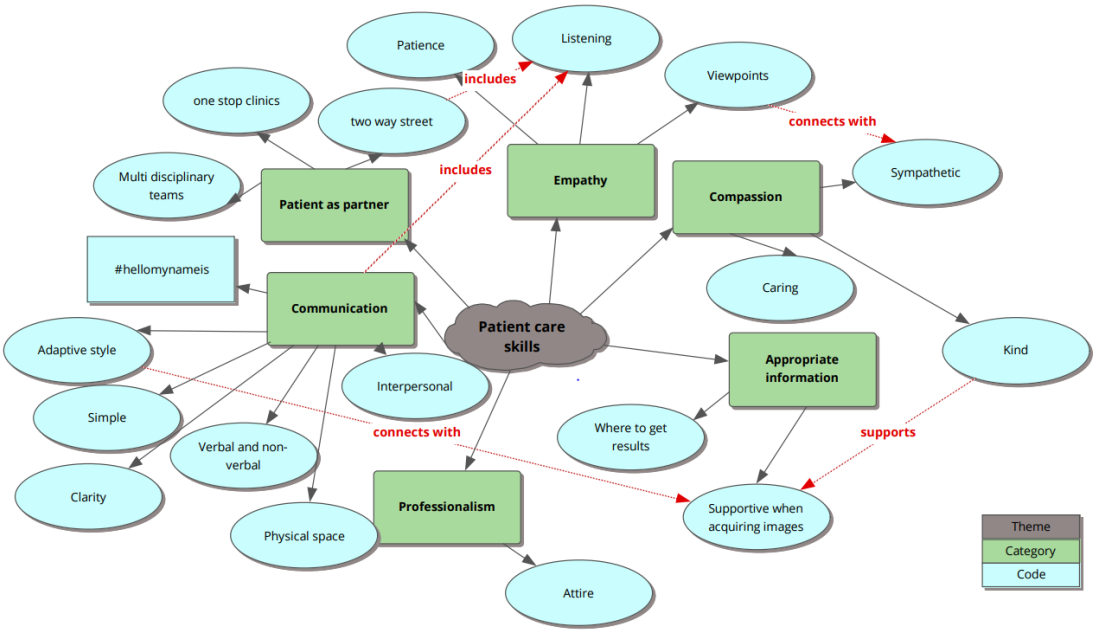


***Figure* 24**. CS2: *Thematic map* 'patient care skills' *analysis*

Being good at performing the scan is not enough, it's important that the profession attracts individuals with a passion to contribute the care of patients. They may be performing a scan but its more than just a procedure to the person having the scan. Good communication skills are essential but it's not just how you say it but what you hear and observe. Good listening skills is so important and patience to allow a patient to tell their story. The results of the scan may be life-changing. Therefore having compassion and showing empathy is also essential.

The categories were generated from a wide range of codes, including listening skills, patience, acknowledging others' points of view, sympathy, kindness, being supportive, using #hellomynameis, speaking with clarity, focusing on verbal and non-verbal communication, and using language the patient understands. Further codes identified were linked to the attire and actions of

those who undertook the medical imaging and their people skills. These codes overlapped those in the first action cycle with the students. Discussions in the previous chapter on these were supported by diagnostic radiography literature by Bolderston et al. (2010), Hendry (2019) and Bliekier et al. (2016).

I was quite scared at the time, but the radiographer introduced themselves to me and asked what I wanted to be called. He then explained what was going to happen. It put me at ease,

Diagnostic radiographers will need excellent communication skills as they often only meet a patient once, and they need to build a quick rapport with the patient to help them through the examination. They will be dealing with a variety of people- patients of all ages, carers, families, other healthcare professionals so they need good communication skills which help to demonstrate their caring professional manner.

Given the local findings from action cycle one and the mapping to national work by Hyde and Hardy (2021b), I was not surprised to see the emphasis patients, and the public placed on patient care and how many votes, comments, and ideas from the second conversation linked to this category. As already noted in chapter 5, Hyde and Hardy (2021b) emphasised how students and patients prioritise patient care, whereas clinical imaging managers prioritise efficiency.

Indeed another paper by Hyde and Hardy (2021a), this time with patients, reiterated the importance patients placed on patient care in medical imaging. As argued in chapter five, whilst patient care will always be part of a diagnostic radiography curriculum, the strong emphasis on this area of practice could have been missed by the current UWE Bristol diagnostic radiography curriculum design team as the design team membership only has a single patient on their team. The findings from the second crowdsource do not add any new results to the published current evidence base; the work undertaken for this thesis happened before Hyde and Hardy's research (2020, 2021a, 2021b). However, it demonstrates that this local research conclusion in a single city in the southwest echoes findings of national work at sites across the midlands and north of England. It is also interesting to note that a limitation documented by Hyde and Hardy (2021a) was the use of focus groups and how some participants who responded to an initial online questionnaire could not attend

physical spaces, thus impacting their focus group recruitment. With crowdsourcing attending a physical space is not an issue.

Closer examination shows that this study (n=46) recruited more participants (n=36) than Hyde and Hardy (2021b). On balance, it is hard to know how diverse the voices captured by Hyde and Hardy (2021b) were as the specific participant demographic details are not detailed. Here, I am drawn to an observation made by Borras and Edquist (2014), as cited in chapter two, who emphasised that an advantage of crowdsourcing is the diversity of voice it brings to a task. However, given the lack of demographic reporting by Hyde and Hardy (2021a), a comparison on this aspect of the recruitment process cannot be made between the two studies.

A final concept within the patient care category was professionalism. Here two codes were noted: the appearance of those taking images and their actions.

UWE students generally come across quite professionally, although they at times will wonder into placement when it suits them or wear trainers. It doesn't only reflect poorly on UWE but their clinical placement site

.

I had a scan where I had to lay in the scanner for 2 hours, having a scan 15 minutes. No one really talked to me during that time, and the person in the scan room was playing solitaire on the computer!

In their narrative review of unprofessional practice and student professionalism dilemmas, Hale and Wright (2021) observe that research into unprofessional practice is occasionally reported in radiography (Whiting & Kelly, 2010; Challen et al., 2017; Nortjé & Hoffman 2018) and more frequently in other health professions literature. Yet, I note that the definition of professionalism varies, and it is not the purpose of this section to explore the range of explanations. Instead, I will anchor this concept in a research report commissioned by the HCPC (2014), the regulator for the diagnostic radiography workforce. Here researchers stated that professionalism has its basis in individual characteristics and values, primarily defined by context, and is a dynamic judgment rather than a discrete skill set. Moreover, its definition varies with

several factors, including organisational support, the workplace, and the expectations of others.

The comment about students wearing trainers, timekeeping, and imaging staff playing computer games when they should be focused on an imaging task are interesting points to ponder when considering how professionalism is taught and modelled. Cruess and Cruess (2021) stress that teaching professionalism must be explicit and implicit. They also refer to the importance of experiential learning and reflections on personal experiences. This point highlights the importance of formal teaching and role modelling to diagnostic radiographer students (Challen et al., 2017) or, as noted by Nortjé and Hoffman (2018), the significance of the regular and hidden curriculum. The hidden curriculum refers to the unwritten values and perspectives students learn in educational settings, whether academic or clinical. While the formal curriculum consists of the courses, lessons, and learning activities students participate in and the knowledge and skills educators intentionally teach to students, the hidden curriculum consists of the unspoken or implicit academic, social and cultural messages communicated to students. Arguably some of this behaviour modelling is outside UWE Bristol's control as 42 weeks of student learning happens within clinical departments away from the University.

UWE Bristol learners already have a formal teaching session on professionalism in year one before their first clinical learning experiences and are expected to attend their assessed simulated practical sessions in full uniform. In addition, clinical staff who deliver the lectures on patient positioning in the practical x-ray room at the University campus will often participate in their uniforms, although this is not compulsory. There is some evidence to suggest that wearing uniforms in the simulation setting adds value to the learning experiences of diagnostic radiography students. A single centre study by Naylor and Foulkes (2018) identified that diagnostic radiographer students commented that wearing uniforms made theatre imaging simulations more realistic of the clinical environment. The concept of realism within diagnostic radiography training is echoed in the multi-centred research of role-play simulation by Zorn et al. (2018). Again Diamond et al. (2011) note the authenticity uniform wearing

made to a multi-professional simulation learning episode. While it may well be true that wearing uniforms in these situations add to the realism of this type of learning, it is less clear if this impacts learner understanding of professionalism.

Professionalism is an area considered in the student weekly reflective logs within the clinical environment. These areas of good practice need to remain in the new curriculum. With that said, designing the new curriculum offers an opportunity for the academic team to collaborate with clinical teams to agree on a definition of professionalism - the attribute of diagnostic radiographers as professionals. Previously in chapter five, I noted an increase in simulation and role-play options supported by clinical staff. However, it will be essential to ensure the sole focus of these is not just technical competencies but also subtle actions and behaviours, including attire and the need to simulate how students should conduct themselves in a clinical environment as per the regulator's expectations.

Of course, diagnostic radiography is a balance of technical and patient skills, which will be recognised in pre-registration training programmes (HCPC, 2013). However, these narratives of lived experience from patients further highlight the duality of the role of a diagnostic radiographer and the need to have skills in both areas. Therefore, in the current curriculum (2015-2020), patient care is given its module called ‘Patient Care’ year one. However, in the new programme (2020-2025), on reviewing the evidence I presented to the curriculum team, it was agreed that teaching technical skills alongside patient care would be woven within modules in years one, two and three rather than separating the two as different skills through specific named modules.

Ranked Number Two. Professional capabilities

This theme had 78 contributions. Three categories were identified: autonomy, technical competency, and image reporting. These were derived from image acquisition skills, knowing the limits of skills, preliminary commenting and image evaluation, and formal radiographer reporting codes - ***Figure 25***.

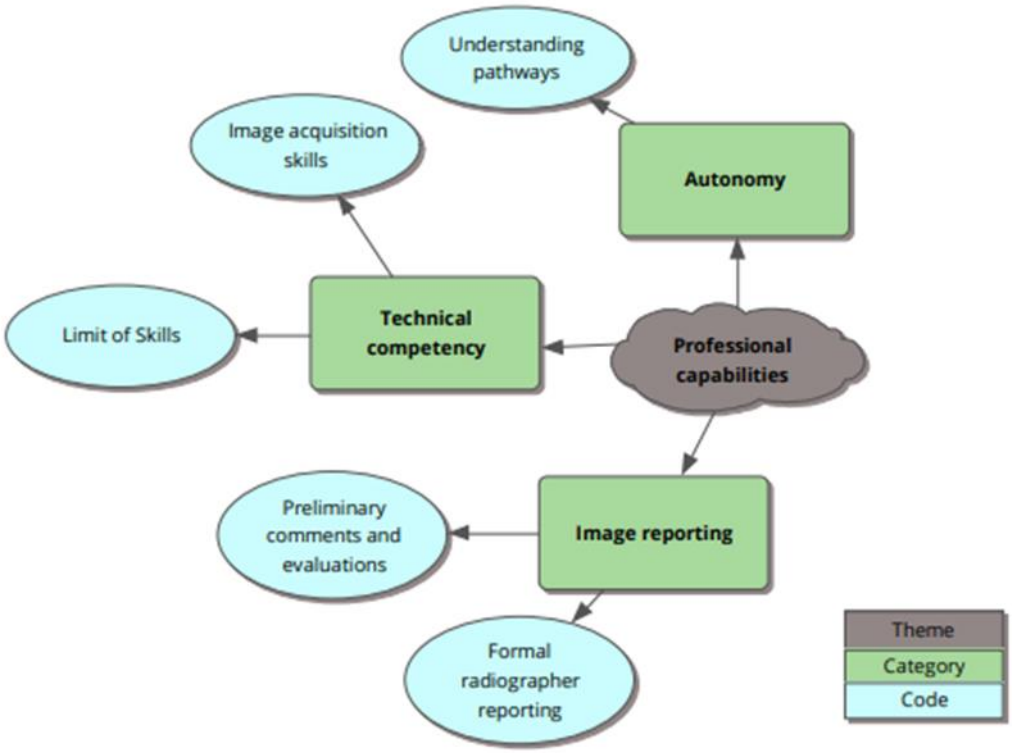


Figure 25. *CS2: Thematic map* 'professional capabilities' *analysis*

The diagnostic radiographer should be technically competent to perform a procedure or have the appropriate supervision. They need a confident friendly manner and excellent verbal skills to explain to the patient what to expect during the procedure.

I feel strongly that the person carrying out the scan/Xray/mri should be able to advise the referrer of a possible next step. I had a really positive experience when having an ultrasound scan, with the health care professional writing her findings for me (I am a healthcare professional myself) and I understood my shoulder problem. I just wish that action was taken quickly afterwards by my GP, and maybe a clear advice with recommendations would prompt the next step.

The traditional role of a diagnostic radiographer was to acquire medical images for interpretation by a medically qualified radiologist (Swinburne, 1971). However, as the demand for imaging increased, it evolved at a greater rate to the radiologist supply, and therefore radiographer reporting was introduced to support the workload (Culpan et al., 2019). Formal reporting by diagnostic radiographers is a post-registration master's level acquired skill and, for this reason, will not be explored further in this section.

Nonetheless, as part of the pre-registration diagnostic radiography curriculum, trainee diagnostic radiographers learn medical image interpretation during their training. As a result, they can often identify significant findings during examinations they perform (SCoR, 2013). In addition, this training affords the ability to support preliminary image evaluation once registered with the HCPC. This system can facilitate timely reporting to the treating clinician by providing a diagnostic radiographer comment that describes the nature, number and location of abnormalities seen on x-ray images. This approach is different from providing a formal report later. However, it is a diagnostic radiography capability often found in the emergency setting as health care decisions need to be frequently made quickly and were first described in the UK literature by Hardy and Snaith (2009). Since 2010 the indicative UK diagnostic radiography curriculum ensures graduating learners can provide a preliminary image evaluation. However, the following participant quote highlighted that this skill is not always adopted in practice which is reflected in the following participant comment:

My daughter (8) broke her arm badly on holiday and we went to the local A+E. Waited 2.5 hours for triage and X-Ray and a further 5 hours (until 1.30am) to be told that there was only one doctor for A+E, who could not review the x-Ray, so we would have to return next day. She spent the night in a tent, in significant pain with a broken arm before the-visiting waiting again and being cast. So I think it's very important that hospitals are using radiographer" expertise for this, not waiting on doctors.

I concede that this contribution relates more to the current radiology service provision design and is not something a curriculum design team can influence. Moreover, for NHS cultural reasons, diagnostic radiographer reporting in clinical practice is still patchy across the UK. However, the Kings Fund (2018) report *"Shared responsibility for health: the cultural change we need"* stated that there should be much greater emphasis on shared responsibility for improving health and care between patients, the public and NHS. Additionally, the Kings Fund (2018) work reminds us of the importance of teaching diagnostic radiography students about co-production. The Kings Fund report (2018) affirmed that more needs to be done to draw on what it described as the renewable energy of people and communities. As the role of patients, and the public as health care

partners is further realised, the curriculum team agreed to keep initial commenting on general x-rays needs in the new curriculum as per regulatory requirements. However, the critique above resulted in the curriculum design team adding patient, public co-production, and the future direction of this area as a new syllabus addition.

Ranked Number Three. Patient needs

The second most discussed area in crowdsource two was patient needs with 57 contributions logged – ***Figure* 26**.

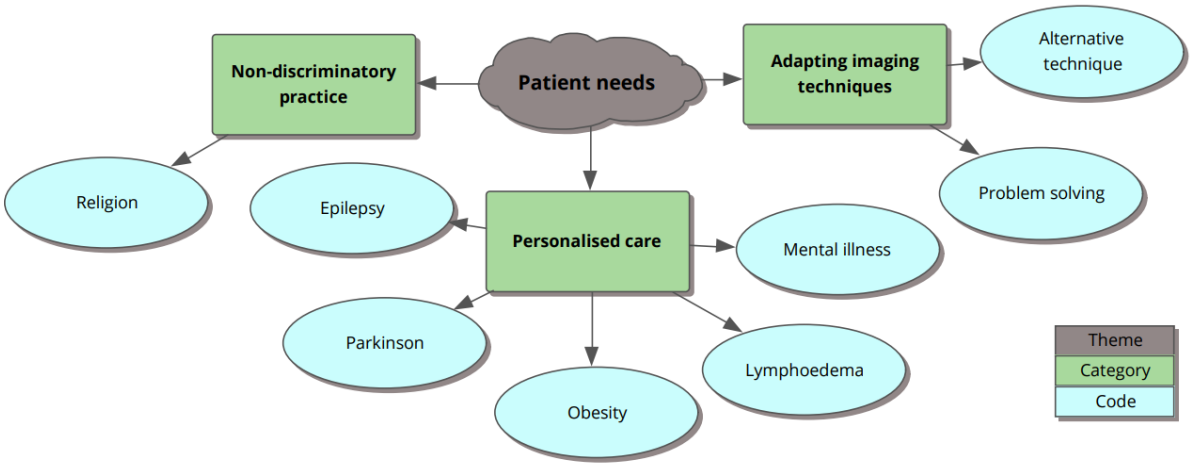


Figure 26*. CS2: Thematic map* 'patient needs' *analysis*

The patient needs category was divided into three concepts: applying adaptive techniques, supporting specific conditions, and practising in a non-discriminatory way. The health conditions listed by participants in the second crowdsource included mental health challenges, those with learning difficulties, lymphoedema, epilepsy, obesity, and Parkinson's. While patients' exact conditions cited differed from the findings in the crowdsource with students, the reoccurring concept of supporting a range of patient needs was evident.

My Mum has Parkinson's and can't lie flat and can be in a great amount of pain from doing so. I have epilepsy and, in the past, have been concerned about having a seizure whilst in an MRI scan as I would hurt myself. I would hope that the radiographer had a good understanding of the implications that other issues can have and the concerns that they would raise for the patient. I don't expect them to be experts in anything other than their field but would hope that they have the awareness and ability to research the other issues that affect the patient.

This finding echoes the cited work by Harvey-Lloyd and Strudwick (2018) and Chau (2020) in chapter two, who emphasised the importance of diagnostic radiographers feeling comfortable interacting and caring for patients from different backgrounds and cultures. The one overlapping condition identified in the findings of crowdsource one and two was imaging obese patients. Whilst learners participating in crowdsource, one had requested more training on the technical skills of imaging obese patients; the patient and public wanted more training in the care of the obese patients. One patient recalled a distressing episode of care and poor communication during medical imaging. Previously in chapter five, I noted that UWE Bristol learners were focused solely on the technical aspects of imaging obese students despite research by Miller et al. (2017) on the communication techniques used by diagnostic radiographers when imaging this patient group. This point strengthens why a range of stakeholders are needed in health professions curriculum design, as this allows data triangulation. Here are two groups looking at the same challenges through very different lenses. Thus eliciting the views of both groups offers a more rounded approach to teaching the same topic, which is critical given the balance between technical skills and patient care synonymous with being a diagnostic radiographer.

They should be able to think about what they need to say to patients but to say it in a kind way. "I need to protect your arms because of the angle you are going to the scanner, in it is possible to make your skin sore if your arms catch on the sides, so I'm going to pop them in some pillowcases". Rather than "put her arms in pillowcases, she's so obese I don't want her skin ripping on the way in". Be able to assess patients and support them; if someone is nervous, talk to them and comfort them.

One participant commented how their religion and physical disability could impact their imaging experience.

I use a wheelchair and am Muslim, so less comfortable if the technician is male. I was lucky that the staff were consistently both patient and supportive to ensure that they took the image they needed, with minimum discomfort to myself but still maintaining the service's 'throughput' of patients.

This quote highlighted the importance of considering the intersectionality of patients, moreover, supporting patients holistically during an imaging episode, as previously discussed in chapter two. On reviewing the evaluation of this

theme, the curriculum design team committed to ensuring a range of diverse patients were used in their teaching and assessment activities. They also reviewed current teaching materials on imaging patients with various conditions to link to the technical and patient needs aspects. It was agreed that this is best achieved by not teaching technique and patient care as separate modules but rather teaching these elements together, thus affording them equal weighting. This was a pledge also made in the previous patient care section.

Ranked Number Four. Other knowledge needed to practice

This theme had the least contributions (n=24) across two categories: knowledge of the human body and tasks beyond the imaging procedure–- ***Figure* 27**.

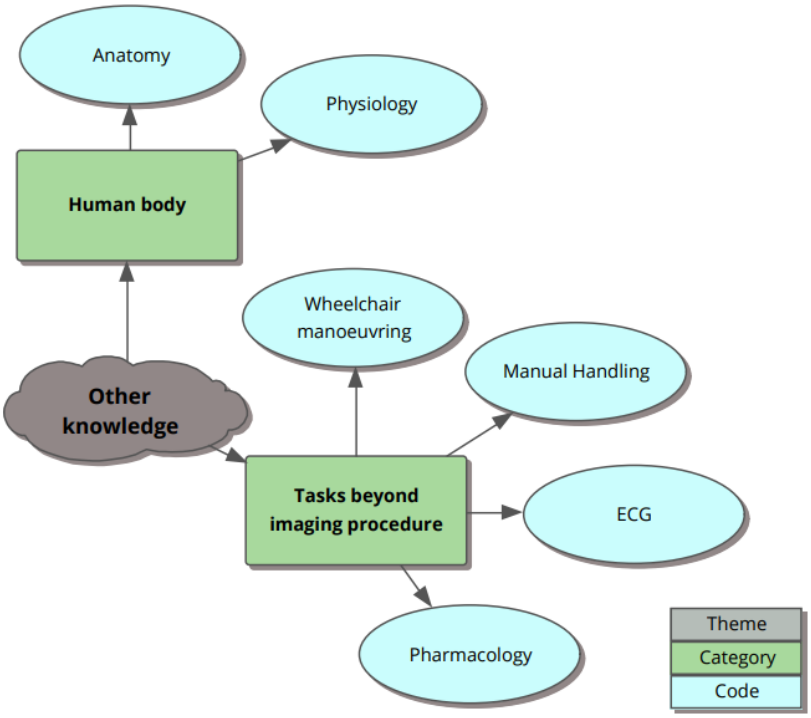


Figure 27. *CS2: Thematic map of* 'other knowledge' *analysis*

Duties beyond the imaging procedure included pharmacology, manual handling, wheelchair manoeuvring and Echocardiogram (ECG) interpretations.

For a different health condition, I had an MRI scan of the abdomen recently. This was a harrowing experience because my body reacted badly to a pre-op injection of buscopan. The technicians were extremely nice again, knew what

they were doing and handled it really well, helping me complete the scan successfully.

These items are currently taught on the curriculum, and the curriculum writing team agreed they would remain. Although diagnostic radiographers do not have independent prescribing rights as per the Medicine Act (1968), it is critical that they can manage patients undergoing imaging that involves contrast agents and be aware of medicines used in radiography procedures such as buscopan, which relaxes the bowels in bowel imaging procedures. Subsequently, all degree programmes teach basic life support skills on an annual basis as part of the clinical environment mandatory training requirements. Besides this, students at UWE Bristol can access part of the teaching that follows the post-registration College of Radiographers Certificate of Competence in administering intravenous injections in their final year. This training offers UWE Bristol graduates an exemption to part of the post-registration course fees and materials. This offer will remain in the curriculum. The crowd proposed an interesting idea on how diagnostic radiographers could obtain a more rounded experience of patient care skills beyond the imaging episode by spending time on the wards or following a patient through the patient pathway.

I agree with everything above and think that radiographers should have some basic understanding of what it's like on a ward. Interpreting a basic ECG, gain the empathy and responsibility of looking after a patient on a ward or even following their pathway would be hugely beneficial in the development of a student radiographer.

Placements on hospital wards is not a new concept to the profession as these were common in the old Diploma award that diagnostic radiographers undertook until the mid-1990s. However, there has been limited reported use of these since the move to the degree programme, with a single article published by Hyde & Errett (2017) sharing the experiences of a single HEI provider. Here students were placed on a one-week 'care placement'. These were in various settings – wards within acute NHS Trusts (Health Boards), nursing homes, care homes and GP surgeries. Each care placement lasted one week.

Evaluating the student experience of these types of placements through questionnaires and a focus group, the placement was well received by

students, and it was reported that the opportunity positively impacted the student experience. The care placements have increased student knowledge and confidence about working with patients with dementia, helped students develop strategies to encourage patients with dementia to co-operate with examinations, and enhanced their communication skills. This placement type is not undertaken on the diagnostic radiography programme at UWE Bristol. However, the concept would also address another challenge diagnostic radiography programmes face due to the lack of suitable placement capacity, as HEE (2021) identified. Therefore the programme team committed to exploring this as a placement option in the new programme.

6.5 Action cycle two: Mapping to the new curriculum

As per action cycle one, following the critical evaluation of each theme, the findings were presented to the curriculum design team. They discussed the findings amongst the group, and a table was drawn up, mapping items in the current curriculum the local diagnostic radiography team would maintain from the 2015-2020 curriculum and items under development for the refreshed 2020-2025 curriculum – ***Table* 10**. This second table includes items not already identified in the first action cycle. A combined table is available in ***appendix* 23**. Previously in chapter six, the importance of the clinical department and the many stakeholders involved in clinical education within the diagnostic radiography curriculum was documented. Hence the refreshed curriculum decisions aligned with the SCoR (2011*) "Roles and Responsibilities in Clinical Education"*. This document notes that the quality of education is paramount to the profession, with academic rigour only being part of the education process. Although the paper is a decade old, it is currently used by the profession. The key messages taken from this professional guidance document included the need to ensure clinical partners were thoroughly versed in the aims, objectives and the broader curriculum of the refreshed programme of study.

Table 10. *Crowdsource two. Contributions mapped to the new curriculum*

CROWD SAID THEME	PROGRAMME WILL MAINTAIN	PROGRAMME WILL DEVELOP
Patient care skills	*Attend practical assessments in full uniform and graded on professionalism *Weekly written reflective logs when on placement, including professionalism	*Removal of a single year one patient care skills module and map this learning into modules that support care and technical learning
Professional capabilities	*Continue teaching image interpretation during the first, second and third year with a final module which ensures graduates of the programme can offer a clinical comment on general x-raying images they take	*Session on patient, public co-design, and coproduction in the context of the national strategies such as the NHS Long Term Plan (2019)
Patient needs	*Continue to teach a range of patient conditions across the three-year groups	*Ensure a diverse range of service users supporting learning and teaching activities (across the eight protected characteristics) *To strengthen teaching patient care and technical skills, include them in the same modules rather than separating them into discrete modules
Any other knowledge needed to practice	*Practical manual handling training *Yearly basic life support training *IV cannulation training in year three using the SCoR IV competency framework	*Consider alternative placements in care homes, on hospital wards or following patient pathways

6.6. Action cycle two: Complete cycle questions and adjustments

Again Wadsworth's (2011) complete cycle questions were applied to consider adjustments to the crowdsource administration between cycles two and three. This process allowed the exploration of research objectives one, two and three. On this occasion, the following areas were considered:

- Recruitment through growing a community of users
- Facilitating the crowdsourcing community
- Shaping of the challenge questions

- Considering the time between each action research cycle

As per action cycle one, I observed what actions I had taken for action cycle two, critically reflected on these actions, and linked these reflections to the literature. Following these reflections on action cycle two, the following areas were readjusted for action cycle three.

1. Capturing the demographic of those participating, specifically if health and social care professionals were engaging as members of the public
2. Implementing a two-week pause between crowdsource two and three to establish if the crowdsourcing process could be sped up
3. Changing from observer to active facilitator
4. Offering patients, and the public the opportunity to comment on four modules in the updated programme

Demographic questions

During the second crowdsource, I was emailed by several potential participants who had had medical imaging in Bristol but did not live in the postcodes as stipulated in the original study inclusion criteria. They connected because they wanted to share their experiences. I did not deem this request an issue because narrowing the inclusion criteria to a set number of Bristol postcodes for crowdsource two had been a pragmatic choice. Furthermore, as described previously in chapter four, I had justified this inclusion criterion given that UWE Bristol is in Bristol. Hence by targeting those who had had imaging services within the city, I was hopeful the call to participate would resonate with people in the area. This approach to recruitment is one supported by Acar (2019).

A further reason for this decision was given there was no published literature on crowdsourcing health professions curricula with patients, and the public, I was unsure if I would receive a deluge of responses. Blohm et al., (2013) observed that this could be overwhelming for the individual or organisation hosting the crowdsource. This was of particular concern for this research as the crowdsource was running parallel with a live curriculum development process, and I needed the data from this crowdsource to be with the curriculum team by

the 30th of September 2019. If there were too much data to analyse, this time frame would be impossible to achieve. Hence, although advertising this updated recruitment strategy was not undertaken, cycle three was opened to anyone imaged in Bristol.

While facilitating the crowdsource, I suspected I was reading comments left by health and care professionals, given the language and tone used alongside participants occasionally identifying themselves.

> *I saw a very professional ultrasound person who advised me exactly of observations in my shoulder (I am a healthcare professional), and it would have been beneficial if they could make suggestions for a referral.*

I could not identify how many health and care professionals were engaging as this data was not captured in the demographic questions. As health and care workers can be patients who access health and care, it could be argued that this is not a problem. Some of my reasoning resonated with a comment made by a participant in work by Hyde and Hardy (2021a). They recalled behaving differently as a patient than a diagnostic radiographer when discussing the need for clear instructions and having the opportunity to ask questions during an imaging episode. However, it was essential to understand the crowd's composition as I needed to consider power dynamics within a crowdsource. Research by Meredith et al. (2018) that looked at the facilitation of members of a closed Facebook group for those undergoing mammography screening noted the critical role of the facilitator in a space where patients and professionals came together. The position was deemed crucial to ensure an equal stake in the conversation when all stakeholders are together in a single online space. Essentially ensuring the patient, and public voice is not overpowered by the professionals.

The concept of identifying the crowd structure led to formulating an avenue for further research, namely *"investigating power dynamics within a crowdsource conversation".* I discuss this opportunity further in chapter eight. This area of research is underreported within crowdsourcing literature. I also deemed it essential to capture this data for the trustworthiness of this research. This research sought to capture a more diverse voice and thus more varied

knowledge. If I heard from people who already worked or were part of the health and care system, this potentially missed this objective. Hence alongside a request to open crowdsource three to those who had accessed imaging in Bristol, I requested that the ethics committee allow me to ask a further question that would break down the crowd into those who worked in the health and social care and who were patients, and the public, ***appendix* 16**. These changes were agreed upon before hosting the third and final crowdsource.

Facilitating the crowdsource

At the end of action cycle one, I concluded that my role as a facilitator for this action cycle, action cycle two, would remain as an expert, observer, and discipliner described by Messner and Rauch (1995). I initially took this approach for action cycle one. I had worked with an internal crowd of students who had lived experiences undertaking the current BSc (Hons) Diagnostic Radiography degree programme at UWE Bristol. Although the platform was anonymous, I believed that acting as an observer would give those participating a sense of freedom in posting positive and negative comments. Furthermore, I thought over-contribution by myself could lead to a demoralised crowd who stopped contributing (Majchrzak & Malhotra, 2020). With that said, I did monitor the crowdsource to ensure the ground rules were being followed.

This facilitation approach worked for action cycle one, so I continued to enact this stance for action cycle two as none of these reasons for adopting this approach had changed. However, during action cycle two with patients, and the public, I found I wanted to ask those contributing to expanding their ideas and comments, much more than was the case for action cycle one with the students. I am unsure why this might have been and postulate that the patient, and public group were sharing their lived experiences of accessing imaging, and as a practitioner, I wanted to better understand the information they shared. I also wanted patients and the crowd to signpost me to teaching materials they may be aware of to support the new curriculum delivery. For this reason, I also asked the ethics committees to change my facilitator role from an observer to someone who stimulated conversation through interacting with the crowd. Of course, I would remain a discipliner, ensuring the platform ground

rules were followed. However, I appreciated that this could be a fragile process that could have resulted in the crowd disengaging and the crowdsource event breaking down, as Majchrzak and Malhotra (2020) cautioned.

The time between action cycle two and action cycle three

The time I allocated between running crowdsource one and two was eight weeks. This duration was a pragmatic choice to allow time to conduct the data analysis and to advertise the opportunity to an external crowd of patients, and the public. I wanted to establish if the time between administrating action cycles two and three could be reduced, thus speeding up the time of the curriculum design process. The space between cycles two and three offered an opportunity to explore this adjustment for this research. Therefore instead of leaving another eight-week gap, I opted for a two-week break between the closure of the second crowdsource and the opening of the third (final) crowdsource. My rationale for making this adjustment was that crowdsourcing is often described as speeding up the innovation process (Brabham, 2013). JISC (2016) also associated the use of technological tools in curriculum design as an opportunity to save time and money potentially. JISC (2016) identified that this was important as in a competitive, fee-paying scenario, this helps HEIs gain a competitive advantage.

Shaping the challenge questions

For the first two action cycles, the questions asked of the crowd were kept broad. In action cycle one, if I had not used this approach and relied on what managers wanted in a BSc (Hons) Diagnostic Radiography programme, as per research by Sloane and Miller (2017), I could have missed the theme of ‘care’. A theme that Hyde and Hardy (2021c) have demonstrated employers often miss but that learners and patients will highlight something further evidenced by this work. Hence by asking patients and the public about good and bad imaging experiences, I could tease out the critical episodes in their experiences. Again care was a strong theme from the second crowdsource, which echoes the first crowdsource findings with UWE students and patient-specific research recently published by Hyde and Hardy, (2020).

The programme team wanted patients, and the public to comment on four modules for the ultimate action cycle. These included two practice-based modules and two new modules for the 2020 programme, which the team wanted to gauge the appetite for these with the patient, and the public crowd. Thus, a term coined by the Clever Together Lab Ltd. team is that the final crowdsource offered an opportunity to 'check and challenge' (verify) specific new curriculum content. As noted in chapter four, the modules were:

1. Year 1 Module: Diagnostic Radiography Clinical Practice 1
2. Year 2 Module: Professional Behaviour and Health Psychology
3. Year 2 Module: Diagnostic Radiography Clinical Practice 2
4. Year 3 Module. Healthy Futures
5. Any other ideas?

As my role as moderator had shifted, I could also add ideas to the crowdsource platform to ask the crowd to verify areas discussed in this crowdsource (action cycle two) section, thus allowing me to sense check some of the themes and categories from this round.

This approach also offered an opportunity to revisit an observation made in chapter two, from work by Rowland et al., (2019). Here the authors stated that if you adopt a democratic approach to writing learning objectives, giving equal status to all contributing to the process can lead to nobody being confident with contributing. So whilst the final action cycle did not ask the crowd to co-produce learning outcomes, this tactic did offer an opportunity to gauge if the crowd would engage in this type of challenge question, which was more specific to the UWE Bristol programme than the previous broad questions.

6.7 Chapter summary

Action cycle two was the first time the research was undertaken with an external crowd of patients, and the public. Altogether individuals joined the conversation and the demographic data collected demonstrated a range of ages and ethnicities took part. Critically reflecting on the activities and steps I

had undertaken regarding the first and second action cycle, and linking these to the relevant literature, resulted in several adjustments before administrating the third and final crowdsource. These reflections included reconsidering the time between action cycles facilitating the crowd and the challenge questions.

The qualitative data analysis highlighted four key themes: patient care, patient needs, professional capabilities, and other knowledge needed to practice as a diagnostic radiographer. Only a few concepts within these categories echoed the findings from the first crowdsource with students. This finding was expected as the students who were part of the first crowdsource focused on their lived experiences of the administration of the curriculum. One category considered by both groups was patient care, although there were nuances in the focus of the patient care aspects. Within diagnostic radiography, there is a growing evidence base around patient-centred care. Hence the findings from this action cycle align with current profession-specific evidence. Equally, it also demonstrated the value of having a range of patients, and public voices considering the full breadth of what a curriculum should contain. This observation is shown by the mapping exercise undertaken highlighting what content would stay from the previous curriculum (2015-2020) and what would be added to the new curriculum (2020-2025) following analysis of the qualitative data generated for action cycle two. The ultimate action cycle is presented in chapter seven.

CHAPTER SEVEN: Action Cycle Three

7.1 Chapter introduction

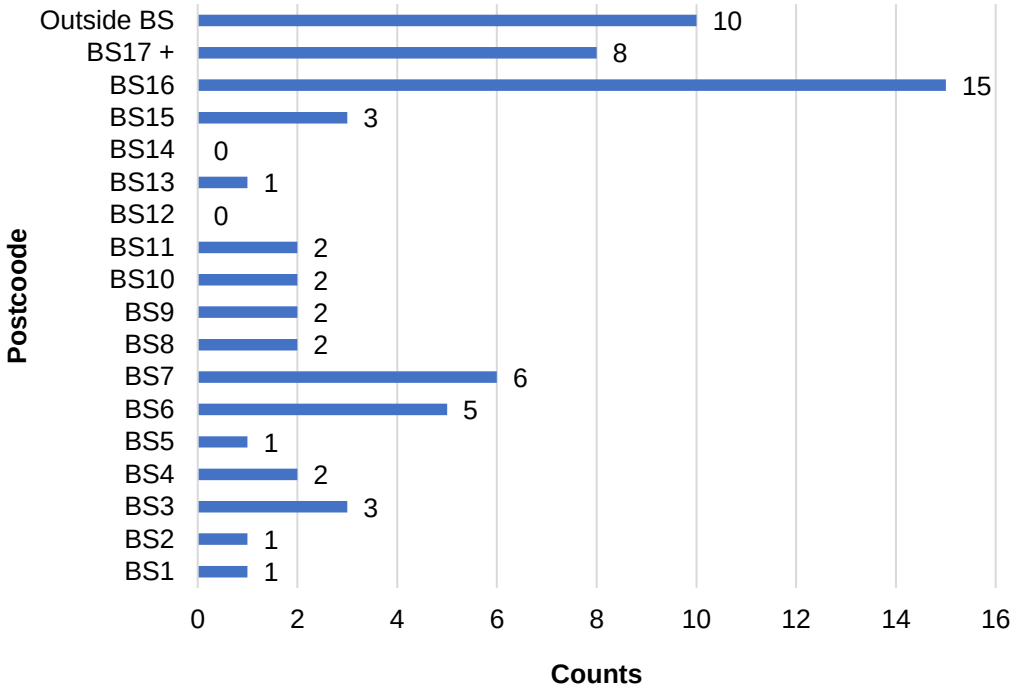
In the previous two chapters, various aspects of action cycle one and two have been presented. This information included capturing participant demographic data, recording the categorical data collected and sharing the qualitative data generated by the ideas and comments left on the crowdsourcing platform. Critical evaluation of the crowd contribution was undertaken within these chapters, and from here, contributions were mapped to the updated UWE Bristol diagnostic radiography pre-registration degree curriculum. This chapter follows the same formula focusing on the third and final two weeks of crowdsource administrated from the 8th to the 21st of October 2019. As per action cycle two, the target audience was patients, and the public. Chapter seven also builds on the previous critical reflections from action cycles one and two by again applying the complete cycle action questions.

7.2 Action cycle three: Participant demographic data

A total of 110 participants joined the third and final conversation. (46 from crowdsource two and 64 for this crowdsource, crowdsource three). Therefore 54% of participants were new recruits since the previous crowdsource with patients, and the public. The following demographic reporting is for the 64 who joined crowdsource three only. Combined demographic data for crowdsource two and three can be found in section 7.7.

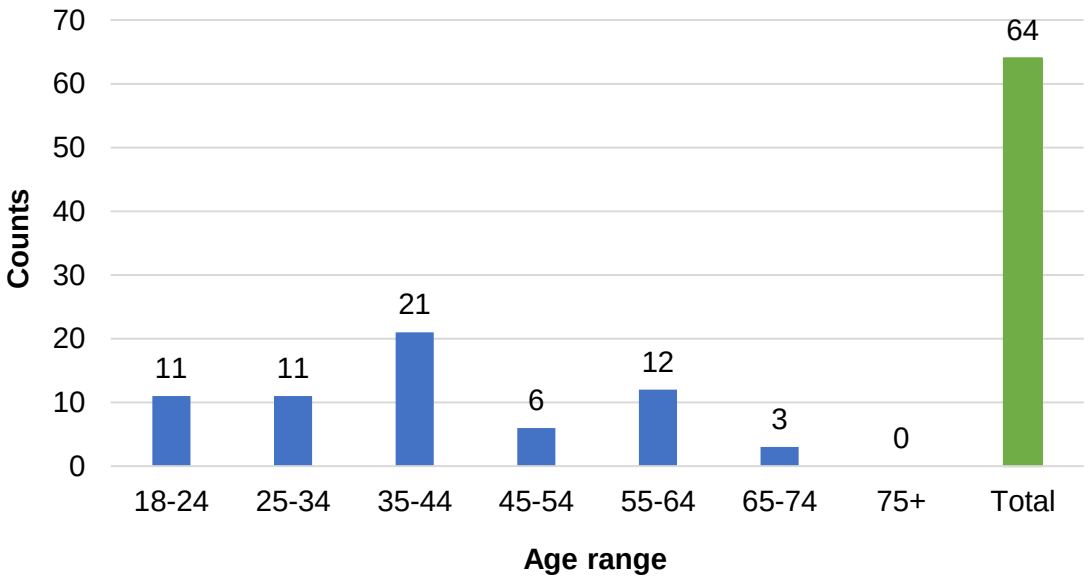
As demonstrated in ***Chart* 10**, 73% (n=46) of the postcodes registered were from the BS1 to BS16 areas. The BS12 and BS14 postcodes registered no participants. The remaining BS postcodes, BS17 upwards, accounted for 12% (n=8) of the responses. The outstanding 15% (n=10) postcodes were outside the BS area. These included Exeter, Newport, Bath, Gloucester, and Swindon.

Chart 10. *Crowdsource three: Distribution of postcodes*



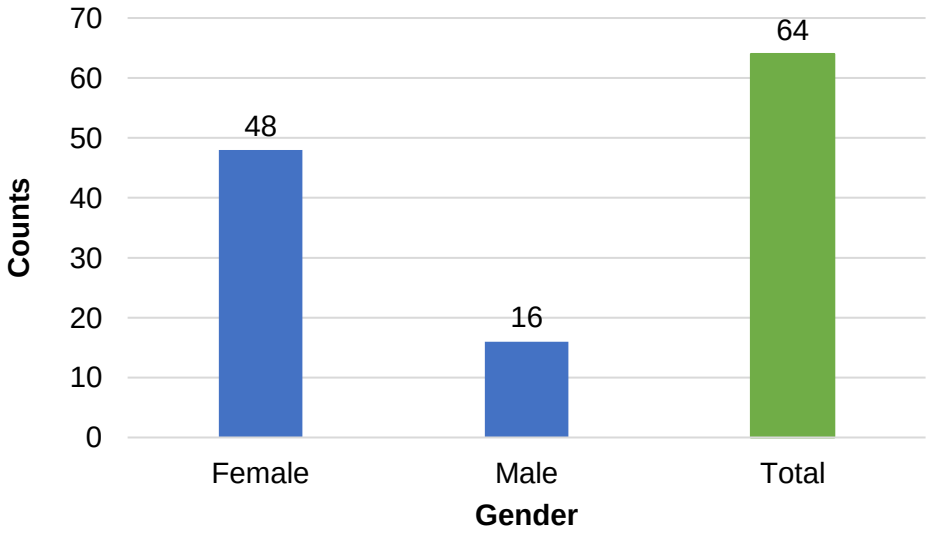
As per crowdsource two, the only age group not to participate were the over seventy fives - ***Chart* 11**. Every other age group had representation. The most represented age group was those who were 35 – 44 at 42% (n=21). The least represented age group was those from 65 – 74 at 5% (n=3).

Chart 11. *Crowdsource three: Age profiles*



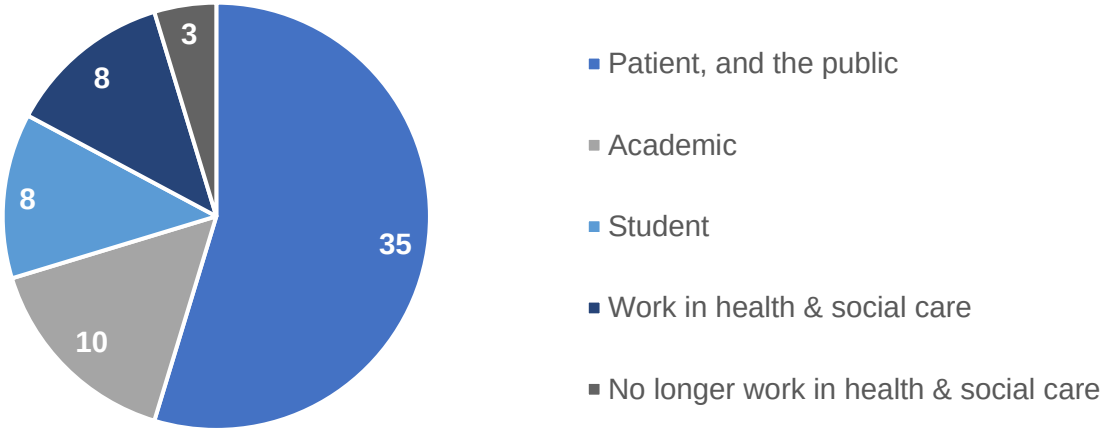
Seventy six per cent (76%; n=48) participants identified as female and twenty four per cent (24%; n =16) as male ***- Chart 12.***

Chart 12. *Crowdsource three: Gender profiles*



For crowdsource three, a new demographic question was added, asking those participating if they were members of the public, students, or health and social care workers - ***Chart* 13**

Chart 13. *Crowdsource three. Crowd composition*



Over half of those contributing stated they were patients and members of the public (53%, n=35). The remaining numbers consisted of academics (16%, n=10) students (13%, n=8), those who currently work in health and social care (13%, n=8) and those who had previously worked in this area (4%, n=3).

A range of ethnic groups were represented. 82% (n=52) registered as white : English / Welsh / Scottish / Northern Irish / British–- ***Table* 11**.

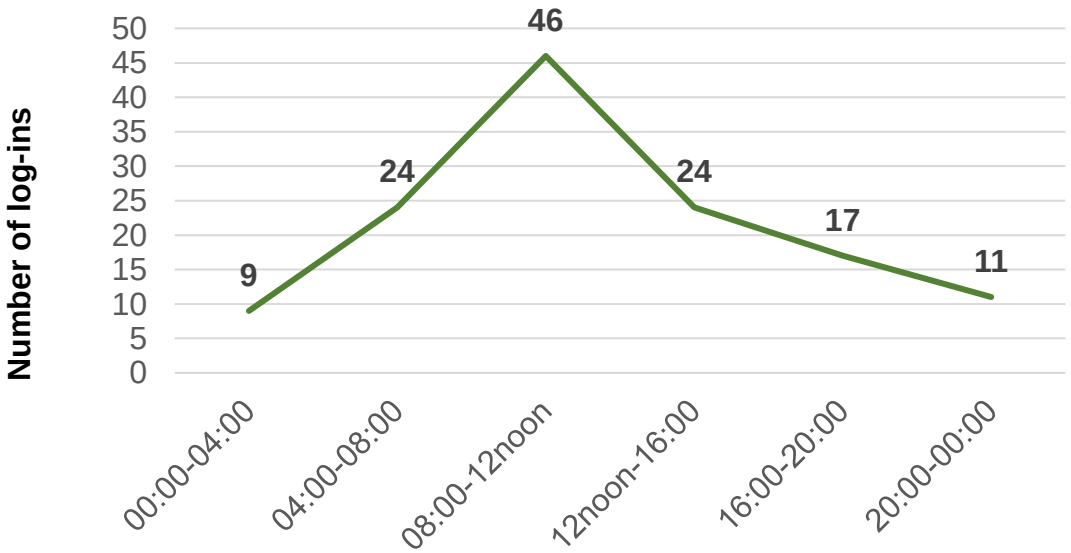
Table 11. *Crowdsource three: Ethnicity*

	ETHNICITY	CROWD		BRISTOL
White	English/Welsh/Scottish/Northern Irish/British	52	82%	77.9%
	Gypsy or Irish Traveller	1	1.5%	0.1%
	Irish	1	1.5%	0.9%
	Any other White background	1	1.5%	5.1%
Black	African	2	3%	2.8%
	Caribbean	1	1.5%	1.6%
Asian	Chinese	0	-	0.9%
	Bangladeshi	0	-	0.5%
	Indian	1	1.5%	1.5%
	Pakistani	1	1.5%	1.6%
Mixed	Mixed Race	2	3%	3.6%
Other	Prefer not to say	2	3%	-
	Any other ethnic group	0	-	1.6%
	Blank	0	-	-
	Grand Total	**64**	100%	100%

7.3 Action cycle three: Quantitative data

A total of 131 log-ins were made during the crowdsource – ***Chart* 14**. On this occasion, there was log-ins across the whole 24 hours. As per crowdsource two, the busiest time was 08:00 to 12 noon.

Chart 14. *Crowdsource three: Login numbers*



The crowd for the third crowdsource generated 357 contributions through the five challenge questions – ***Chart* 15**. These contributions were further broken down into ideas, comments, and votes, as demonstrated in ***Chart* 16.**

***Chart 15**. Crowdsource three: Sum of all contributions*

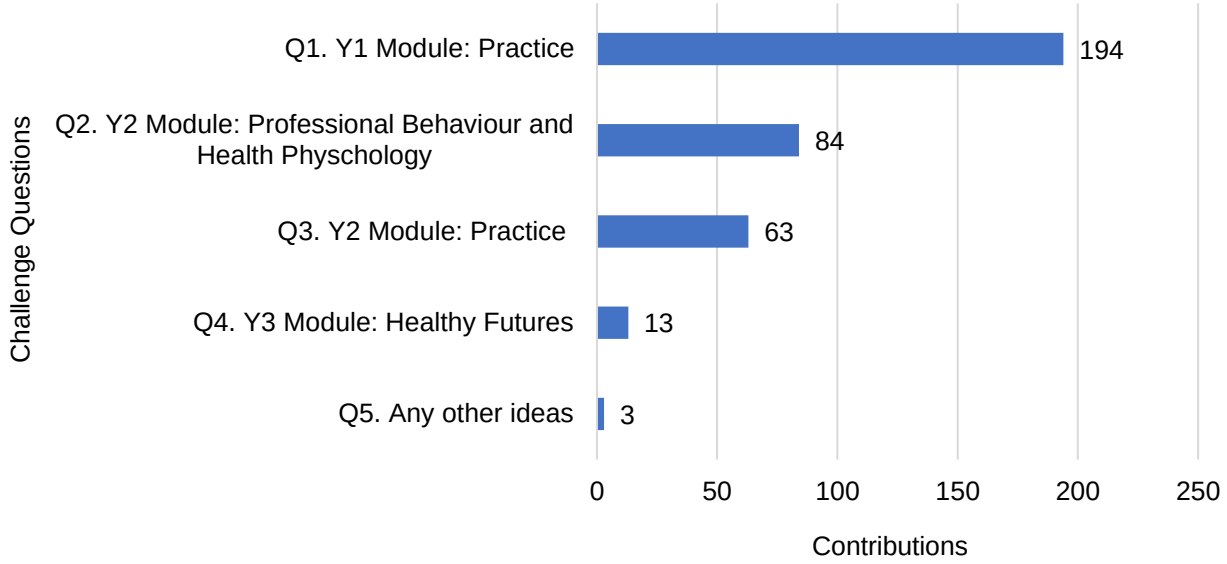
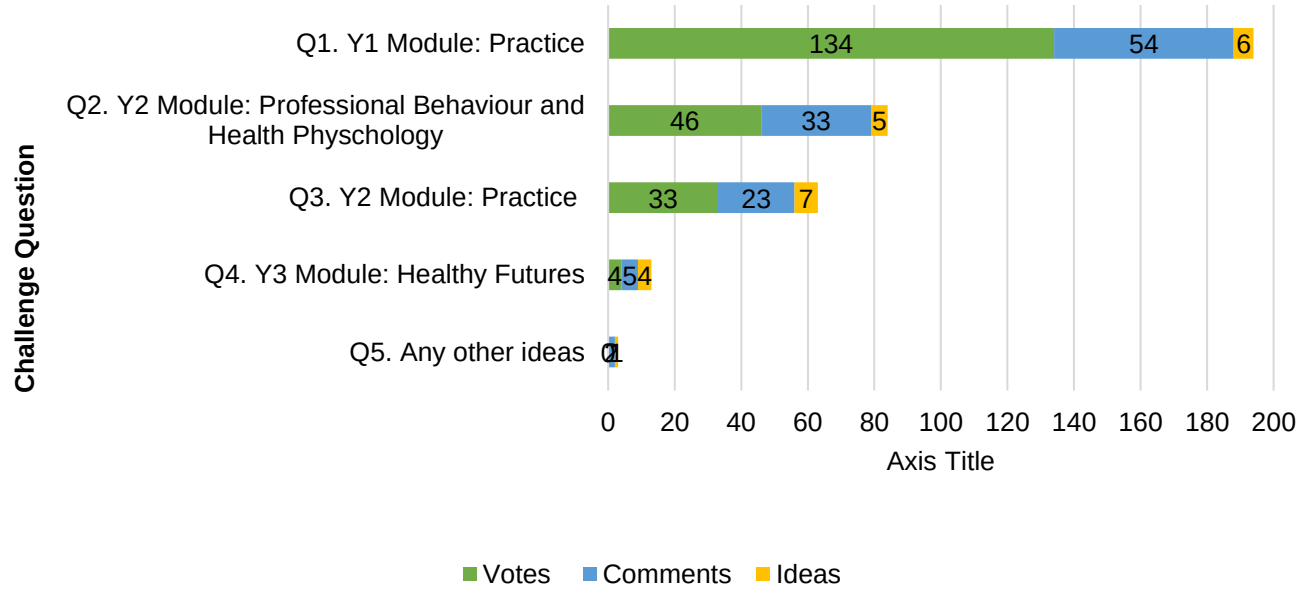


***Chart 16**. Crowdsource three: Votes, comments, and ideas*



The ideas ranked by total contributions are outlined in ***Table* 12**. Ideas I had included on the platform for discussion are written in blue. A further breakdown of each idea into votes, comments, and ideas is located in ***appendix* 20, 21.**

Table 12. *Crowdsource three: Ideas ranked by contributions*

No	Challenge question theme	Idea description	Total contributions
1	**Year one module: Practice** First placement position.	Six months in the university in first year for academic only learning followed by 14 weeks in a hospital needs reviewing. In workshop one it was highlighted that being in University for this length of time meant learners were not able to practice their skills. Do you agree with this observation? What would an alternative look like?	56
		Clinical Placement Logistics	
2	**Year one module: Practice** Hospital ward time	A comment in workshop was that diagnostic radiographers should have a basic understanding of what i''s like on a ward stating that the responsibility of looking after a patient on a ward or even following a patient pathway would be hugely beneficial in the development of a student radiographer.	44
		Interprofessional Learning	
3	**Year one module: Practice** Care, empathy and listening skills	This was a popular theme in workshop one. How can we teach these skills?	36
		Syllabus Content	
4	**Year one module: Practice.** Safe handling of equipment	This theme from workshop one related to a variety of areas including being able to operate the imaging equipment safety. The safe transfer of patients onto x-ray tables and scanning couches, “driving”" a wheelchair were also listed as examples. Do you agree?	31
		Syllabus Content	
5	**Year two module. Professional Behaviour and Health Futures** Work with different patient groups	Meeting the needs of vulnerable groups including safeguarding	31
		Patient Needs	
6	**Year two module. Professional Behaviour and Health Futures** Placement in mental health Trust	One in four people will experience a mental health issue in their lifetime. Do you agree that student radiographers should spend time on a Mental Health placement to better understand this patient group? How long do you think student diagnostic radiographers should spend on this type of placement? Currently learners have 14 weeks of placement in year one, 14 weeks in year 2 and 14 weeks in year 3 (52 weeks in total). Please share your thoughts and comments.	27
		Patient needs	
7	**Year two module. Practice** What is professionalism?	Professionalism was a reoccurring theme in workshop one. What professional behaviours are you looking for in a diagnostic radiographer? Does appearance matter?	23
		Patient Care Skills	
8	**Year one module. Practice** Balance technical	Balance between talking to Patients and carrying out the necessary procedure	15
		Patient Care Skills	
9	**Year one module. Practice** Advise patients why an image is being retaken	Learners should be able to tell you why they have to repeat an image in workshop the need for radiographers to get the images correct first time was noted . If this does not happen they should be able to tell you why a repeat image is needed. Do you agree with this expectation?	12
		Patient Needs	
10	**Year two module. Practice** Care of LGBTQIA+ patients	LGBT: what expectations they may have of you as a professional	12

		Patient Needs	
11	**Year one module. Practice** Simulation in placement hospital	To have students come to placement hospital to have simulation practice with radiographers in a hospital out of hours. I think this will give the student a better idea of wha''s expected of them on placement.	11
		Syllabus Content	
12	**Year two module. Practice** Adapting your technique	Participants in workshop one wanted diagnostic radiographers to recognise patient individual needs and to be able to adjust their approach to imaging to support patients. What does best practice look like?	10
		Patient Care Skills	
13	**Year two module. Professional Behaviour and Health Psychology** Module content	This module will also include informed consent, capacity, confidentiality, justice, fairness and resource allocation. What else would you like to see being taught in this module?	10
		Patient Needs	
14	**Year two module. Professional Behaviour and Health Psychology** Ethnic minority patients	To have discussed different ethnic minority groups	9
		Patient Needs	
15	**Year two module. Professional Behaviour and Health Psychology** Communicate with a range of patients	This was a common theme in workshop one. Patient groups mentioned included MS, Parkinson, epilepsy, larger patients, patients with learning disabilities and anxious patients. Would you add any further groups?	8
		Patient Needs	
16	**Year three module. Healthy futures** Working with medical students	Shocked that students aren't already engaged in inter professional education at this level. This was a standard throughout my degree course at another academic institution. Gave me a real understanding of the pressures from other professions and how different acronyms meant different things to different professionals. We had large scale lectures with all professionals (paramedic, different nursing specialities, midwifes, radiographers, radiotherapists, social workers etc.) which included smaller classroom session discussions regarding hospital pressures and how each profession would/could fit into the patient pathway based of different scenarios. We did written assignments based on our own professional values and the importance of interprofessional care and working. We had a lecture with a panel of different professionals including my patients talking about their experience.	6
		Interprofessional Learning	
17	**Year three module. Healthy futures** Medical students' involvement	Ensure medical students included in this multi-professional module [sic]	4
		Interprofessional Learning	
18	**Year two module. Practice** Learners need the skills to treat children	In my experience of x-rays with my child, there is a clear need for radiographers to have the skills to perform x-rays and scans on children both in a clinic and on a ward environment. This is less about the actual skills and knowledge to scan and more around the softer skills. My experience is with a Child in hospital and depending on where the child is in their hospital journey (before or after surgery) will depend on the approach needed to be taken due to the child's anxiety and fear. The radiographer needs to show empathy for this and adapt accordingly. This also relates to pain. I think these are essential skills which have both a classroom and a practical element to them.	3
		Patient Needs	
19	**Any other ideas** Placement position in year 3	Students should have more theoretical teaching before embarking on their final placement. As appraisers and professionals we are expected to assess the student's competency to complete a trauma appraisal before they can properly assess an image (should be embodied from first year not just a slap on module AFTER their third year	3

		placement!). Third year students haven't really had any teaching since their 2nd year. They haven't progressed, and are far behind the skills of other academic institutions. I wouldn't hire a UWE student based on the knowledge they demonstrate in the 3rd year –appraisal - no knowledge of common bony pathologies, can't confidently comment on fractures or give an informal red dot comment; really worrying!	
		Syllabus Content	
20	**Year two module. Practice** Marking of appraisals	The current marking system for the appraisal structure needs to be revised in my mind. Currently the marking scheme runs from 0-3 for the majority of criteria, with 3 being for unassisted and with a good degree of competence, 2 for unassisted but lacked proficiency, 1 for required assistance and 0 for failure to complete a part of the required criteria, which results in a zero score or, depending on the criteria, an automatic fail. I believe that this should be revised to a scoring system of 0-5, which would give a better range between the very good, the good and the not so good students. The current pass mark for 1st year students is 80%, with appraisals for 2nd and 3rd years requiring a score of 70% to pass. With the marking system and passing marks as they are, it can mean that students can pass too easily, so separating the wheat from the chaff can be difficult. For reporting courses, a pass mark of 95% is required, and while I wouldn't suggest a score that high be the passing mark, 70% is surely too low. I think expectations should be high, I think we should be aiming to produce the highest quality radiographers we can, and one of the first things to do is raise the bar.	2
		Syllabus Content	
21	**Year three module. Healthy futures** Modality Specialist Module	A module where students are encouraged to ''specialise' in a modality they have a preference towards. i.e. mammography, CT, MRI, NM or ultrasound.	2
		Syllabus Content	
22	**Year two module. Practice**	More focus should be on echocardiograms	1
		Not Applicable	
23	**Year three module. Healthy futures** Leadership	We must lead by example to progress, there must be an element of leadership in the curriculum. Not sure if the current programme incorporates this idea but i' it doesn't then maybe it should. Radiographers meet all walks of life at all times of the day and night, and we are living in a time that is heading towards a pluralistic society (hopefully), having the mentality and confidence of a leader is a quality that should be encouraged.	1
		Syllabus Content	
		Total contributions	**357**

Rank	Theme	Total Contributions
1	**Patients' needs**	112
2	**Syllabus content**	86
3	**Clinical placement logistics**	56
4	**Interprofessional learning**	54
5	**Patient care skills**	48
6	**Not Applicable**	1
	Total contributions	357

7.4 Action cycle three: Qualitative data

As per the critical reflections in chapter six and the curriculum design team request, participants were asked to comment on the following modules. (Detailed explanations of each question can be found in ***appendix* 9**).

1. Year 1 Module: Diagnostic Radiography Clinical Practice 1
2. Year 2 Module: Professional Behaviour and Health Psychology
3. Year 2 Module: Diagnostic Radiography Clinical Practice 2
4. Year 3 Module. Healthy Futures
5. Any other ideas?

General observations from the qualitative data generated by crowdsource three are that four themes had already been identified and discussed in crowdsource one (patient care, syllabus content, clinical placement) and crowdsource two (patient care, patient needs). This indicated that a level of data saturation was achieved across the three crowdsources. However, there were some nuances and new information from these themes which are shared. Also, a new theme was more evident in this crowdsourced data – interprofessional learning. The latter theme reflects how the new year three interprofessional module, 'Healthy Futures', would be administrated as it was a planned shared learning opportunity for all Allied Health Profession learners in the department. One idea (ranked 22nd) was not included in the coding. This contribution referred to diagnostic radiographers undertaking more echocardiogram training Echocardiography is a skilled scanning technique of the heart. A different professional group undertakes training to perform these - cardiac physiologists.

Action cycle one and two themes are presented in the following section order of ranking aligned to the total number of contributions (ideas, comments, and votes) the theme received – ***Table* 12.** Again themes within the thematic maps are presented in grey, categories in green and codes in blue – ***Figures* 28, 29, 30, 31, 32**. In addition, categories and codes already identified in crowdsource one are labelled with a pink rectangular box and crowdsource two are labelled with a yellow rectangular box.

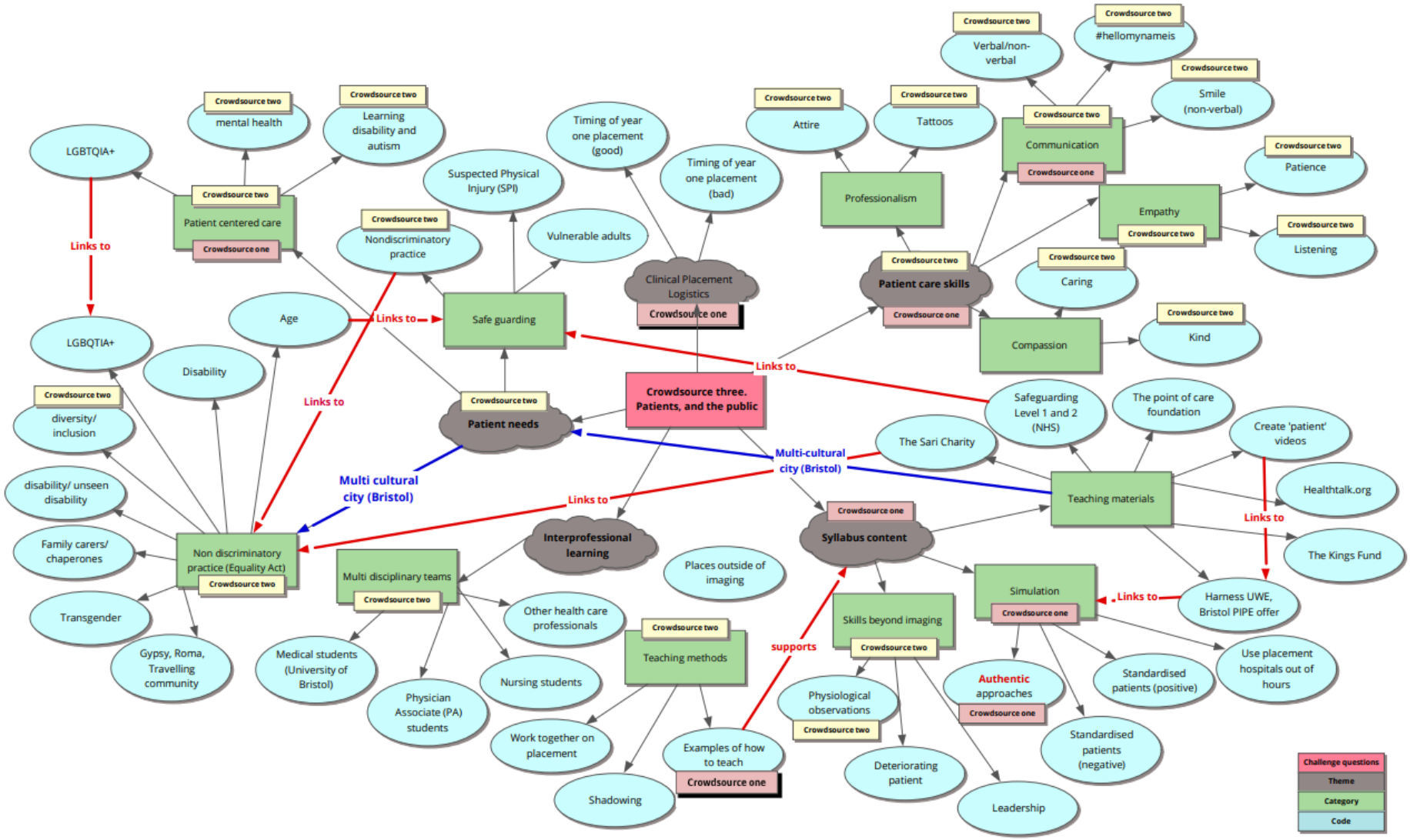


Figure 28. *Crowdsource three (CS3): Qualitative data analysis*

Ranked number one. Patient needs

Patient needs was the highest-ranked theme in the third crowdsource with 112 contributions - ***Figure* 29.** For this theme, three categories were identified: patient-centred care, non-discriminatory practice and safeguarding.

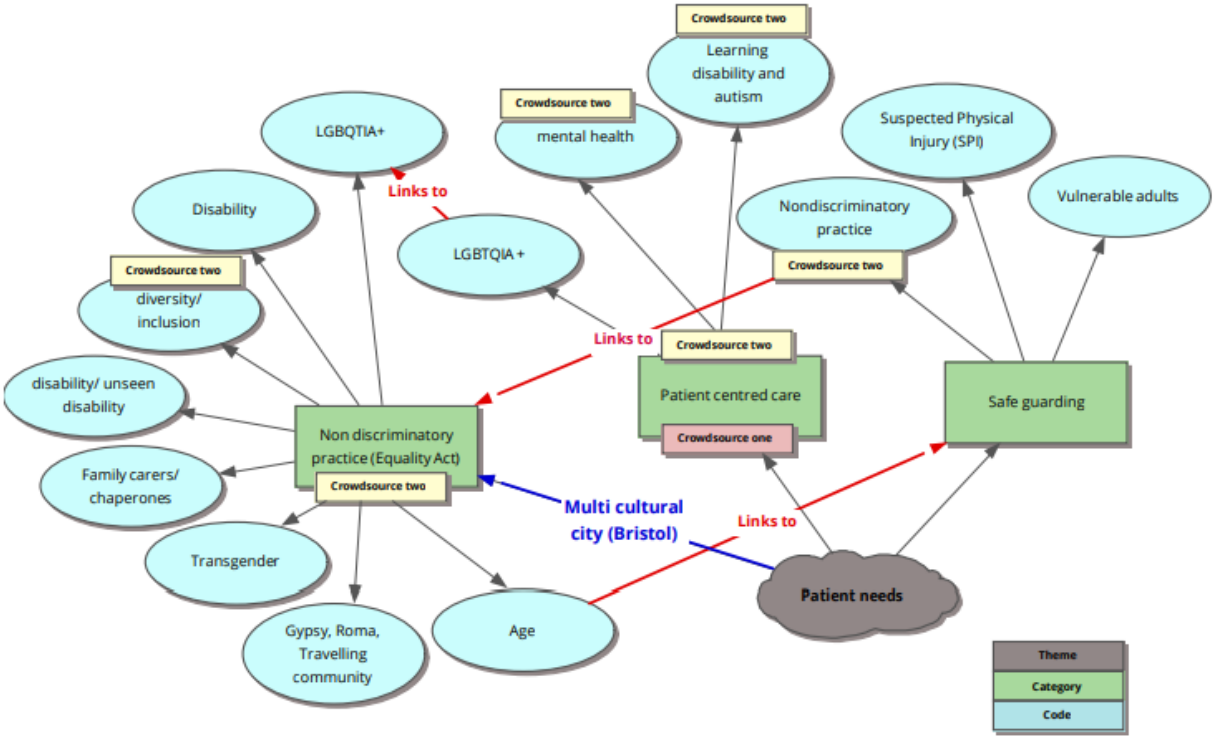


Figure 29. *CS3: Thematic map* 'patient needs' *analysis*

This theme had already been highlighted in crowdsource two; however, there were further details shared in this round. Of note was the non-discriminatory practice category. In previous rounds, the only protected characteristic that participants noted was religion. This category had been widened to include age, the Lesbian, Gay, Bisexual, Transgender, Intersex, Queer or Questioning, and Asexual or Ally (LGBTQIA+) community and disability age, those who act as carers and the Roma gipsy/ travelling community. There was also specific mention of the transgender community, and two contributions made the point that the UWE Bristol diagnostic radiography programme content should reflect the multi-cultural city of Bristol.

"Without impressing students of the 'need' to engage in LGBT, it is a good idea to be aware of the possible interaction situations, especially when engaging transitional people."

As previously discussed in chapter one, given the diversity of the patient's diagnostic radiographers work alongside, this was not surprising. This patient group experience significant inequities when accessing health care, with transgender and non-binary patients at a greater risk of experiencing health disparities due to their specialised health care needs (Bolderston & Ralph, 2016). Since the last UWE Bristol BSc (Hons) Diagnostic Radiography programme validation in 2015, there has been an increase of literature in this area with the subject discipline of radiography (Society of Radiography, 2016; Bolderston & Ralph, 2016; Saunders & Pedersen, 2018; Floyd et al., 2019; Bolderston, 2020). These research papers point to this patient group's negative patient care experiences within imaging and radiotherapy departments.

A review of the literature on the implementation of transgender and gender diverse curricula in medical imaging programmes by Pedersen and Corcoran (2021) identified three areas for consideration. Educators' acknowledgement of the importance and value of adding sexual and gender minority content to healthcare curriculum; educators' lack of a sense of preparedness, experience, and knowledge to teach this content: and lack of resources and institutional support to help develop a curriculum (Pedersen and Corcoran, 2021). There is currently a gap in the UWE Bristol programme for teaching this area; hence the programme team agreed that this topic would be added to the new year two module 'Professional Behaviour and Health Psychology'.

A new category of safeguarding was also identified from the third crowdsource conversation. Alongside students already undertaking mandatory NHS training on safeguarding to attend clinical placement, UWE Bristol also runs an extra-curricular Continuous Professional Development (CPD) day for year three diagnostic radiography students and registered professionals on imaging suspected physical abuse of children (UWE Bristol, 2022b). It was agreed that this extra-curriculum activity would remain in the updated programme.

"I think inclusion of safeguarding is essential, alerting concerns re non-accidental injury is everyone's responsibility. How to raise a safeguarding alert for any vulnerable person."

Alongside themes, categories and codes, the crowd on this occasion also suggested sources of teaching materials the programme team could use. This was offered following a post from myself as moderator for their advice.

"Sari in Bristol run excellent training/understanding including trainers from the LGBTQ community they may be able to help you with teaching materials".

As previously discussed in chapter three, the literature indicates that crowdsourcing teaching materials in this way are already adopted by health professions educators (Bow et al., 2016; Blakewell et al., 2016, Lewis et al., 2017.) The following section explores this further.

Ranked number two. Syllabus content

Syllabus content was the second-ranked theme - ***Figure* 30**.

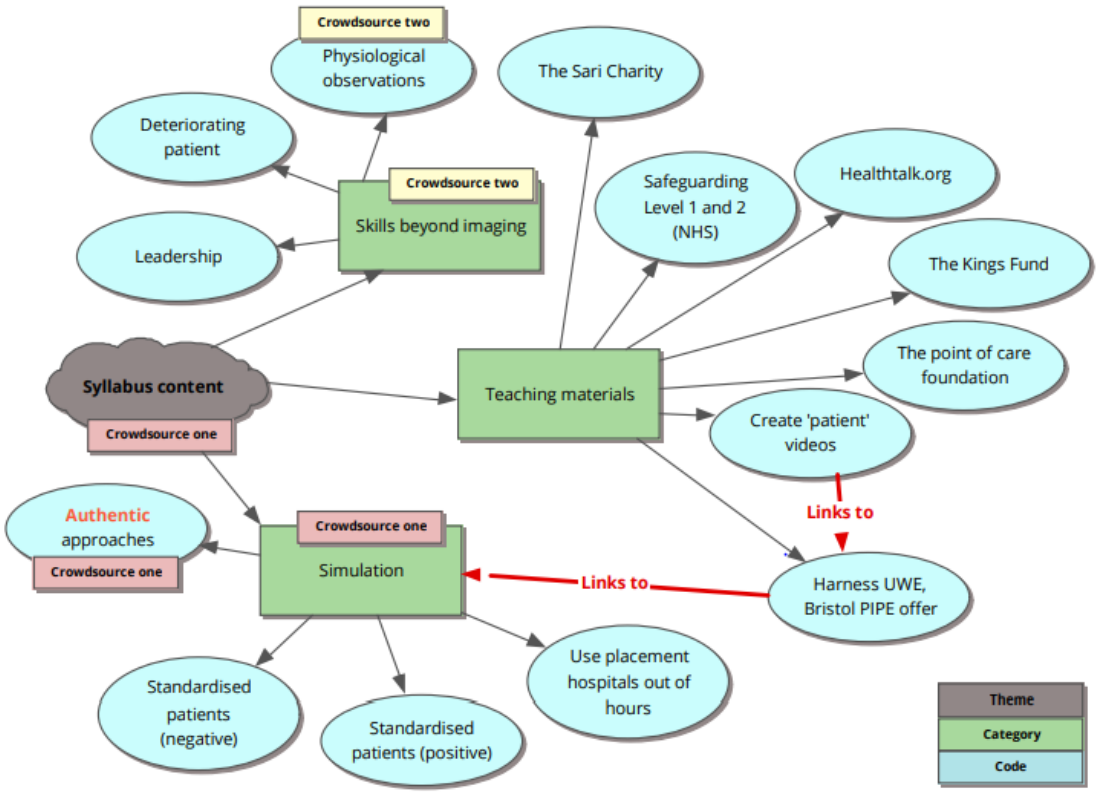


***Figure* 30**. *CS3: Thematic map* 'syllabus content' *analysis*

As was seen in the aforementioned 'patient needs' theme, several categories were reoccurring from previous crowdsources, namely the simulation category

and the skills beyond undertaking a medical image category. Some new codes within these categories are worth noting. One idea shared by the crowd was the use of clinical placement hospitals as places for simulation. I note that as cohort numbers increase, the single x-ray room at the university is getting harder to access; hence this offered an alternative way of increasing capacity. Likewise, the concept of leadership was noted in the 'skills beyond medical imaging' category. Leadership, theory and applied is already incorporated into the new level three "Healthy Futures" module.

Noted at the end of the previous theme discussion, a new category in this theme was the collation of teaching materials that the crowd highlighted. Linking back to the observation by Pedersen and Corcoran (2021) on educators' lack of a sense of preparedness, experience, and knowledge to teach LGBTQIA+, sourcing teaching resources in this manner offers an interesting proposition. The crowd suggested the programme team consider using teaching materials from groups such as 'The point of care foundation'. 'Healthtalk.org', 'The Kings Fund', safeguarding training through the 'e-learning for health pages' alongside working with the Bristol-based 'Sari charity'. These are all resources worthy of further investigation. The crowd also discussed how the current UWE Bristol Patient Public Involvement offer could be harnessed, using patient videos and 'standardised patients' in a simulation setting.

If videos are useful to supplement simulation, are there any 'discussion starters' available through The Point of Care Foundation or the King's Fund?

We must lead by example to progress, there must be an element of leadership in the curriculum. Not sure if the current programme incorporates this idea but if it doesn't then maybe it should.

Ranked number three. Clinical placement logistics

Clinical placement coordination was the highest-ranked single idea, with 56 contributions. Currently, UWE Bristol students do three 14 week block placements, one 14 week block in year one, undertaken in term three following a six-month academic block. Fourteen weeks in year two after Christmas and a further 14 weeks, in September at the start of year three. Approaching the clinical placement offer ensures only one cohort of diagnostic radiography are in the

local hospitals and medical imaging centres at any time, thus maximising the already limited clinical placement capacity available.

There is no set combination of how many weeks/hours students need to complete their degree programme (SoR, 2013a; HCPC, 2017). Nor is there guidance on when these placement blocks should be undertaken within the programme, although it is implicit that they need to support consolidating practical learning. Hence, the pre-registration higher education institute provider decides the placement length of placements. There were mixed views from the crowd on the clinical placement coordination theme.

I think first years would benefit from a short placement much earlier in their studies. Maybe just 2 weeks within the first three months to get the chance to shadow a radiographer and practice very basic skills e.g. upper limb x-rays under close supervision.

I think students should understand the theory before going into the NHS. If this takes 6 months, then that's fine.

Until the students have gained a sound understanding of the theory and technical side of taking x-rays at university, there's no point in them shadowing a busy radiographer too early in the degree. The student won't know what is going on from observation alone and the radiographer won't have time to explain. Placement after 6 months is probably right.

Compared to other students from another university, UWE students are very far behind the skills and knowledge of other universities in this stage of there training (other uni radiography students are confidently performing spinal, abdo, chest and extremities X-rays by Easter)

The current clinical placement model has been used for over ten years at UWE Bristol and works for the clinical placement providers regarding capacity and the local exam and award board timings. Therefore this was one crowdsourcing idea the programme team could not change, so this idea was rejected.

Ranked number four. Interprofessional learning

Interprofessional learning was a new theme not highlighted in the previous two crowdsources – ***Figure* 31**. Of note, participants were asked to comment on the new interprofessional module design in challenge question four, thus a probable reason it was a new theme in the final conversation.

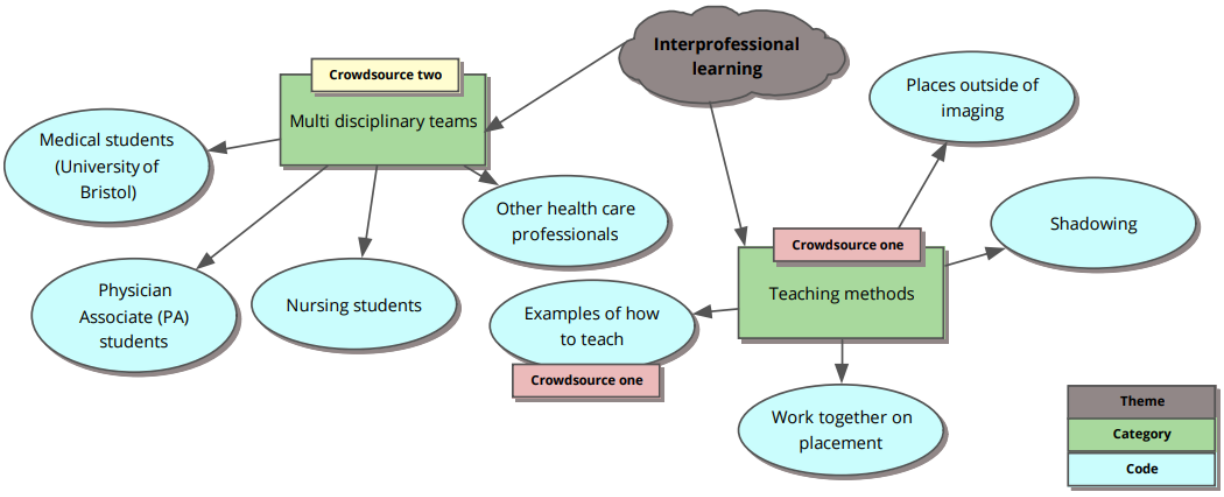


Figure 31. *CS3: Thematic map* 'interprofessional learning' *analysis*

In 2010 the World Health Organisation (WHO, 2010) stated that effective inter-professional learning was vital to the rapid scaling-up of health workforce production. Interprofessional learning is already embedded in the UWE Bristol BSc (Hons) Diagnostic Radiography programme and there is a plethora of literature on this topic in the diagnostic radiography subject discipline (Strudwick & Day, 2014; Holmstrom & Ahonen, 2016; Milburn & Colyer, 2018; Roberts & Goodhand, 2018). Ways of incorporating this in a curriculum include case-based activities, simulated activities, and clinical learning opportunities. A multi-professional case-based approach is used as detailed by one crowd participant for the outcoming UWE Bristol diagnostic radiography programme. Another extra-curriculum opportunity available to radiography learners is the annual major incident simulation provided by the BSc (Hons) Paramedic Science programme (The Guardian, 2019).

We had large scale lectures with all professionals (paramedic, different nursing specialities, midwives, radiographers, radiotherapists, social workers etc.), which included smaller classroom session discussions regarding hospital pressures and how each profession would/could fit into the patient pathway based on different scenarios. In addition, we did written assignments based on our professional values and the importance of interprofessional care and working.

The current UWE Bristol diagnostic radiography offering does not include medical students, and this is a code identified in the comments made by the crowd.

I think an attempt to involve medical students in this module may help to develop a better understanding between all health professional groups as the doctors are making decisions involve input from all [sic].

Although there is no diagnostic radiography literature around the inclusion of medical students, there is research from therapeutic radiography. Alongside Ball et al. (2021) highlighting the advantages of including oncology registrars in their simulation offer. Equally they found that offering equal opportunities for engagement across the professions are challenging to plan, and timetabling issues between the three groups present significant difficulties. This experience was echoed by a participant in crowdsource three who noted that medicine is taught at the University of Bristol and not UWE Bristol.

This has been discussed before but the medical school were not willing. Given the changing landscape and diverse role of radiographers this may now be achievable. Definitely the Physicians Associates could be utilised.

The new module, Healthy Futures, already encompasses five professional groups, so although the programme team noted this was worth exploring with the medical school.

Ranked number five. Patient care skills

The categories for this theme, professionalism, communication, empathy, and compassion, had been previously discussed in crowdsource one and two - ***Figure* 32**. The majority of the categories and codes mapped to crowdsource two. The category relating to communication is also mapped to crowdsource one. As there were no new contributions, there is no further discussion of this theme for this round of crowdsourcing.

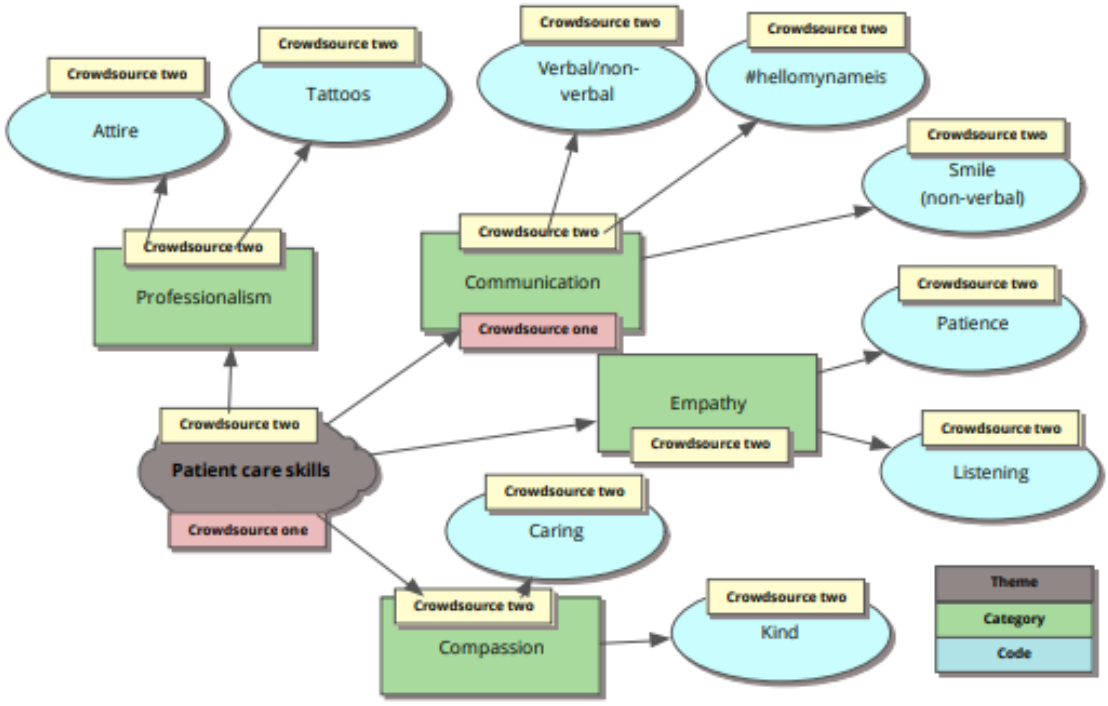


Figure 32. *CS3: Thematic map* 'patient care skills' *analysis*

7.5 Action cycle three: Mapping to the new curriculum

As per action cycles one and two, following the critical evaluation of each theme, the findings were presented to the curriculum design team. The team discussed the findings amongst the group, and a table was drawn up, mapping items in the current curriculum the local diagnostic radiography team would maintain from the 2015 - 2020 curriculum and items under development for the refreshed 2020-2025 curriculum – ***Table* 13**. This third table includes items not identified in the first and second action cycles – ***appendix* 22**. A combined table is available in ***appendix* 23.**

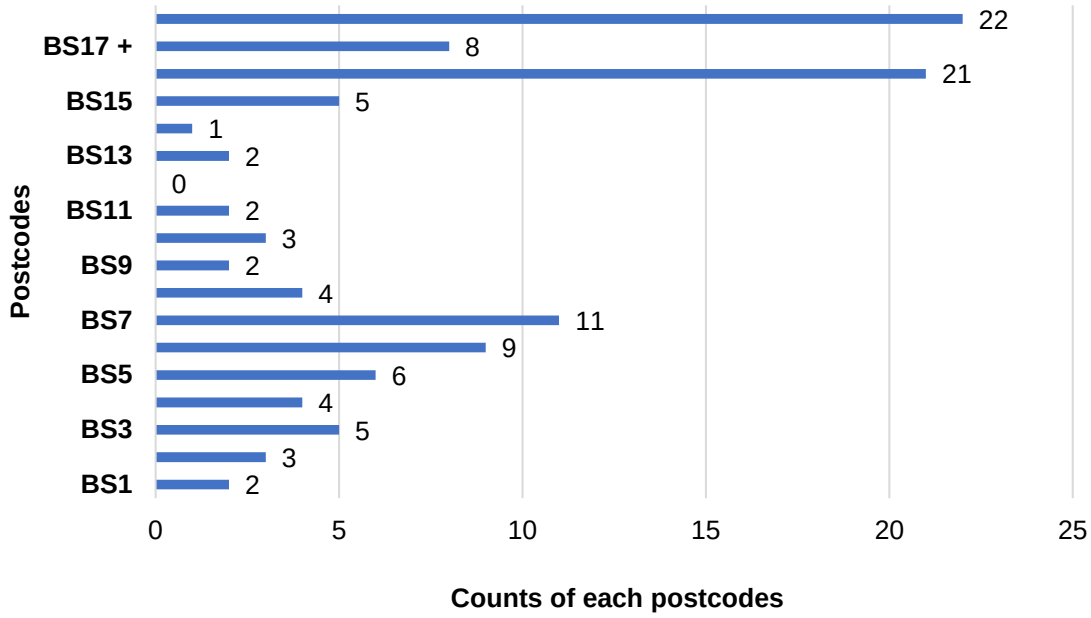
***Table 13**. Crowdsource three. Contributions mapped to the new curriculum*

CROWD SAID THEME	PROGRAMME WILL MAINTAIN	PROGRAMME WILL DEVELOP
Patient Needs	*Extracurricular study day on Suspected Physical Injury (SPI) for year three learners *Annual safeguarding mandatory training modules before attending clinical placement (e-learning for health platform)	*Specific teaching opportunities on supporting the LGBTQIA+ community *Consider teaching and learning opportunities across all the protected characteristics
Syllabus content	No new observations	*Consider accessing local clinical hospital (placement) capacity for simulation using medical imaging equipment *Explore the links shared in the crowdsourcing and how these can be integrated into the programme: Sari, the King's Fund, the point of care foundation, healthtalk.org, e-learning for health safeguarding modules *Working more closely with the UWE Bristol, Patient Public involvement (PIPE Team) *Consider leadership (teaching of) within the curriculum
Clinical placement logistics	*Current positioning of clinical placement within the academic year	No new observations
Interprofessional Learning	*Continue to deliver this opportunity with the other five Allied Health Programmes in the department *Develop teaching and learning opportunities with the UWE Bristol Physician Associate, and nursing programmes	*Explore learning and teaching opportunities with the Medical school at the University of Bristol *Consider what learning together on placement
Patient care skills	No new observations	No new observations

7.6 Action cycles two and three: Combined demographic data

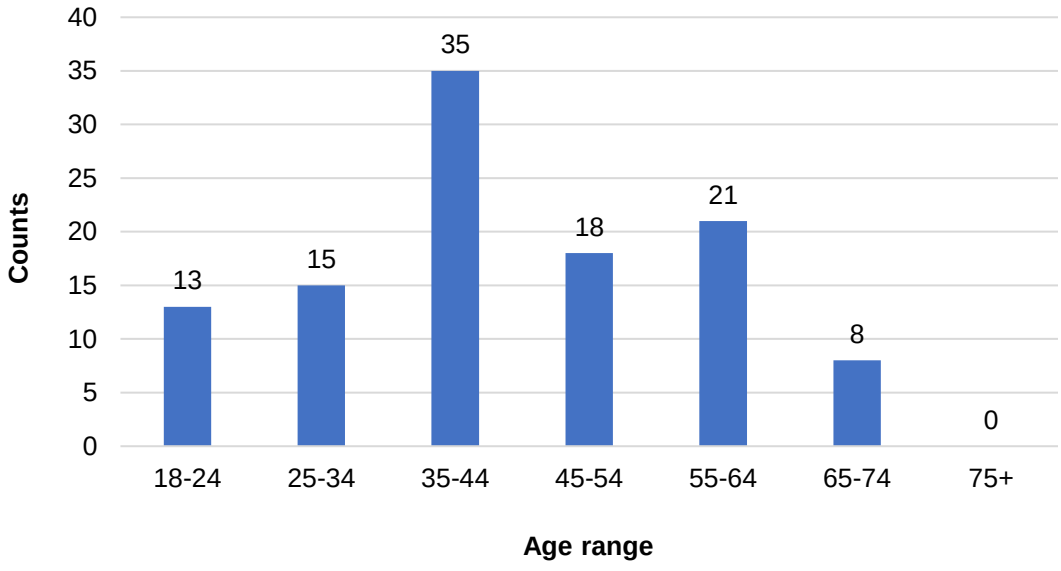
Across the last two conversations, 110 participants registered. The largest number of participants came from outside the BS1 to BS16 postcodes (20%, n=22). No participants registered from the BS12 postcode for crowdsource two or three; however, every other postcode were represented – ***Chart* 17**.

***Chart 17**. Crowdsource two and three: Distribution of postcodes*



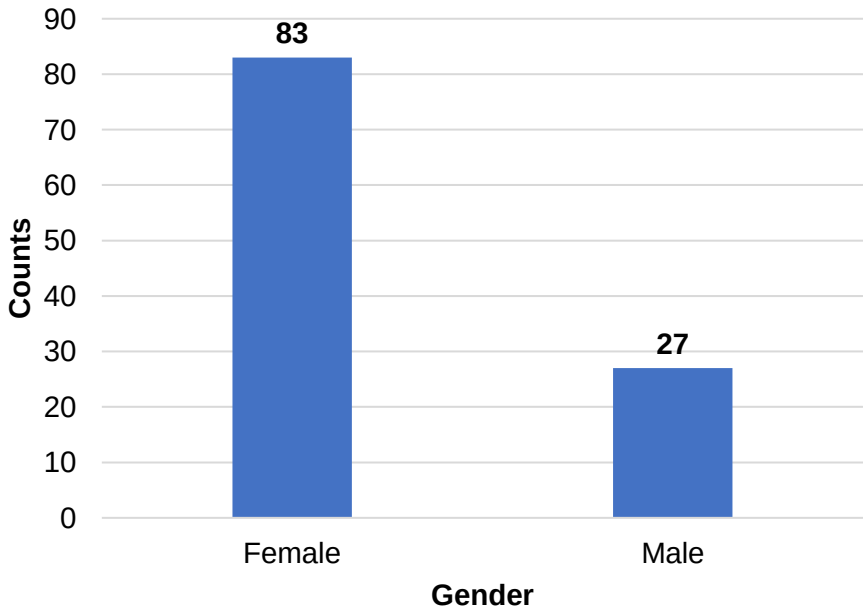
There was no participation by those over 75, and the most active age range was the 35-44 year olds (32%, n=35) – ***Chart* 18**.

***Chart 18.** Crowdsource two and three: Age profiles*



Combining the crowdsource two and three data, the ratio of females to males was 2:1 with 75% of participants registering as female and 25% as male - ***Chart* 19.**

Chart 19. *Crowdsource two and three: Gender profiles*

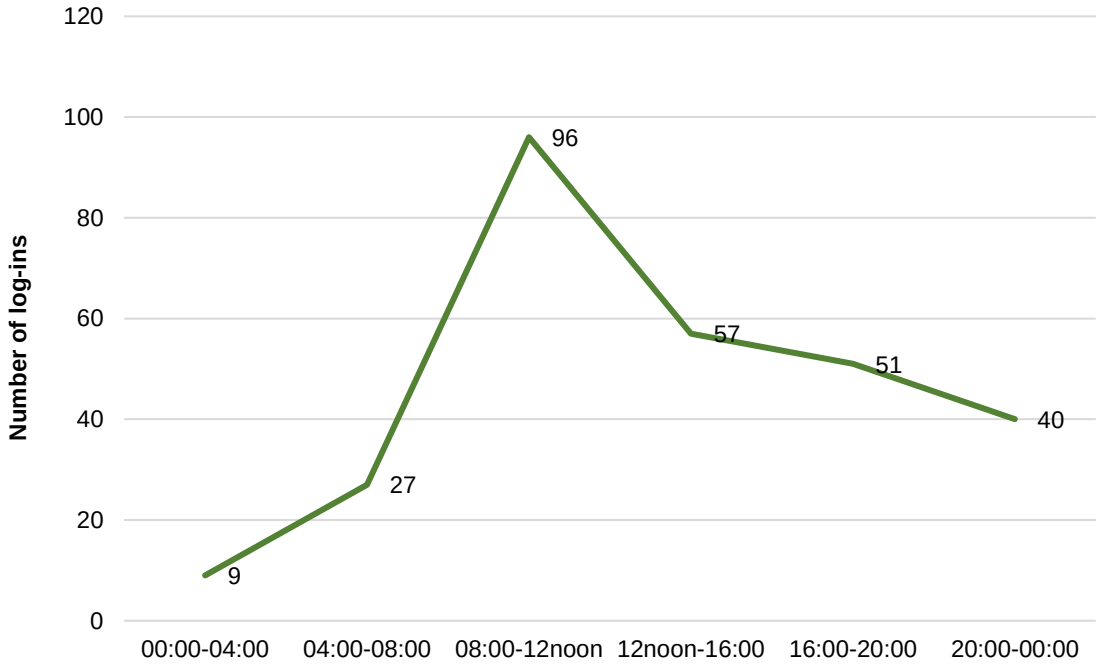


The number of white British/ Welsh/ Scottish/ Northern Irish (72%) engaging was less than the Bristol average (78%). The only ethnicity not registered was Chinese, with participation logged for each of the other ethnicities – ***Table* 14**.

Table 14*. Crowdsource two and three: Ethnicity*

	ETHNICITY	CROWD		BRISTOL
White	English/Welsh/Scottish/Northern Irish/British	79	72%	77.9%
	Gypsy or Irish Traveller	1	0.9%	0.1%
	Irish	2	1.8%	0.9%
	Any other White background	2	1.8%	5.1%
Black	African	2	1.8%	2.8%
	Caribbean	2	1.8%	1.6%
Asian	Chinese	0	0	0.9%
	Bangladeshi	1	0.9%	0.5%
	Indian	1	0.9%	1.5%
	Pakistani	1	0.9%	1.6%
Mixed	Mixed Race	3	2.7%	3.6%
Other	Prefer not to say	2	1.8%	-
	Any other ethnic group	1	0.9%	1.6%
	Blank	13	11%	-
	Grand Total	**110**	100%	100%

Chart 20. *Crowdsource two and three: Login numbers*



Log-ins were noted for each range. The most popular time for log-ins was 08:00 to 12:00 - ***Chart* 20**.

7.7 Action cycle three: Complete cycle questions and adjustments

As per the earlier action cycles, Wadsworth's (2011) complete cycle questions were applied for a final time to this action cycle. Areas considered were:

- Participant recruitment
- Facilitating the crowdsourcing community
- The challenge questions
- The time between each action research cycle
- The combined cycle two and three findings

As per action cycles one and two, I observed what actions I had taken for action cycle three, critically reflected on these actions, and linked these reflections to the literature. As this was the final cycle, adjustments proposed shaped the design principles presented in chapter eight:

1. Identifying the crowdsourcing project team membership and roles
2. Considering the universal design capability of the chosen platform
3. Administrating crowdsourcing as an engagement adjunct
4. Recruiting to the crowdsource
5. ‘Unleashing’ and liberating the crowd
6. Sustaining the crowdsourcing community

Participant recruitment

For this cycle, a further 64 new participants joined the conversation. The majority of contributions came from the 35-44 age group (n=32). When mapped to ethnicity data, white British/ Welsh/ Scottish/ Northern Irish female voices aged 35-44 were the most commonly recorded group (n=22). I predicted this might happen in chapter four, given the focus on a social media recruitment strategy (Ofcom, 2019). Whilst I tried to mitigate a skewed response from this age group by placing adverts in local community newsletters, this did not have the desired impact. A way to address this would be placing recruitment flyers in NHS hospitals, outpatient clinics, GP surgeries and other healthcare settings. Another method of sharing the opportunity would be to connect directly with hospital PPI teams to harness their networks and engagement expertise. Unfortunately, this was not achievable for this research as NHS Research Ethical Approval (NRES) was not sought. Exploring other recruitment methods is something to consider when developing the design principles.

In this action cycle, I introduced a new question to determine if those with health and social care experience joined the conversation. Twenty-nine participants (40%) indicated this was their background. Capturing this data proved my suspicion that health professionals were engaged in the patient, and the public crowdsource. Earlier in action cycle two, citing comments made by Hyde and Hardy (2021), I considered what this meant and argued that health professionals could also be patients, and members of the public, so this exercise could be deemed unnecessary. However, as capturing demographic data is not common in health professions crowdsourcing activities (St. John – Matthews et al., 2020), offering this breakdown added to the knowledge base and explored the idea that crowdsourcing may capture a more diverse voice.

I returned to the methodology and methods chapter to revisit my rationale to run crowdsources with distinct groups (students and patients, and the public) accessing different rounds. Part of the reason was that these groups were not engaged locally in the current diagnostic radiography curriculum design processes. The other reason was because students represented an internal crowd and patients, and the public represented an external crowd. Yet, with 357 contributions, crowdsource three demonstrates that students, internal curriculum stakeholders, patients, and the public can come together in a single place. Given the benefits lens applied to this research, I deduce that the advantage of this would be a decrease in resources as fewer crowdsource rounds would be needed. However, by bringing everyone together, group power dynamics would require consideration. I have expanded on this reflection later in this chapter under the 'areas of future research' section.

Facilitating the crowdsourcing community

My facilitation role was to act as an observer, expert, and discipliner for the first two action cycles (Messner & Raunch, 1995). However, following critically reflecting on action cycle two, I decided to shift this role to stimulate conversation within the crowd through interacting with participants. This change in approach was agreed upon with the ethics teams - ***appendix* 15.** When I set out on this research journey, crowdsourcing was seen mostly as an idea generation tool (Howe, 2006; Brabham, 2013). In idea-generating crowdsourcing, communication during the competition can increase the chances of high-quality submissions as participants may require more information on solving the problem (Zheng, 2014). Adopting two longitudinal experiments, Camacho et al., (2019) showed that moderating feedback stimulated ideators' participation intensity. With regards to gathering responses, negative feedback was better than no response.

Although the crowdsourcing literature acknowledges the delicate balance of moderating crowdsourced activities, there is limited guidance on the how. Thus in action cycle two, I tentatively drew on learning from off-line activities whilst acknowledging that "qualitative methods cannot simply be transposed onto an online setting" (Gregory, 2018, p. 1611). Majchrzak and Malhorta (2020) noted

that crowdsourcing moderation is a fragile process and that *'heavy-handed'* moderation that pushes an agenda or emphasises particular suggestions can lead to a breakdown of the crowdsourcing process. To this end, moderation for cycle three took the form of me adding ideas (n=10) to the five challenge questions before the platform went live to stimulate discussion. These were presented as 'open-ended questions' in ***Table* 12**. This action is explored further in the following section.

The challenge questions

I added ten ideas within the five challenge questions to stimulate the crowd to engage. These ten ideas, outlined in blue in ***Table* 12**, were in the Top 15 voted ideas. Beyond this, I added a further six comments asking participants to expand on contributions they had made. I placed a double asterisk mark (**) by each of these comments to easily identify instances where I had engaged.

*"**Thank you for this information. Just wondering if anyone else has any further thoughts or comments on this topic? We would like to hear from you."*

A future consideration when administrating the crowdsourcing would be rotating the questions. This observation was made across two of the crowdsources (crowdsource one and three), where the first question had the most contributions, and the last question had the least - ***Chart* 21**.

	Q1	Q2	Q3	Q4
Crowdsource 1 contributions	106	76	29	11
Crowdsource 2 contributions	74	25	36	110
Crowdsource 3 contributions	194	84	63	13
TOTALS	**374**	**185**	**128**	**134**

Chart 21. *Contributions mapped to each challenge question*

Considering the time between each action research cycle

The time between crowdsource two and three was two weeks. This time frame contrasted the eight weeks between crowdsource one and two. This decision was pragmatic to ensure the crowdsource supported the last round of local curriculum design meetings before submitting the paperwork to the internal University programme validating committee.

My experience was that this time frame was too short for an individual researcher. Firstly from a practical sense of analysing and reflecting upon the data and presenting this to the curriculum design team for consideration. Secondly, I needed to undertake other tasks, including 'broadcasting' the opportunity, rebuilding the challenge question list, and altering the demographic questionnaire page. I had support from the Clever Together Lab Ltd. team to complete the last two items. As per key learning from previous action cycles, the work commitment needed to broadcast a crowdsourcing activity should not be underestimated. Without a crowd, there is no crowdsource (Keating & Furberg, 2013, Dahlander et al., 2020).

Previously in chapter two, I had alluded to the idea proposed by Brabham (2013) of having 'community management' professionals support the crowdsource when it is live. These are individuals trained explicitly in managing crowdsourced activities. This idea of having specialists overseeing the crowdsourcing was echoed eight years later by Ulbrich and Wedel (2021), who listed eight roles that can support an organisation with crowdsourcing activities. These include a crowd master, a campaign owner, a crowd technology master, a content owner, a secondary counterpart, the crowd, an executive board and an employee union representation. It is important to alert the reader that Ulbrich and Wedel's (2021) work applies to companies crowdsourcing with internal stakeholders. Hence an employee union representative in this instance is justified by the authors. I reflect that having this number of people would allow the delegation of tasks. However, looking through a 'benefits led' lens, it is my impression that this would be a human resource-intensive approach. The proposition of 'community management' is considered in the proposed design principles in the following chapter.

Considerations on viewing the combined cycle two and three data

Referring back to chapter two, where focus groups, nominal group technique, world cafes, and the Delphi method were critically evaluated, there are several areas worth revisiting concerning the perceived advantages of using crowdsourcing for all activities, not just curriculum design processes. Firstly, a disadvantage of the Delphi method is that the experts you start with within

round one need to be the same group of experts you work with throughout the rounds. In other words, no new participants can join as the rounds progress. Equally, experts can leave after each cycle (Helmer - Hirschberg, 1967; Keeney et al., 2011; St. John-Matthews et al., 2017). This potential decrease of participants as rounds progress contrasted with crowdsourcing, whereby participants could join at any time (Howe, 2006). This observation is evidenced in this research, with 64 new participants joining the final crowdsource. However, the ability of new participants to join as rounds progress is already acknowledged as an advantage of crowdsourcing (Brabham, 2013). The findings within this work demonstrates that this statement also applies when the UWE Bristol pre-registration diagnostic radiography curriculum was crowdsourced.

I propose that one of the advantages of new people joining this research would further diversify the participant group. For example, no participants registered as African, Chinese, Indian, Pakistani, or mixed-race were logged in the ethnicity data for crowdsource two. By crowdsource three, the only ethnicity not represented was Chinese. As demographic data is rarely captured for crowdsourcing activities collecting this data adds to the crowdsourcing evidence base. With that noted, I have previously highlighted the challenges of time resources for this work. I, therefore, postulate that having someone as a designated ‘campaign manager’ would allow reactive recruitment for underrepresented demographics as the crowdsource progressed. This tracking would include age groups, gender, ethnicity. It could also incorporate encouraging different stakeholders to engage.

Another advantage previously noted about using crowdsourcing was the ability to engage at a time that suited the participant rather than on a set time and date as per more traditional tools (Schenk & Guittard, 2009). As demonstrated previously in ***Chart 20***, for the two crowdsources accessed by patients, and the public, the most popular log-in time slot was 08:00 am to 12 noon (n=96). On the other hand, the student crowdsource peak log-in times between 16:00 and 20:00 (n=18). Although fewer logins were outside these hours, participants used the full 24-hour clock to engage. A further positive is that the number of

logins for each of the crowdsources was more than the number of participants engaged with the platform – ***Chart 22***.

	Participants	Total logins	Average login/ participant	Total contributions	Average contribute/ participant
CS1	27	83	3.07	222	8.2
CS2	46	147	3.17	245	3.19
CS3	110	131	1.19	357	2.7

Chart 22*. Average login and contributions per participant*

This data indicates that participants may have reflected on reading and logged back into the platform. As discussed in chapter three, this ability to undertake self-paced asynchronous personal mental dialogue before replying is listed by Nicolini et al. (2012) as a crowdsourcing advantage over other traditional methods. However, as demonstrated in crowdsource one, some log-ins can be attributed to a single user (34 logins, 40 contributions) - ***Table* 5**. Hence, crowdsourcing presents a similar challenge to traditional tools - good participant facilitation, so one voice does not dominate.

Having had a group of interested people come together, in this case during the final action cycle of this research (n=64), this raises the question of why might a health professions education curriculum team seek to nurture these new links? First, it is helpful to consider the term community. In its simplest form, community is defined as a group of people living in the same place or having a particular characteristic in common. Broadly speaking for this research, the commonality of this group of people is partaking in a crowdsourcing activity.

Cunningham and Cunningham (2008) offer a helpful typology of communities, placing them under three headings: aesthetic, geographical and communities of interest. Mapped to this explanation, logic suggests that crowdsourced activities represent an aesthetic community, specifically what Bauman (2001) terms a spontaneous community that responds to a one-off issue or event. By their nature, these types of communities are considered temporary. However, Cunningham and Cunningham (2008) continue by highlighting that aesthetic

communities can, in some cases, lead individuals to develop confidence and skills to engage in more substantive community work.

In chapter two, I presented the case for diverse stakeholder voices in all aspects of diagnostic radiography pre-registration programmes, including curriculum design, teaching, assessment, and evaluation. I also outlined that the various stakeholders supporting a curriculum are essential for a UK degree programme such as diagnostic radiography because the four nations are diverse in ethnicity, age ranges, genders, sexual orientations, physical abilities, and faiths. Whilst the UWE Bristol BSc (Hons) Diagnostic Radiography programme mapped well regarding stakeholder input into all activities other than the curriculum design process, it was beyond the scope of this work to explore the diversity of those already engaging. I believe there is an opportunity to support the diverse voices who joined the crowdsource to stay engaged across the whole gamut of the programme delivery. This diversity of ethnicity, age, and gender of those involved in this research has been demonstrated in the demographic data reported in action cycles two and three.

A positionality statement that acknowledges that I have dyslexia is included in chapter nine. This lived experience whilst working with a crowdsourcing platform led me to consider the accessibility of crowdsourcing as a technology tool. As previously mentioned in chapter two, unless in-house crowdsourcing platforms are specifically built for a project, it is common to use commercially available platforms, for example, Amazon MTurk (Amazon, 2020), Clever Together Lab Ltd. (Clever Together, 2020), NHS Horizons (NHS Horizons, 2020) for crowdsourcing projects, as already noted in chapters two and three. Returning to the key crowdsourcing papers and books, I noted that platform accessibility is an underreported area of crowdsourcing literature. Of course, companies that provide digital media have a legal requirement to meet web content accessibility guidelines (WCAG) World Wide Web Consortium (W3C, 2021). However, it is still important to ensure a platform that is accessible and inclusive to all by applying a Universal Design (UD) approach. Developed in 1997, UD has its origins in the built environment and aims to remove the barriers that create undue effort and separation for those with a disability

(Connell et al.,1997). Seven principles connect universal design with digital accessibility, as outlined in ***Figure* 33**. Given that this thesis is based on research in health professions education, UD should not be confused with Universal Design Learning (UDL). UDL is a learner-centred theoretical framework with corresponding principles for pedagogical decisions using inclusive instructional design to reduce barriers to learning and promote success across a range of diverse learners (Kumar & Wideman, 2014; Meyer, Rose & Gordon et al., 2014; Smith et al., 2019).

I acknowledge it is difficult to ensure a single webpage design will work the same across different operating platforms such as Apple and Microsoft alongside different software versions. However, these UD principles offer a helpful starting point of areas that need consideration.

Digital accessibility Universal Design (UD)		**Description**
1	**Equitable use**	Providing an equal way for users to access features, for example, having high contrast, allows those with visual impairment
2	**Flexibility in use**	It allows users choice on how they access and operate websites using different input methods, such as touch, speech, gaze, a mouse or a keyboard
3	**Simple, intuitive use**	Websites are straightforward, with clean layouts, consistent interaction, and precise information.
4	**Perceptible information**	Content is provided in text as well as visually or audibly so that the information is accessible using different senses
5	**Tolerance for error**	Interactions are designed to promote success and minimize risks, for example, by providing confirmations and feedback
6	**Low physical effort**	People can efficiently operate websites using their preferred input device (such as a keyboard)
7	**Size and space for approach and use**	The necessary tools to operate a website interface are visible and readily available

Figure 33*. Universal Design Principles*
Connell et al. (1997)

I have been left contemplating if the crowdsource participants highlighted areas that the curriculum team would have missed if they had only adopted their local design processes. Unfortunately, this cannot be deciphered due to the project design with the crowdsourcing activity running parallel with the traditional curriculum design process. Still, it is worth noting that the programme team embraced a range of crowd suggestions. This hints that the points raised were deemed valid, and many mapped to the current literature on diagnostic radiography curriculum. The areas of future research section in chapter nine examines how this could be explored in further studies.

Based on the above discussion, there are six areas of consideration when drawing up design principles for those seeking to administrate a crowdsource within a health professions curriculum design process. These are:

- Creating a ‘community management team’
- Considering the accessibility of a crowdsourcing platform
- Recruiting to the crowd (internal and external crowd)
- Ensuring all voices are captured
- Facilitating the crowdsource
- Maintaining the community to support programme delivery

7.8 Chapter summary

This chapter concludes the three action cycles whereby findings have been shared and critically evaluated for each cycle. Across the three cycles, I have demonstrated how I improved my understanding and honed my expertise when using crowdsourcing by applying the complete action cycle questions at the end of each crowdsource and cross-referencing this with the relevant literature. All of the observations made, which have evolved through the critical reflections between the three action cycles, will now be used to construct the design principles presented in the following chapter. As this process has been undertaken methodically, the reader can be assured of the trustworthiness of the conclusions drawn.

CHAPTER EIGHT: Discussion and Design Principles

8.1 Chapter introduction

This chapter draws on all previous chapters to propose a set of six design principles for those wishing to use crowdsourcing within health professions curriculum design processes. This was achieved by gathering observations, reviewing relevant literature, and supporting critical reflections from the action cycle one, two, and three complete cycle questions. These principles considered both the crowdsourcing design and the overarching considerations of hosting a curriculum design project.

Before detailing the design principles, I revisit key literature published after the literature review in chapter three was written, alongside considering the impact of Covid-19 on this research. Next, I describe two England wide projects conducted whilst the design principles were created, and I demonstrate how the work shared in this thesis influenced these projects. Although these projects are not linked to curriculum design, they were related to healthcare, and I used them to further improve my understanding of crowdsourcing. These projects, conducted after the data was collected for this thesis, highlighted how crowdsourcing could be applied flexibly in the number of rounds administrated and how findings were validated. Concluding the chapter, the research aim, and objectives are revisited, and consideration is given to how these have been met.

8.2 Discussion: Returning to the crowdsourcing literature

In this section, I discuss three publications I deemed important to the findings presented in this thesis. These have been published after the thesis literature review was undertaken in Autumn 2018, and all relate to crowdsourcing. A note on managing the literature search time-lag between chapter three, composed in Autumn 2018, to submission in Spring 2022 is made later in this chapter.

Crowdsourcing a curriculum

Säily et al. (2020) explored the Finnish national primary school maths curriculum's development via a national crowdsource. Although this crowdsourced activity was conducted in 2014, it was not discovered in the initial literature review for this thesis, as 2020 was the first time the study was published in an academic journal. Furthermore, Säily et al. (2020) noted that access to the documents was not straightforward, and they had to request special permissions to access the Finnish National Agency for Education archives to conduct their work.

Reasons cited by the Finnish government for using crowdsourcing was that it offered a democratic approach and sped up a curriculum design process deemed slow and unreactive, an observation I had made earlier in this work. i.e. viewing crowdsourcing through a 'system lens'. The crowd was listed as teachers, teacher educators, parents, educational researchers, non-governmental organisations, and other citizens. However, I observed no further demographic details, including the total number of people who engaged. As previously highlighted in chapter three, this is not unexpected as detailed demographic information is often not reported in crowdsourcing research, hence why this thesis sought to address this. Säily et al., (2020) found that although the national curriculum design team provided a crowdsourcing opportunity, this process did not succeed as intended. Their work reported that of the 126 ideas presented by the crowd, only a fraction of these were included in the final design documents.

One noticeable difference between the work of Säily et al, (2020) and this thesis is that this research is grounded at a local level. It is possible that the introduction of the National Student Survey (NSS) has conditioned the UWE Bristol BSc (Hons) Diagnostic Radiography programme team to listen to students as consumers. Consequently, the programme team are more open to and more proactive when taking on board their recommendations (NSS, 2021). The NSS is an annual survey of half a million final-year students from across the UK. The survey gathers opinions from students about their time in higher education and asks them to offer feedback on what it has been like to study their course. It was

introduced in 2005 to help inform prospective students' choices and assist universities in enhancing the student experience. As a result, the BSc (Hons) Diagnostic Radiography team has consistently achieved over 92% student satisfaction between 2015 and 2020. Equally, UWE Bristol has consistently ranked in the top 10 universities for student satisfaction (UWE Bristol, 2021). However, I have no empirical evidence for this claim. Although the professional body will seek student feedback when undergoing a programme revalidation, they do not receive feedback directly from students as part of annual programme monitoring activities.

Another salient point is that the NSS question *'overall I am satisfied'* is the single most important student satisfaction measure for HEIs despite the survey consisting of 27 questions. There are variances in UWE Bristol diagnostic radiography student experiences across the other areas of the NSS survey. Of particular note is the low scoring of questions on assessment and feedback. These issues are reflected in the themes noted in crowdsource one, which included academic support, learning environments, syllabus content, assessment and feedback. However, I would argue that using the NSS as a measurement tool on student satisfaction situates students as consumers. A different line of reasoning links the UWE Bristol institutional values described in chapter one. This lens views learners as partners and includes a commitment to involve students in all aspects of their education journey, including the curriculum design process.

The same pattern is seen in this thesis of the UWE Bristol curriculum team actioning ideas and contributions from patients, and the public who partook in crowdsources two and three. This demonstrates that patients, and the public do have influence in shaping a health profession's curriculum, and their lived experience is critical in determining the curriculum. Nevertheless, there were areas that the curriculum team could not change, for example, newly qualified radiographers working as reporting radiographers as this required a change to national policy. Another area was clinical placement timing, as UWE Bristol and local placement providers managed this to maximise placement capacity. Clinical placement is deemed critical to ensuring enough diagnostic radiographers qualify

each year nationally. This is particularly important for this health professions workforce, given the profession is on the Home Office Occupations shortage list (Home Office, 2021).

Within this research, I have demonstrated that this study's findings from a single local UK diagnostic radiography degree programme differ from those from a national primary school maths curriculum design in Finland. I note Säily et al., (2020) concluded that work is needed to understand the power dynamic between the central national maths curriculum design team and how this translates to crowdsourcing's deliberative democratic nature. This shift in use, from an idea-generating tool to a collaborative tool, is something I have previously highlighted as I reflected on my role as a facilitator through the three action cycles of this research. Thus it has been added as an area for further research.

Crowdsourced syllabus

In chapter one, I noted that curriculum is described as a plan for learning that includes a programme aims, intended learning outcomes, syllabus, assessment, and teaching methods which play out as a sequence of learning and experiences organised in a particular way (Tyler, 1949; Walker, 2002; Biggs, & Tang, 2011). Put another way; it is the whole student experience that occurs within an education process. For this research, the syllabus content was a theme identified in two crowdsource rounds (rounds one and three). Here the syllabus was understood to be an overview of the curriculum defining expectations and responsibilities. For both crowdsource rounds, participants offered ideas on what the curriculum should include alongside teaching resources that might be helpful. The latter, sharing potential resources, echoed experiences of Bow et al., 2013; Blackwell et al., 2016 and Lewis et al., 2017, as outlined in the literature review.

Curating the contributions of Twitter™ users via hashtags, McRae (2021) sought to respond to critical questions in real-time through the idea of a crowdsourced syllabus. Their book showed how this approach to developing a syllabus fills the gap in education knowledge by providing access to forgotten and unpopular resources. Case studies included in the book include the

#RapeCulture syllabus, #BlackDisabledWoman syllabus and #NewFacism syllabus, to name a few. McRae (2021) notes that Marcia Chatelain created the first crowdsourced syllabus in 2014, following the fatal police shooting of Michael Brown Jr. in Ferguson, Missouri. In this case study, Twitter™ followers were asked to gather resources to help teach the tragedy in their classroom. The result was a repository of articles, photographs, oral histories, films and reading lists. Those who contributed included teachers, journalists, activists and students. McRae (2021) proposed that crowdsourcing the syllabus would support educators to resist the limitations of their curricula and provide timely and critical responses to emergent situations. Although not the same approach to gathering resources, assembling useful education resources occurred in crowdsource three of this research.

There are some examples of crowdsourcing patient experience in therapeutic radiography via Twitter™, with opportunities for therapeutic radiographers to learn from social media data to improve patients' experience of undergoing radiotherapy. In this work, Meeking (2016) conducted a retrospective qualitative analysis of tweets written by patients receiving radiotherapy treatment for cancer. Twitter™ was queried with the word ‘radiotherapy’, and a purposive subsample of tweets authored primarily by patients was collected over one randomly generated composite month in 2016.

For my study, crowdsourcing was defined using the Estellés-Arolas, & González-Ladrón-de-Guevara (2015) verification tool. Hence crowdsourcing activities using Twitter™ was not captured. Equally, this work directly asked participants to signpost the programme team to teaching materials, as per the approach used by McRae (2021). Nevertheless, given the original concept of crowdsourcing related to gathering information and ideas, collating information using Twitter™ as an adjunct activity, either retrospectively or prospectively, presents an interesting proposition for health professions educators.

Creating crowdsourcing design principles

Design principles for crowdsourcing activities is a term used by Majchrzak and Mahorta (2020). The authors developed ten principles following their research

of 20 crowdsourcing events. They wrote that the reason for developing their principles was to turn something theoretical into a practical offer. The first six design principles consider how to use a crowdsourcing platform to motivate people to share their knowledge, allow for easier knowledge sharing and support the evaluation of knowledge generated. The remaining four principles address how continuous engagement with a crowdsourcing community can be maintained during and after the crowdsourced event.

Creating crowdsourcing design principles is not a new concept, and prior work in this area is not cited by Majchrzak and Mahorta (2020). As demonstrated in chapter three, earlier attempts at developing systems supporting those wishing to deploy crowdsourcing interventions exist. For example, the five-step methodological framework proposed by Keating and Furberg (2013) and the eight-point Estellés Arolas and Gonzaléz-Landron-de-Guevara (2015) crowdsourcing verification tool. This thesis has used the latter to support the delivery of a single crowdsource with three rounds. Although the Estellés Arolas and Gonzaléz-Landron-de-Guevara (2015) verification tool was developed outside the healthcare field, it was the most robustly created verification tool available at the time of undertaking this work. Since completing the data collection, I acknowledge that further work includes the DBAS framework (defining, broadcasting, attracting, and selecting ideas) proposed by Dahlander et al., (2020). Even though the authors cite that the construction of this acronym is inspired by the behavioural theory of firms who view decisions as the critical unit for understanding organisations (Ceyrt & March, 1963), there is no further reporting of how their approach was developed.

The design principles suggested by Majchrzak and Mahorta (2020) differed from previous offers because they set out a list for those wishing to undertake what they term as ‘deliberative crowdsourcing’. This term, deliberative crowdsourcing, is also used by Säily et al., (2020) and Dahlander et al., (2020). This change within the literature on reporting of the capabilities of crowdsourcing marks a pivot away from considering crowdsourcing as an idea-generating only offer designed to pick the best idea to a space where the value

of crowdsourcing for dialogue between participants is viewed and how participants themselves verify the ideas proposed by others considered.

8.3 Impact of a global pandemic on this research

I submitted a 14,000 word professional doctorate portfolio in the summer of 2017. The purpose of this was to support my transition from a postgraduate taught programme to a postgraduate research programme (Swansea University, 2020). This submission contained the thesis protocol, reflective work, risk assessments, and Gantt charts. The risk assessments included everything that I thought may cause a challenge to my studies and how I would mitigate these risks. A global pandemic was not listed. However, by May 2020, the Covid-19 pandemic had infected over 3.5 million people worldwide, with more than 250,000 dying (John Hopkins University, 2020). Although pandemics are classed as a 'low frequency and low controllable event' (Akkermans et al., 2018), I note it has been a highly disruptive and extraordinary event for many researchers. As per Events Systems Theory (Morgeson et al., 2015), the intensity, duration and valence experienced will vary according to individual circumstances (Akkermans et al., 2020). Thus Thomson (2020) wrote that individualised risk management becomes essential for doctoral candidates. They continued by saying that there is a need to decide how long to let things drift and a point where choices need to be made.

Subsequently, at the pandemic's beginning, I revisited my original risk assessment and formulated a pandemic action plan in discussion with my supervisors. For this research, all data collection was completed by November 2019, analysed by March 2020, and data had been incorporated into the new curriculum ready for the professional body (College of Radiographers) and regulator (Health Care Professions Council) revalidation event in April 2020. Hence, I did not need to postpone data collection. The curriculum review event should have happened in April 2020, and my research timeline was pointed to this - ***appendix* 1**. However, by mid-March 2020, the University had closed all campuses, and it was agreed that the external revalidation of the BSc (Hons)

diagnostic radiography would be postponed until February 2021. As the module and programme specifications were not being changed, no further action was deemed necessary for my research as the risk was minimal. Therefore, it was mutually agreed with my supervision team that I would focus my attention on writing up the doctorate. The programme validation was completed by the College of Radiographers and HCPC in February 2021. The validated programme went live in September 2021.

One positive of the pandemic has been the increased availability of published academic literature and books on crowdsourcing, as partially demonstrated in this chapter (Säily et al., 2020; Majchrzak & Malhorta, 2021; Ulbrich et al., 2021; McRae, 2021; Muñoz et al., 2022). This was because during lockdowns face to face research was halted, and researchers had to look at other ways to collect data. Organisations such as NHS Horizons have actively promoted crowdsourcing (NHS Horizons, 2020). There has also been a surge in interest in digital data collection tools in research, including co-design and co-production (Beresford et al., 2021; Williams et al., 2021). Although I note in the Covid-19 co-production in *"Health and Social Care Research, Policy, and Practice Rapid Review*" presented by Williams et al. (2021), no crowdsourcing case studies were included. The authors reasoned that their book focuses on theory and practice that addresses inequalities in power. Whilst there is a lack of research in this area for crowdsourcing, I would argue that this thesis demonstrates that crowdsourcing does meet their other criteria of methods that seek to include excluded perspectives and understandings into the strategic and procedural decision, making the most of everyone's different skills, knowledge, experience, and abilities.

It would be remiss of me not to acknowledge the England-wide crowdsourcing work I have been involved in whilst drafting this thesis. The reason for this comment is that learning from these two projects has further shaped my thinking on the content of the design principles presented later in this chapter. Maintaining my reflective diary writing during each project and applying Wadsworth's (2011) complete cycle questions after each project meant these opportunities were similar to running a fourth and fifth action cycle. This

observation is borne out as each project has been instigated with what O'Leary (2004) describes as improved personal understanding and action implementation based on evaluative practice that alters between actions (projects) due to critical reflection.

8.4 Crowdsourcing projects completed whilst writing up

Between June 2020 and March 2022, I was involved in crowdsourcing projects linked to the Allied Health Professions (AHPs). AHPs include 14 distinct occupations: art therapists, dietitians, dramatherapists, music therapists, occupational therapists, operating department practitioners, orthoptists, osteopaths, paramedics, physiotherapists, podiatrists, prosthetists and orthotists, diagnostic and therapeutic radiographers, and speech and language therapists. There are 190,000 AHPs on the relevant regulator register in England.

Project one. June – September 2020.

Health Education England (HEE) AHP Placement Consultation 2020

The first crowdsourcing project was a consultation commissioned in June 2020 by HEE asking AHP stakeholders to discuss expanding pre-registration programme placement provision. This work represented a national workstream seen as a critical component to increasing graduating AHPs across England. HEE is an arms-length body of the NHS in England, working with partners to plan, recruit, educate and train the health workforce. Sustainable growth in the AHP workforce is an ambition of the NHS Long Term Plan (NHS England, 2019). Yet, historically access to good quality placements has been a barrier to increasing pre-registration training numbers. Generated insights from this project shaped the aims and objectives of the national HEE pre-registration AHP student practice learning programme for 2020/2021. I was recruited as a subject expert in health professions education and crowdsourcing (St. John-Matthews & Hobbs, 2020). This work has also been published in a special COVID-19 edition of the international peer-reviewed open-access "*International*

Journal of Practice-Based Learning in Health and Social Care" (St. John-Matthews et al., 2021).

Due to the ongoing COVID-19 pandemic and the absence of face-to-face activities, crowdsourcing provided an online data collection tool offering stakeholders an opportunity to engage with the placement capacity agenda and share learning. As the work needed to be completed in a tight time frame, a single two week crowdsource was hosted by Clever Together Lab Ltd. This activity ran from the 23rd of June to the 7th of July 2020. In total 1,800 participants made 8,500 contributions (ideas, comments, votes). Most of the participants were based in England (84%). There were also contributions from practitioners in the devolved nations (12%) and internationally (4%). Alongside considering the challenges to placement capacity, several innovative practices developed due to the pandemic were highlighted.

I have taken several learning points from this project to the next crowdsourcing task as part of my personal learning. Firstly, this work considered the co-planning phase. As the results of the work impacted AHP students, a pre-registration physiotherapy student joined the project team. They supported decisions made on the crowdsource design, analysed data, and co-authored the project report (St. John-Matthews & Hobbs, 2020). AHP students across England were also encouraged to contribute to the crowdsource, given their experiences accessing placements. 52 students contributed.

Hosting a single crowdsource presented a challenge on how the analysed crowdsource data would be validated. Thus co-design was realised when eighteen AHP students critically evaluated the findings of the crowdsource via a virtual focus group conducted in August 2021, an idea I put forward to the project team. These students were part of the Council of Deans of Health 150 Leaders programme, which aims to promote and develop future nursing, midwifery and AHP workforce leaders, with pre-registration students accessing the programme (Council of Deans, 2021). This adjunct activity supported the crowdsource. This trend by researchers of using virtual spaces to co-design is

reflected in the rapid review of health and social care co-production during the pandemic presented by Williams et al., (2021).

Recruitment to the crowdsource quickly developed momentum. One explanation for this level of recruitment was that the campaign was picked up by social media active AHPs, who had large followership. They potentially acted as project champions, and it is probable that sharing the opportunity with their networks enabled engagement with a broad audience. To sustain this community of interest, a space was created in the Futures NHS platform (2021). The Futures NHS platform is a collaborative virtual platform that supports people working in health and social care to share information. It has hundreds of diverse types of communities and thousands of virtual workspaces. The 'AHP placement learning exchange' can be found within the 'national AHP virtual hub'. This offered a permanent online space to support the growth and development of this community of practice. When writing this thesis, the AHP placement online community remained active.

A tangible impact of the momentum created by this crowdsourced activity is that clinical practice partners were encouraged to bid for monies to support sustainable placement growth in their areas following the crowdsource. Due to the number of bids submitted to HEE, as a result of the interest generated by the crowdsource, in September 2020, £5.8 million was made available for AHP placements, representing 50% more monies than initially pledged by the Government. This funding supported 4,250 additional AHP pre-registration clinical placements in England for 2021/2022 (HEE Clinical Placement Expansion fund, 2020). The following tweet shared by the HEE Head of Allied Health Professions captures the impact of this work:

"What a triumph out of adversity. An incredible transformational piece of work packed full of student power, and which led to a multi-million £ investment which shifted #AHPPracticeLearning on its axis. Transformational research in action!" (Harden, 2021)

Project two. January 2021- March 2022

NHS England and Improvement (NHS E & I) AHPs Listen project 2021/2022

As noted in chapter two, my research idea was inspired by the development of the Allied Health Professions (AHP) framework and strategy for England 2016/ 2017 – 2021/2022, *'AHPs Into Action'* (NHS England, 2016). It was considered the most comprehensive crowdsourced healthcare policy in northern Europe, capturing input from AHPs, other health professionals, patients, and the public. 1,949 participants from across diverse geographic locations made 16,128 contributions that shaped the document.

In 2020 it was announced that a second updated strategy would be commissioned as mandated in the NHS Long Term Plan (NHS England, 2019, p82). This revised strategy would span 2022 – 2027. Again, stakeholder engagement was identified as critical to the strategy development with a specific commitment to co-create the updated document with patients, and the public. During the thesis write-up, an opportunity to function as the project lead became available via a clinical fellowship role working with the Chief Allied Health Professions Officer (CAHPO) for England. Following a successful recruitment process in December 2020, I started in post.

The project, titled *'AHPs Listen',* was commissioned before the Covid-19 pandemic and therefore was designed to include several regional face-to-face workshops to support the crowdsourcing element. However, as lockdowns in England continued due to the pandemic, the digital platform became critical to collating stakeholders' views. Three areas that required specific focus were: recruitment of patients, and the public to the crowdsource, the platform accessibility and the project team composition. The former two became the centre of interest, as the project was committed to capturing the voice of all those who accessed NHS AHP services. Losing the option to conduct face to face workshops across England presented obstacles to accessing diverse groups. One could argue that the original *'AHPs into Action'* strategy had included patient, and public engagement hence this was just a rerun of the 2015/ 2016 crowdsourcing activity. However, on closer inspection of the total

participant numbers for *'AHPs into Action',* only 26 people of the 1,949 participants identified as non-professionals.

Despite the challenges of moving the project online, 3,200 people engaged with the *'AHPs Listen'* crowdsource*.* 1,200 (37.5%) participants identified as individuals who accessed healthcare, with participants making 21,000 contributions from 500 English postcodes. 17% (n=560) of those contributing were non-white British. There was representation from all NHS pay bands within the NHS. 7.5% (n=240) of participants identified as non-heterosexual, and 10% (n=320) as persons with a disability (Rastrick, 2021).

The *'AHPs Listen'* project team consisted of five people. Two staff members from the office of the CAHPO, two members representing the crowdsource platform supplier (Clever Together Lab Ltd.) and an individual with lived experiences of accessing 24-hour care through a personalised care package. This individual was also a trained NHS England and NHS Improvement (NHSEI) 'Peer Leader' and acted as a critical friend. Of course, the project team could have recruited any person with lived experience, but the 'Peer Leadership Development Programme' aims to develop knowledgeable, skilful, and effective advocates (Future Learn, n.d.) hence our choice. The project was split into three online conversations. The first conversation was with patients, and the public in England, asking them to share how they would like health and social care delivered by the fourteen AHP professions (March 2021). The second conversation was with AHPs to understand how they could support patient, and the public ideas generated in phase one (May 2021). The third (final) conversation involved patients, the public, and professionals challenging the views from the previous two conversations to agree on the themes to be included in the final strategy (July 2021) - ***Figure* 34**.

As the project progressed, the need to run adjunct activities was required to support those potentially digitally excluded. Thus several virtual focus groups were conducted parallel to conversations one and three. One of these was with the NHSEI learning disability and autism group. Another was with the NHSEI Age UK older people sounding board.

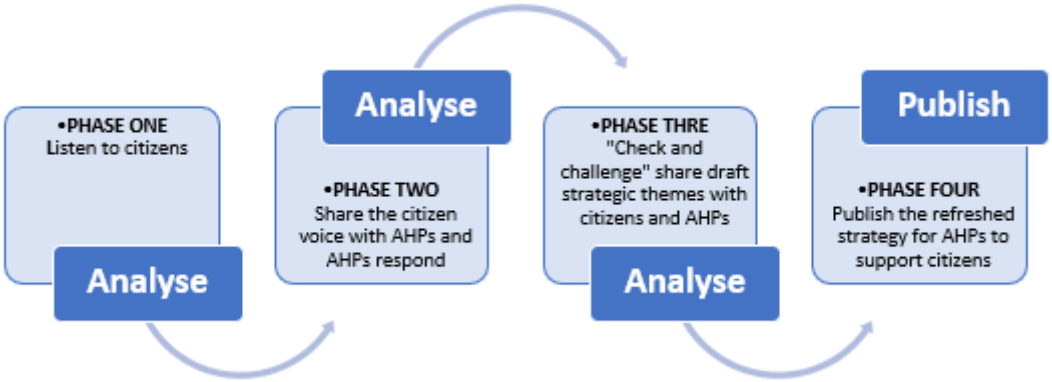


Figure 34. *Different phases of the AHP Listen conversation*

In addition, three workshops were conducted with the organisation 'Working with Everyone' (WE, 2021). These specific workshops included those who were homeless, gipsy Roma and traveller communities, migrants, refugees, people who use drugs (current or former) and those who have experienced the criminal justice system. To support the workshops, the WE team ensured those participating had access to laptops, data and Wi-Fi. These workshops were critical as they ensured those often not included in research could share their views. The identification of these excluded groups is supported by Russell et al. (2020) and discussed in chapter two. However, the marginalised community workshops required further funding and were commissioned separately to the crowdsourced activity.

This project provided an opportunity to operationalise the suggestions made about the accessibility of the platform content. An electronic translator was purchased and piloted on the platform for the third conversation. This ensured that the platform was available in over 50 languages. Of course, electronic translators have their disadvantages, as outlined by Nunes-Viera and O'Sullivan (2021), including not managing the complexity of language and associated cultural tone. Moreover, the unequal development of some languages can further exacerbate inequalities. On the other hand, having an electronic translator is better than having nothing. It is worth considering how translating services could be factored into the project's costings for future crowdsourced activities.

The platform was then reviewed by the NHSEI personalised care strategic co-production group, 20 people with lived and learned experiences of accessing personalised care. This approach meant participants with a range of cultural and social backgrounds considered what the text and images meant to them and how we could then pitch our digital platform to meet the needs of multiple audiences. Recommendations included consideration of font size, formatting of paragraphs and the availability of easy read FAQ and promotional materials, which were all developed. As undertaken in this thesis, a SMOG index review was carried out (McLaughlin, 1969) on the platform to gauge the readability score. Of course, there were noted accessibility challenges even with these changes, hence why the adjunct work was still needed. When writing this thesis, the strategy was being formulated for publication in summer 2022.

8.5 Design principles for crowdsourced health professions curriculum

In chapter one, I noted that a structured and well-facilitated curriculum design process helps educators focus on the task and consider particular curriculum arrangements and pedagogies that best support student learning (Handelzalts et al., 2019). Hence the following section proposes a series of steps to support crowdsourcing in this context, thus addressing research objective three:

> *"...to develop a set of design principles for those who wish to use crowdsourcing in their pre-registration health professions curriculum design processes."*

The following is a presentation of design principles that have emerged from applying the Wadsworth (2011) complete action cycle questions at the end of each crowdsource cycle undertaken for this research. Developed through learning and critical reflections between the three action cycles, they are further supported by the literature on curriculum design presented in chapter one and the healthcare stakeholder engagement literature presented in chapter two. In addition, these design principles represent a new offer to the evidence base as all previous attempts omitted learning from the health professions education sector when they were created, potentially missing the nuances of deliberative

crowdsourcing with stakeholders such as patients, the public, and students. Whilst there are subtle differences in the language used in the literature, including typology, framework, and verification tools, the ultimate goal of the proposed list is to support future crowdsourcers with approaches that can be replicated. Hence the phrasing 'design principles' is adopted. Finally, despite this research being conducted for a diagnostic radiography programme, these design principles could be applied to various health professions programmes. This is because the ethos of stakeholder engagement to include students, patients, and the public holds true for a wide range of health and care education programmes (Rowland et al., 2019) - ***Figure* 35.**

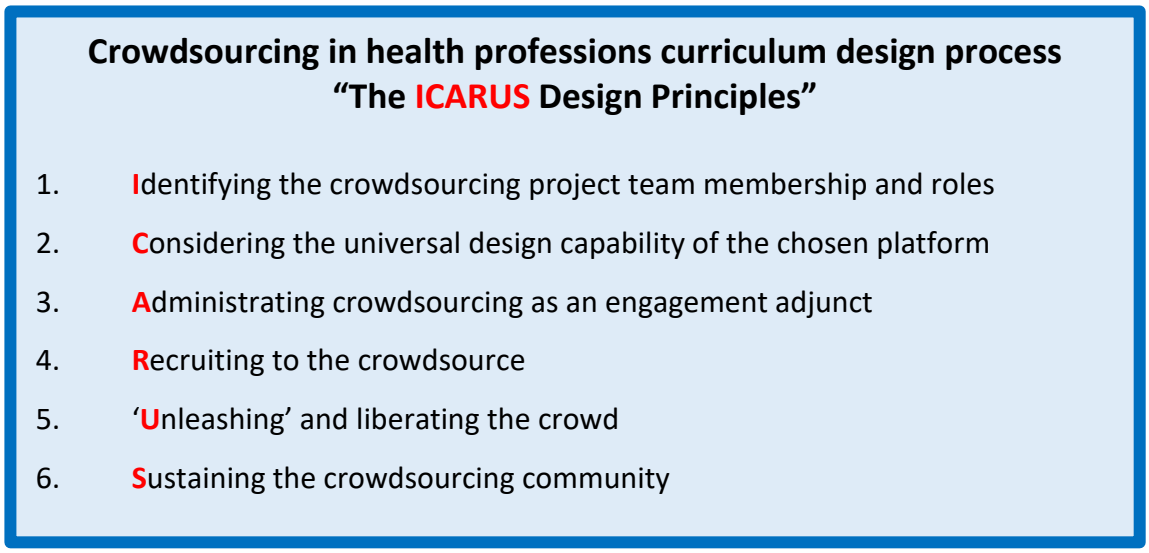


Figure 35. *Crowdsourcing in the healthcare curriculum design process*

These six principles form the acronym **"ICARUS".** Icarus is a figure from Greek mythology who tried to flee the island of Crete with wings constructed of feathers and wax. However, when Icarus flew too near the sun, the wax melted, and he fell, drowning in the sea. The choice of phrase aligns with the ICARUS paradox concept, which states that making optimal use of information technology does not mean using computers for everything. Here Drummond (2009) acknowledged that the most effective organisations are not the ones with the most advanced information systems but the ones that recognise the limits of their IT technology.

DESIGN PRINCIPLE ONE.
Identifying the crowdsourcing project team membership and roles

This principle recommends that a student and a patient representative are members of the health professions education curriculum design oversight project board. The principle is offered for consideration irrespective of the tools used to conduct the consultation process, such as crowdsourcing, focus groups, the Delphi method, global cafes, or the nominal group technique. For example, in chapter two, I acknowledged that at UWE Bristol, an employed patient with lived experience already supported the local curriculum design processes. Accessing a single individual with lived knowledge in diagnostic radiography degree programme development echoed published work by Strudwick and Lloyd-Harvey (2016), who followed the same practice at their HEI. On the other hand, at UWE Bristol, there was limited formal input from students, which is also reflected in the wider HEI literature.

Earlier, I emphasised ‘community management roles’ as Brabham (2013) originally proposed. Work by Ulbrich and Wedel (2021) listed eight roles. My action cycle three critical reflections noted that this might be too many, but my individual experiences indicated that having a sole person undertake this role is difficult. Hence I suggest that a small project team is created to include a patient, a student, two from the internal curriculum design team and one from the crowdsourcing supplier. These roles would be:

- A crowd master and moderator (university programme team)
- A participant recruitment manager (university programme team)
- A crowd technology master (platform provider)
- A subject matter expert (patient)
- A subject matter expert (a student)

This approach was partially implemented in the AHPs Listen project. Overall, this group would also develop messaging that would alert participants to the opportunity and signal the work's purpose and proposed outcomes (Majchrzak & Mahorta, 2020) alongside incorporating the remaining design principles. This

reflects the observations made in action cycles one, two and three on the importance of recruting to the crowdsource. This is also dicussed in design princple four.

DESIGN PRINCIPLE TWO.
Considering the universal design capability of the chosen platform

At the end of cycle three, I drew on personal lived experience and considered the accessibility of commercial crowdsourcing platforms. In particular, I considered the need to ensure platform providers applied a Universal Design (UD) approach (Connell et al., 1997). These are: equitable use; flexibility in use; simple, intuitive use; perceptible information; tolerance for error; low physical effort; size and space for approach and use - ***Figure* 33**.

Overarching this technical factor is the consideration of populations and people who experience digital exclusion and how their 'voices' are captured in a curriculum design process. These excluded populations may include those with learning disabilities and autism, older people, and those under eighteen, to name a few groups. The latter is a group I had highlighted previously in chapter four, given the age to consent to accessing crowdsourcing activities and the extra considerations of engaging under 18s (British Sociological Association, 2017). When hosting crowdsourcing activities, consideration is also needed for those who do not have access to electronic devices, computers, phones, laptops or Wi-Fi. These groups may include the homeless, refugees, those with poor internet connections in rural areas, and those in low socio-economic groups (Muñoz et al., 2022). These are the same group previously highlighted in chapter two that Russell et al., (2020) documented as not being included as part of work in the patient, and public involvement arena within health research. They noted the homogenous demographic of retired white well-educated males within patient participation groups.

Nevertheless, I note that a member of the Irish travelling community engaged with crowdsource three. This is the first time the diagnostic radiography

programme has captured the voice of this community. For these reasons, and as per actions in the two post-data collection projects with HEE and NHSE&I, curriculum design teams should consider using adjunct engagement tools to support their curriculum design activities.

DESIGN PRINCIPLE THREE.
Administrating crowdsourcing as an engagement adjunct

Chapter two considered the positives and negatives of more traditional curriculum design tools, including focus groups, the nominal group technique, world cafes and the Delphi method. This thesis has demonstrated opportunities and challenges in harnessing a digital tool. By collecting participants' demographic data, this research established diversity in terms of age and gender. Although numbers were low, the data highlighted that people did engage from various ethnic groups. Another advantage of crowdsourcing was offering an open-invitation opportunity to all rather than I as a researcher selecting whom I wanted to partake (Schenik & Guittard, 2009). However, as reflected several times in this work, whilst people may have wanted to engage, they may not have access to digital tools or have an internet connection.

Adjunct activity can take several forms (Ludwig et al., 2017). For action cycles, one, two and three findings proposed by participants were mapped to contemporary radiography education literature, national healthcare policy, regulator, and professional body requirements. An alternative opportunity proposed in this chapter was to review Twitter™ conversations relating to the topic under investigation (McRae, 2020). A further example is in the HEE student placement work whereby a virtual focus group was undertaken with students to validate the results from a single crowdsource round (St. John-Matthews et al., 2021). Similarly targeted work with underrepresented communities was conducted in the AHPs Listen project (Rastrick, 2021). Yes, adjunct work could include any traditional design tool, including focus groups, the nominal group technique, world cafes and the Delphi method. However, a virtual offer was the only option in both cases due to Covid-19 restrictions.

Work by Naylor et al. (2022), exploring the experiences of diagnostic radiography students during the Covid-19 pandemic, concluded that administrating focus groups online provides opportunities beyond those requiring a physical presence, flexibility around scheduling and widening geographical participation.

As noted for the NHSE&I AHPs Listen project and design principle two, supporting those accessing a virtual workshop can include providing devices and giving prepaid data access. Whilst virtual focus groups do overcome some traditional face to face activities barriers, crowdsourcing still offers anonymity and the ability to reflect on one's answers and return to the platform later. Hence working with a few engagement tools can widen the net the breadth of recruited stakeholders. As outlined by Shier's (2001) 'pathways to participation, ***Figure* 4**, organisations need to offer and support patients and the public to access these. Equally, as proposed by Tritter and MacCallum (2006), different tools are needed to ensure truly inclusive practice.

DESIGN PRINCIPLE FOUR
Recruiting to the crowdsource

Recruitment to the crowd has two considerations. Firstly, the broad concept of recruitment and the nuances of recruiting an internal and external crowd. In previous crowdsourcing frameworks, recruitment is termed 'broadcasting' or 'priming', and it is listed as a critical step in the crowdsourcing process (Keating & Furberg, 2013; Majchrzak & Mahorta, 2020; Dahlander et al., 2020). For this research, it was a topic that was reflected upon after each action cycle as per research objective one. A reoccurring observation was that recruitment to a crowdsourced activity should not be underestimated. At this juncture, it is helpful to note that although extensive literature on external crowdsourcing exists, internal crowdsourcing is much less researched (Zuchowski et al., 2016; Zhu et al., 2016, Pohlisch, 2020). This point is important as the structural differences between internal and external crowds mean that recruiting is not

always transferable to internal crowds (Pohlisch, 2021). These differences include how to recruit an internal and external crowd.

Gathering input from internal and external stakeholders in crowdsourcing has advantages and disadvantages. Summarising previous observations, internal crowds have implicit knowledge of a particular service or product, which may not be inherent to those external to the organisation Ulbrich and Wedel (2021). This statement was obvious when the students shared their experiences of the current diagnostic radiography curriculum at UWE Bristol. On the other hand, external crowds have not been shaped by organisational values and so maybe braver in the discussions they engage with. When comparing crowdsource one and two, it was evident that the internal crowd (students) and the external crowd (public, and patients) had different views on the curriculum. Equally, they shared a common view on patient care.

When considering learning from this thesis, it is better to run a crowdsource that recruits internal stakeholders of a health and care programme during the academic year, specifically within term time. Whilst this thesis used flyers and the virtual learning environment to raise awareness of the opportunity, this approach can be enhanced further through internal newsletters and workshops (Davis et al., 2015). The fact that year one students on placement only logged in after 16:00 shows the importance of organisations giving people time to engage with curriculum design processes (Ulbrich & Wedel, 2021). Although I acknowledge that crowdsourcing allows 24 hours per day/ seven days per week engagement (Wendelken et al., 2014; Malhotra et al., 2017).

When seeking patient, and public views, crowdsourcers will inevitably look to a crowd external to the provider. I have discussed how a social media-focused recruitment campaign can bias toward capturing the voice of white British/ Scottish/ Welsh/ Northern Irish women aged 35-44. Hence those crowdsourcing should consider other routes, including healthcare settings and traditional media such as newspapers and newsletters.

DESIGN PRINCIPLE FIVE
'Unleashing' and liberating the crowd

Unleashing the crowd is the title of the book by Majchzark and Malhorta (2020) and captures all the activities needed for successful engaging participants who join a crowdsource. For this design principle, 'unleashing the crowd' refers specifically to the challenge questions and crowd moderation.

Writing several challenge questions for the crowdsourcing platform is recommended as breaking the big question, 'what should a new curriculum contain' into smaller supports participant understanding of the task they have been asked to engage with (Piezunja & Dahlander, 2014). Observations from action cycle one and two demonstrated that asking broad, open-ended challenge questions resulted in participants' engagement through the addition of ideas, comments, and votes. Moreover, crowdsource three findings indicated that asking the crowd to comment on new modules within the curriculum was also well received. Finally, care needs to be taken to rotate the questions, as demonstrated in ***Chart* 21**, to ensure that the first questions posted do not receive the majority of the feedback.

Facilitation can be defined as the skill of moving people through meetings, planning sessions, or training, and successfully achieving a specific goal (Efron & Ravid, 2020). A good starting point was to set ground rules for the crowdsource which participants agreed on prior to consenting to joining the platform. It is noted several times when reflecting on the end of each action cycle that moderation needs to be balanced, although it is difficult to locate guidance or literature on how this can be achieved in a crowdsourced activity. There is of course a need to moderate the space to ensure that the ground rules for the task are being abided by to ensure the space remains safe for all those accessing it ***appendix* 12.** As demonstrated in action cycle three moderating through adding ideas to the platform resulted in participants contributing. Likewise, asking participants to identified suitable teaching content also resulted in sourcing teaching materials adopted by the curriculum team.

DESIGN PRINCIPLE SIX
Sustaining the crowdsourcing community

Crowdsourcing may enable us to recruit a diverse voice. However, linking back to previous comments citing Taeihagh (2017), I observed that crowdsourcing is classed as a technology enabler rather than an absolute means of co-production in policy development terms. Thus I suggested that crowdsourcing could fulfil the citizen participation component of Arnstein's (1969) ladder of participation, albeit at rung five, consultation, but it would not fulfil the highest rungs of citizen control. One way to consider co-production in health professions curriculum design and the role crowdsourcing could play would be to look through the lens of co-production proposed by Roper et al. (2018). Here a co-production approach sees stakeholders involved in leading, defining the problem, designing, delivering the solution, and evaluating the outcome, either with professionals or independently. Whilst this co-production model has been developed in a mental health context, the approach that mental health consumers are positioned as knowledge holders and people from whom there is much to learn echoes my standpoint in chapter two. Here I acknowledged the expertise students, patients, and the public brings to the health professions education curriculum design process. In chapters five and six, this was most evident with the emphasis both of these groups put on the patient care aspect of the imaging episode.

In this model, co-production requires longer-term engagement from professionals but leads to 'sustainable change' (Spencer et al., 2013, p.7). All phases need to be developed collaboratively in co-production, including co-planning, co-design, co-delivery, and co-evaluation. In this case, the co-design aspect of curriculum design within crowdsourcing can stand alone as a collaborative activity. However, co-production cannot occur without full collaboration in considering all of these phases. In the beginning, I saw crowdsourcing as a way to support collaborative co-design. However, on undertaking this research, I can see how the community engaged in crowdsourcing can enrich the co-implementation and co-evaluation phases over a curriculum lifespan. In this case, for the five years between a periodic programme validation.

8.6 Revisiting the research question and research objectives

The thesis research question was:

> *"Can a crowdsource be deployed to support stakeholder (student, patient, and public) involvement in pre-registration health professions curriculum design processes?"*

Using a detailed critical reflective analysis approach, across three action cycles, the research question has been attended to through addressing the following research objectives:

Objective one: Explore the design of a crowdsource that supports stakeholder involvement through gathering information on the demographic of those who engage, considering how to grow a community of users, designing the crowdsourcing activities, and facilitating the community*.*

Data on the crowd's diversity has been considered by capturing the demographic data for each action cycle. Chapter four has described how an internal and external crowd was recruited. Using Wadsworth's (2011) complete cycle questions to consider adjustments between each action cycle offered an opportunity to consider how facilitation of the crowd should be undertaken and timelines used to conduct the crowdsourcing process.

Objective two: Establish if the ideas and comments expressed by the crowd are included in the new UWE Bristol BSc (Hons) Diagnostic Radiography curriculum documentation. This includes critically evaluating the ideas proposed by the crowd in the context of relevant radiography and health professions education literature.

The crowd's ideas and comments were coded, categorised, and themed. These were then critically evaluated alongside contemporary radiography and health professions education literature. The relevant ideas were mapped to current curriculum content following this data triangulation. This mapping considered areas of teaching and learning that already existed in the curriculum and

subsequently would remain. The mapping also acknowledged new ideas that would be incorporated moving forwards. Two ideas were not carried forward.

Objective three: Develop a set of design principles for those who wish to use crowdsourcing in their pre-registration health professions curriculum design processes.

Six design principles have been presented. These are based on completing objectives one and two and through further understanding acquired through two England-wide health and care crowdsourcing projects undertaken during the thesis write-up. Some of the proposed design principles overlap established curriculum design practices. The design principles section brings together the research findings and personal critical learning during the research process and write-up to offer an integrated set of principles. Overall the crowdsource was a success as people joined and shared their views on the content to be included in the next BSc (Hons) Diagnostic Radiography programme at UWE Bristol. As a result, many of these ideas were incorporated into the new curriculum. However, there were limitations to the work, and it became evident that there were areas for potential future research. These are considered in the following two sections.

8.7 Limitations of this work

Methodological and method considerations

I was the only person analysing the qualitative data for cycles two and three. This raises the question of the trustworthiness of the findings presented, given that only one coder was used (Walsh & Wigens, 2003). However, my abilities as a coder have been partly addressed through the double 'blind' coding of the first action cycle, which resulted in both coders returning comparable results. Furthermore, written feedback from the PMRMI08 data analysis assignment undertaken at the beginning of the Doctorate programme commented on my excellent ability to analyse secondary data from interview scripts. The thesis

also contains a final reflective chapter that tracks my decisions and how 'critical friend' conversations supported this.

Between crowdsource two and three, I considered how I could 'sense-check' the findings from action cycle two (Efron & Ravid, 2020). This included adding ideas to the four challenge questions and asking participants their thoughts. Since conducting this research and applying my expertise to two national crowdsources, I have used my learning to strengthen this area. For the HEE placement capacity crowdsource, an online member checking focus group with learners was created to check the themes from the crowdsourced data (HEE, 2020). For the national AHP strategy development project, the themes between crowdsource two and three were shared with the final crowdsource participants for their evaluation.

At the time of conducting the research, there was no published work on crowdsourcing a curriculum and, therefore, no indication if, and how many, people would contribute. Hence to gauge the potential size of the crowd in chapter three, I looked at the policy literature (Altamonte & Landemore, 2013; Ginsburg & Elkins, 2014). Here it was noted that the numbers of those participating are not always recorded rather the number of contributions made. For this research, only a small number of students (n=37, 22% of the UWE Bristol diagnostic radiography student body) engaged with the first crowdsource. Small numbers were also recorded for crowdsource two and three (n=110) with patients, and the public from across Bristol. This does raise the question of how representative the findings of this work are to the UWE Bristol student community and the wider Bristol population. Nevertheless, I believe this work to be successful as people chose to engage with the tool, and the demographic data showed a range of ages, genders, ethnicities, and postcodes engaging. Furthermore, some of the recruitment challenges identified in this thesis can be linked to the resources available for this work.

Resources available to conduct the study

The volume of data and the time restrictions for this Doctorate impacted the depth of data analysis possible within the available resource. Of course, all

research has resource limitations, but this was particularly evident in this investigation, especially when compared to the HEE and NHSEI projects I have been involved with after completing the data collection aspect of this work.

There were also specific challenges to using a crowdsource as a data collection tool. Of particular note is marketing the opportunity to a crowd external to the organisation, as explored in chapter four. Engaging those external to an organisation is seen to increase the creative ideas and conversations within a crowdsourcing space. As already noted, Majchrzak and Malhotra (2020) wrote that reaching out to participants beyond those employed by an institution meant those recruited will not already be shaped by the values of the organisation hosting the crowdsource. This differentiation between an internal and external crowd was crucial, as only working with an internal crowd can narrow the crowd's ideas. The critical need to market the opportunity beyond an internal crowd was further supported by work conducted by Dahlander et al., (2020), who stated that broadcasting and attracting a crowd are two of the four key considerations when managing a crowdsourcing activity, alongside defining what the crowdsource is asking, and selecting the most appropriate ideas generated. They suggested that if organisations want to include crowds external to their organisation, they should pay ‘intermediary’ companies with expertise in marketing to fulfil this task

However, I could not harness the internal UWE Bristol marketing team expertise or employ a marketing agency. Hence, I needed to use free methods or those with minimal monetary costs. Consequently, much of the crowdsourcing promotional activity for this research revolved around social media, which as a recruitment tool has been critically evaluated in chapter four. It took time to upskill in social media marketing approaches and administer the associated recruitment activities. While I used several platforms and had a strategic communication plan, ***appendix* 16**, I acknowledge that I am not a social media marketing expert. Moreover, this approach will have excluded communities, including older people and individuals who experience digital access challenges (Ofcom, 2019).

Despite these limitations, the data presented in chapters six and seven demonstrates a range of ages and ethnicities engaging in the project far exceeding what has happened in the current diagnostic radiography curriculum design processes. Whilst my recruitment for action research cycles two and three included an internal crowd of 100 patients and members of the public who already supported teaching, learning and assessment activities at the Faculty of Health and Applied Science. Unfortunately, I did not capture who, if anyone, was new to working with UWE Bristol. Thus, I cannot determine which participants in the crowdsource were new to the organisation. However, I did receive an email from someone with lived experience of a long-term condition who joined the online conversation. They inquired about how they could be involved with student education. This example suggests that some crowd members were external to those employed by UWE Bristol.

Running the crowdsource parallel to the local curriculum design process

As there was no published evidence at the start of the research that crowdsourcing could be used in health professions curriculum design and the literature search confirmed this paucity of research, I could not replace the current evidence-based local university-wide approach to curriculum design processes (Cowie et al., 2015) with my proposed approach. At UWE Bristol, this work activity was overseen by the central Academic Practice Department (ADP) during this research. As an outsider to this part of the organisation, I had little sway on incorporating a new unevidenced approach in our local work. Thus, I had to run the crowdsource parallel with the established processes. Subsequently, a situation arose whereby I became the intermediate between the crowd and the curriculum design group. Earlier in chapter two, I introduced the concept of a bridge to support community engagement (Upward & Taylor, 1995). I saw crowdsourcing as removing this extra layer of the collaboration process. However, I was unable to realise this ambition entirely during this work. Subsequently, the information I passed to the curriculum group, shaded yellow, ***Figure* 15**, needed to be accurate.

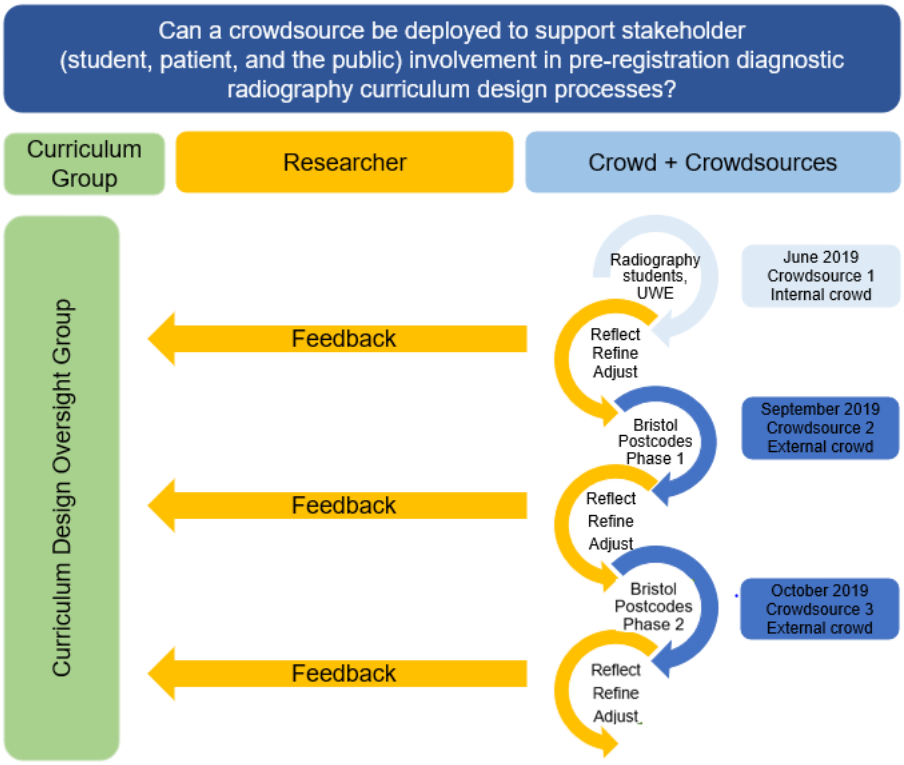


Figure 15. *Overview of the action cycles and crowdsource design*

Again, using critical friends to review my data findings supported me in reflecting on what I thought the data was saying before sharing the crowdsource findings with the diagnostic radiography curriculum design team. As I explored in chapter nine, reflexivity became critical to this aspect of the work, especially the ability to reflect in action as the work progressed, as outlined by Schön (1983). I anticipate that the design principles presented as a result of this work will support organisations to remove the bridge role of the researcher and allow curriculum teams to crowdsource directly.

One option for the research design is to run the crowdsource parallel to the main curriculum design event. From here, it would have been possible to assess the outputs from the crowd and the traditional design processes mapping similarities and differences to assess if using crowdsourcing as a tool would have harnessed different outputs to current local processes and tools.

Presenting the chapters in chronological order

Finally, this part-time doctorate is presented in chronological order. Hence the chapter three literature review was conducted in autumn 2018. This activity was

undertaken before setting out how to complete the research, and ethical approval sought. This process is an accepted approach for qualitative studies where an iterative process to literature review comes from exploring the material as the research progresses (Hart, 2008). Hence, acknowledging this limitation mitigates the risks of missing key literature for the discussions in chapters five, six and seven. In this instance, I revisited literature from summer 2018 to autumn 2021.

I carried out this activity to identify if anything new had been published since conducting the literature review (Efron & Ravid, 2020). This ongoing activity included capturing work that addressed crowdsourcing, diagnostic radiography pre-registration curriculum design and content. I have also reviewed three key publications on crowdsourcing a curriculum, crowdsourced syllabi, and design principles discussed earlier in this chapter. In addition, publishing my findings as the doctorate progressed ensured that outputs from this work were disseminated promptly. Moreover, the published research was date stamped in case others published in the same subject field.

Another change during the write-up of the thesis was that at the end of 2019, the UWE Bristol 2020 strategy (UWE Bristol, 2015) was superseded by the UWE Bristol 2030 strategy (UWE Bristol, 2020). A pertinent point here is that whilst a new strategy was published, the commitment by UWE Bristol for collaboration and community working to support programmes of study remains an institutional value. As already considered, the Covid-19 pandemic, and subsequent lockdowns, meant face to face research had to pause. The consequence of this was a surge in interest in digital data collection tools, and several papers used in this work were published from March 2020 until the submission of this thesis. However, it is worth noting that even at a time of rapid uptake of digital tools in research, crowdsourcing in health professions curriculum design remains a novel piece of work at the time of submission of this thesis.

The final key pending document was the updated College of Radiographers *"Education and Careers Framework"* (Knapp et al., 2021). I would argue that

this would not have been applicable to this work as the programme validation had been agreed against the current framework (SCoR, 2013a). With that said, Knapp et al. (2021) indicated that the new framework would strongly focus on patient care and patient needs as the evidence base in this area continues to develop. This will need to be balanced with technical skills. Other areas emphasised in the upcoming framework are leadership, working across pathways and having skills beyond the task of undertaking medical imaging. These items have been highlighted through the local crowdsourced activities presented in this work, thus offering reassurance that the new curriculum is in keeping with current professional trends and developments.

8.8 Areas for future research

My initial reason for undertaking this research was to explore the potential of crowdsourcing to capture a diverse and inclusive voice in curriculum design processes. In chapter two, I specifically argued the case for capturing the voices of students who undertook the UWE Bristol BSc (Hons) Diagnostic Radiography degree programme and from those patients and the public who experienced imaging from graduates of the programme. Here it was proposed that crowdsourcing could replace established tools already used locally, focus groups and tools used elsewhere, namely global cafes, nominal group techniques and to a lesser extent, the Delphi method. Chapter two noted that traditional tools supporting stakeholder engagement in curriculum design processes might disempower stakeholder engagement. The cause of this disempowerment is because conventional tools are often designed to help the researcher's goal, not the needs of the participants. Furthermore, how these established tools are administrated by allocating set times, connecting in physical spaces, and rigid agendas support the researcher's goal of collecting data that can alienate marginalised groups.

I originally envisaged undertaking this work through what Habermas (1987) describes as a ‘life-world’ lens. However, following reading more on crowdsourcing and curriculum design processes, I decided to take a pragmatic view and research the topic through Habermas' (1987) ‘system lens’. In

chapter three, I explained that this choice was due to the absence of research exploring crowdsourcing in health professions' curriculum design processes. Hence, as Brabham (2014) recommended, it was necessary to grow the evidence base of applying crowdsourcing in the subject discipline of health professionals' education. Furthermore, Habermas (1987) noted that funders, academic researchers, and professionals work in a cost-benefit logic where efficiency, productivity, and utility are the driving forces. As an experienced health professions educator, this point is particularly relevant for a marketised Higher Education industry in England with Universities charging students fees of £9,250 per year. Therefore in the earlier chapters of this thesis, I argued that if crowdsourcing was to replace other more established methods of gathering stakeholder input; it made sense for me to apply a business subject discipline research approach to explore the research question, thus growing the evidence base through the 'systems' lens.

However, I also acknowledged in chapter three that there would be opportunities to view the work through a 'life-world' lens once the research base was established. This type of research would support patient, and public involvement work that is often neglected and is framed by Russel et al. (2020) as viewing the work through a 'social justice' lens. The outputs for this thesis offer a base on which I can build on the 'benefits led' lens on completing this doctorate, which I am keen to explore and develop further.

Investigating power dynamics within the crowdsource conversation and facilitating the online conversations

The following suggestion for future research considers participatory design methods. Participatory design methods aim to involve participants throughout the research process and treat the public, and patients as co-researchers acknowledging the valuable expertise they bring to the research (Light & Akama, 2012). Here, community knowledge is emphasised, and academic knowledge is not primacy (Light et al., 2011).

I could find no published literature that looked at the power dynamic within the crowdsource conversation throughout this research. However, I acknowledge

that a formal systematic literature search on this topic has not been conducted. This finding could be mainly because, and as previously noted, contemporary crowdsourcing research considers crowdsourcing an idea-generating rather than a deliberative tool. Nevertheless, as indicated in chapter six I suspected that some power dynamics were happening during this research; hence I introduced questions to establish if health professions had joined the conversation. This change between action cycles two and three meant that I could gather data to show how many professionals, patients, and the public engaged in the final conversation.

One way to look at power dynamics would be to conduct a discourse analysis of the written content of a crowdsourced activity. This approach would offer a way to explore potential power imbalances within a crowdsource. To realise this, I would need to run a crowdsource with all curriculum stakeholders working together (academic staff, professional services, clinical staff, alumni, employers, students, patients, and the public). Previous work by Meredith et al. (2019) looked at this within a closed mammography Facebook group. Their analysis suggested that moderators need to ensure that potential conflicts of interest are managed appropriately and that all members' views are heard. However, it is worth noting that an advantage of crowdsourcing over Facebook is that everyone in a crowdsourcing space is automatically anonymous. This concept of power imbalances is an essential point as in chapter one, I referred to work by Usher and Farmer (2018) whereby the authors describe the challenges in curriculum design and how even when students and junior staff are invited to contribute to curriculum design, senior academics did not believe they were able to give candid feedback as tools employed to foster collaboration often mean people are identifiable.

At present, little is known about successfully facilitating a crowdsourcing conversation. Brabham (2014) put forward the idea of a new role emerging from crowdsourced activities called community- management professionals. These are individuals employed and trained to manage the crowdsourcing community. They made the point that new technologies create new economies and new economies create new jobs. In addition, they put forward the notion of

needing to develop best practice guidelines and policies on this activity. As observed in chapter seven, this concept of roles when hosting a crowdsource has been expanded to eight by Ulbrich and Wedel (2021), although none of these eight are linked to facilitation. This is a worthy observation as facilitating the crowd was an area I struggled with the most when conducting the action cycles, and I needed to refer to more traditional research on face to face and online internet facilitation. It also connects back to the observation made by Meredith et al. (2019) of how facilitators could mitigate any power imbalances when all stakeholders are together in a single online space.

Investigating if the curriculum changes agreed were actioned

As part of my exploration of crowdsourcing for each of the action cycles one, two and three, I have mapped the suggested ideas from the crowd against what the programme team have agreed to include in the new curriculum. Unlike observations by Säily et al. (2021), I demonstrated that suggestions made by the crowd were included in the updated curriculum paperwork. However, it is quite possible that whilst these changes have been made on paper, they may not be actioned in day-to-day teaching practice. This links back to an observation made in chapter one, where the lack of individual teacher buy-in can mean things get changed on paper within programme and module documentation but not in practice (Brown et al., 2013; Taylor & Znajda, 2015). Hence this is an area worthy of investigation. A retrospective documentary analysis of materials provided within modules and across the programme could be explored by establishing if the agreed items were kept and delivered in the new curriculum. This work could be undertaken after the current first run of the new programme in June 2024. As proposed in design principle six, the original members could co-evaluate this activity crowdsource.

8.9 Chapter summary

This chapter has built on actions cycles one, two and three. The learning from these cycles has resulted in a set of design principles being proposed which contribute to the evidence base on crowdsourcing curriculum. These practical

principles include identifying the key stakeholders to include in the crowdsource conversation, considering the membership of the crowdsourcing project team, crowdsourcing as an adjunct to other engagement activities, accessibility of the platform and sustaining the crowdsourcing community. Whilst these design principles have been written for those wishing to crowdsource a health professions curriculum, they could be used for a variety of crowdsourcing projects which seek to engage a range of healthcare stakeholders. This statement has been realised by demonstrating how these design principles have been applied to the Health Education England placement and the NHS England and Improvement AHP strategy crowdsources, conducted after the data collection for this research.

During writing up this section, it was evident that crowdsourcing is still a rapidly evolving research area and several key publications published after the literature review was conducted, relevant to this work, have been discussed at the beginning of chapter eight. The research limitations explored include methodological considerations and the impact of running the crowdsource parallel to, rather than fully integrated with the current local curriculum design processes. Another limitation was presenting this part-time thesis in chronological order, although mitigating features within the work have been highlighted. Regardless, the use of online data collection tools has been accelerated with the Covid-19 pandemic as researchers rapidly switched to digital, thus strengthening the case for adding crowdsourcing to the available curriculum design tools.

The following chapter, chapter nine, concludes the thesis. Here a reflective commentary is offered that supports the trustworthiness of the findings presented in action cycles one, two and three and the wider research process.

CHAPTER NINE: Reflections, Dissemination and Future Research

9.1 Chapter introduction

Chapter nine is the concluding chapter of this thesis; with the content supported by diaries, I have kept since starting my professional doctorate in October 2015. Therefore, it offers a meta-reflexive critique, thus appreciating how making meaning is part of everyday experience. This section has been included to support the trustworthiness of the findings of this work, of note the confirmability and how I have acknowledged my biases and challenged these throughout the research period. As presented in ***appendix* 18**, reflective entries I have written have loosely adopted the trigger questions 'What? So What? What Next?' to engage with the experiential learning cycle. Moreover, providing reflective commentary evidence how I have developed professionally over time in the context of the theory and paradigm of my profession.

By way of introduction, I share my learning journey, detailing how I reached this career point and how this led to undertaking a professional doctorate. From here, I explore my positionality, acknowledging that this has shifted in the six years whilst undertaking the professional doctorate programme. This narrative is followed by a discussion on the role of reflexivity within action research and how I approached challenging my values and thoughts throughout the research. I achieved this by checking my developing work with critical friends, including my doctorate supervisors, a patient, and the Clever Together team. I then consider my experiences working with action research as a health professions educator, the impact of being an experienced teacher on how I view health professions education, my research and my development, and the risks this familiarity posed to developing an original piece of work.

This account is followed by revisiting the reflection section in the graded 60-credit integrated portfolio submitted in year two of the doctorate programme in May 2017 before moving to the research stage. The portfolio explored what I perceived my doctorate's impact on me, my profession, and my subject

discipline. Re-examining this allowed me to consider how my beliefs, judgements and practices have evolved whilst undertaking this work.

9.2 My learner journey

In chapter one, I introduced the organisation where the research for this thesis was undertaken. In this segment, I focus on myself as the researcher.

My motivation for this research was my deep understanding of the current local curriculum design and review process and how this works. As Fulton et al. (2013) noted, this personal desire to produce new knowledge and novel approaches within the workplace is in keeping with pursuing a professional doctorate. They write that a professional doctorate route is concerned with professional people developing professionally through working in partnership with their employer. I can relate to this as I wanted my research to contribute to my local setting, UWE Bristol, thus bringing about organisational change. The change I wanted to see was improved stakeholder involvement, mainly student, patient, and public involvement in curriculum design processes. Anderson and Jones (2000) also documented a theme of 'personal drive' in their professional education doctoral dissertations research, concluding that practitioners working in educational leadership were motivated by similar reasons. These practitioner-researchers saw research as a way to deepen their practice reflections. In doing so, they could problem solve practice from the inside out.

I deem myself of excellent knowledge and understanding of diagnostic radiography education and curriculum. Since qualifying in 2001 as a diagnostic radiographer, I have been involved in health professions education at various levels in the clinical setting, including teaching undergraduate students and later those new to the field of cross-sectional imaging (computed tomography, CT, and magnetic resonance imaging, MRI). My first formal education role was as a national UK Education and Development Manager for a private imaging company. I had oversight of 400 clinical and 400 non-clinical staff (2008-2010). For this employer, developing the workforce through education was seen as an

enabler to improving patient care. During this time, I designed, developed, and delivered the first graduate training scheme for newly qualified staff in MRI at the company and set up undergraduate learning experiences; the latter was written up as a 20,000-word dissertation towards my master's in medical imaging awarded by Lancaster University in 2010.

I spent eight years working in academia and have held various contracts, associate fixed-term, permanent, part-time, and full time (2010-2012; 2014-2020). First, as a senior lecturer in diagnostic radiography, secondly as the head of the radiography subject cluster alongside developing CPD learning opportunities for all Allied Health Professionals (AHPs). From here, I moved into the role of Academic Director and then Deputy Head of the Department of AHPs at UWE Bristol. During the thesis write-up, I left academia to work as a clinical fellow to the Chief AHP Officer (CAHPO) at NHS England and NHS Improvement to lead the project to develop an AHP strategy for England. My current project has been influenced by the learning and findings of my thesis. I was also awarded a visiting fellow post from UWE Bristol. A visiting fellow is a scholar who visits a host university to teach, develop a knowledge exchange arrangement or perform research on a topic. The visitor is someone the University wishes to work with, and a research group hosts them.

Starting in 2015 and ending in 2020, I represented UWE Bristol at the national Heads of Radiography (HRE) education group, a group representing the voice of most of the 30 providers of diagnostic and therapeutic radiography education across the UK and Ireland. I hold a postgraduate certificate in teaching and learning in Higher Education (HE) and am a Senior Fellow of Advance HE (Advance HE, 2021), having previously held Fellow and Associate Fellow status. I have also been a board member of the British Association of MR radiographers, BAMRR (2016-2018), a voluntary membership organisation committed to improving the skills and knowledge of radiographers working in MRI through the development of national guidelines and educational programmes (BAMRR, 2021).

I have only worked at UWE Bristol during my formal academic career. This observation is critical, as Baumard (1999) stated that being ingrained in an organisation can make you less critical. In other words, my beliefs have potentially been shaped by UWE Bristol and, therefore, may be challenging to alter. For example, Fulton et al. (2012) affirmed that nursing is a profession where there is the challenge of a strong sense of professional identity, driven by values of patient care. As a healthcare professional, this echoes my experiences and how I define myself firstly as a diagnostic radiographer. The same is true for my values as an educator, as my understanding of HE practice has been shaped by my employing organisation. Although I have worked for a private health professions education provider, much of my formative years have been spent at a single Higher Education Institute (HEI). This point was particularly noticeable when writing chapter one when I assumed that the UWE Bristol institutional approach to the curriculum design process was used at other HEIs. It was only through questioning by my supervisors and further reading that I realised that the UWE Bristol Learning 2020 institutional approach to curriculum design was unique to the organisation I worked in, and on the whole institutional-wide approaches to this aspect of Higher Education remain rare (Cleaver et al., 2017).

Whilst employed at UWE Bristol, I have been a team member developing two diagnostic radiography curriculum revalidations: 2010 and 2015. In addition, I have led teams who have co-designed individual postgraduate modules, including a postgraduate certificate in Specialist Practice (CT). However, my employment history demonstrates that some of my experience has involved working beyond my professional silo. Put another way, I have stepped out of my professional grouping, diagnostic radiography and worked on other projects and with other teams. For example, in 2015, I was the project lead for developing a local MSc. Physician Associate Studies (UWE Bristol, 2015) programme. Thus, I have experience setting up a new programme of an emerging profession in the UK (Lawrence et al., 2017). For this research, due to my role within the department at the time, I was not directly involved with the curriculum review for the 2020 BSc (Hons) Diagnostic Radiography degree. Instead, I worked with the associate head of the department for quality across

all five programmes being validated: diagnostic radiography, therapeutic radiography, physiotherapy, occupational therapy, and sports rehabilitation. Thus, my role within the local curriculum design process between 2015 and 2020 has shifted from ‘insider’ to ‘outsider within’ (Herr & Anderson, 2015).

9.3 Positionality and reflexivity

Exploring researcher positionality is essential in all qualitative research, but a central dilemma unique to action researchers is their relationships to their setting and participants (Herr & Anderson, 2015). Furthermore, with professional doctorate research, the researcher and practitioner are often the same. Added to this is the need for researchers who use crowdsourcing as a digital data collection tool to consider their relationship with the crowd, tasks, and platform (Eklund et al., 2019). Hence it was essential for me to acknowledge my unique positionality and the impact this has had on all aspects and stages of this research process. Foote and Bartell (2011) identified that the personal experiences shaped by my positionality might influence what I brought to this research, my choice of processes, and my interpretation of outcomes. Subsequently, Holmes (2020) wrote that positionality could affect the totality of the research process.

To ensure this research recognised potential biases due to my previous work history, the following positionality statement was devised to anchor this work:

I am a white Irish, working-now-middle class, able-bodied, female with dyslexia who is a UK registered diagnostic radiographer. I am the first person in my family to undertake Doctoral studies. I have held various paid and unpaid roles throughout this research, starting in academia then leaving academia to work in healthcare policy development. I have a strong sense of fairness and equity.

However, these five lines did not truly highlight who I am, and parts of this identity evolved during the research process. For example, because of Brexit in August 2020, I applied for and gained British citizenship (via descent) and achieved dual Irish/ British citizenship status. This life event made me revisit the expression of ‘citizen’ when considering stakeholders as described in chapter two expressly how the term ‘citizen’ excludes those who live in but are

not citizens of a country. Ultimately, I considered how this language impacts involvement by marginalised ethnic minorities and refugee groups within a democratic society (Oliver & Pitt, 2013). Applying a wider lens also forced me to consider the nuances of the different phrasing used to describe those we care for i.e. patients, public, service users, citizens, and clients. For example, in the UK, there are four ways of gaining citizenship: birth, descent, registration, or naturalisation. The latter two involve a citizenship test. Furthermore, citizenship through naturalisation or registration, unlike citizenship through birth or descent, can be revoked by the Government.

There were multiple ways I could consider my position within this research (Collins, 1990; Cochran et al., 1993; Smith & Lytle, 1993; Villenas, 1996; Anderson & Herr, 1999; Anderson & Jones, 2000; Willinsky, 2000). The continuum of positionality described by Anderson and Jones (2000) following numerous action research studies appealed as it recognised that this state of being could change during the research process. This perspective was vital for me as a part-time doctorate candidate on a six-year programme of study, with the idea of a continuum acknowledging that my positioning might alter over the research life cycle. Here six positions are described:

1. Insider: researcher studies own self/ practice
2. An insider in collaboration with other insiders
3. An insider in collaboration with outsiders
4. Collaboration: insider and outsider teams
5. Outsider in collaboration with insiders
6. Outsider studies insiders

I initially anchored myself at point three, and I would be an insider working with outsiders. My work sought to increase a knowledge base, improve practice, and transform the organisation's curriculum design process. However, taking this approach to positionality raised unique issues regarding how knowledge claims would be justified and how power and control over the research process would be distributed. Furthermore, while I started this research as an insider to the educational institute and was a member of the diagnostic radiography teaching

team, within three years, I was promoted to the cluster head for the radiography programmes, to the academic director and finally deputy head of department. These promotions meant I went from an insider to an outsider to the curriculum design group and position five. These multiple positions brought conflicting allegiances within the research site and much complexity (Collins, 1990).

Nevertheless, as has been a common thread in this work, I needed to be cautious that I did not simply pretend I was a true outsider to this work, thus drawing on the validity criteria for more traditional research designed for non-participatory outsiders. Taking this stance fails to address the unique dilemmas of practitioners studying at their sites as an ‘outsider within’. Herr and Anderson (2015) wrote that neglecting to acknowledge this can lead researchers to avoid the level of self-reflection needed for good practitioner research, demonstrating the study's trustworthiness. Additionally, the more we understand the intricacy of the situation, the more likely research will create professional and organisational learning and generate new understanding. Hence, given the complexities listed and how these could influence the research process, Muhammad (2015) acknowledged that positionality must be subject to an intuitive process. This process has been achieved through analysing the decision making throughout the research linking theory to practice. Taking the time to analyse and evaluate critically allowed refocusing, thus supporting the generation of new knowledge and ideas (Jasper, 2013).

Reflexivity relates to how a researcher's positionality may influence the research design, execution, and interpretation of the data generated (Greenbank, 2003). Reflexivity was essential in this work, given the action research approach and crowdsourcing as a data collection tool. I have been a diagnostic radiographer and health professions educator for some time, which challenges applying a critical lens to my work. Baumard (1999) described the challenge as territorialised embedded in a profession or organisation. They describe how professionals who study doctorates later in their professional lives will have created a cognitive map of their work context. This lived experience can produce a barrier to creating new knowledge in a different setting. Linked to

this is professional identity, defined as the constellation of attributes, beliefs, values, motives, and experiences (Schein & Edgar, 1978). Watts (2009) concurred, stating that the greater the territorialisation of knowledge and the stronger the sense of professional identity in doctoral candidates, the less likely it is that fresh approaches to thinking and problem-solving are created.

In acknowledgement and alongside the positionality statement acting as an anchoring point, I kept diaries of my experiences and observations I made as the research progressed. A sample diary entry is located in ***appendix* 18.** This approach established how my feelings and values might impact the research findings. On writing the reflections, I contemplated my interpretation of the diary posts made. I acknowledge that it was sometimes challenging to keep up with writing regularly due to full-time work and part-time study pressures. As Koshy et al. (2011) noted, I tended to stop writing when my research was not going well. However, persevering and using the diaries proved helpful in constructing the write-up.

9.4 Sense checking

Even if a doctoral candidate practises reflexivity and contextualises their positionality, it does not mean that the research is necessarily more truthful or honest. For example, Luft and Ingham (1955) highlighted that there are always areas of ourselves we are not aware of, and only other people can see those areas. Therefore, my diary entries were used in monthly supervision meetings with my supervisors and external research advisor.

McGuire (1987) suggests seeking thesis supervisors versed in action research. Unfortunately, this approach was impossible with the professional doctorate programme at Swansea University Medical School (SUMs), as supervisors were pre-determined on entry to the programme. Furthermore, the exact research question and the methodology to be applied were not confirmed on admission to the programme. The reason was that the development of the research question and method was part of the professional doctorate process.

However, the allocated supervisors were willing and open to working with me through the research. Herr and Anderson (2015) noted that action research is an untidy, unpredictable process, and a crucial part of the inquiry is a recording of decisions made throughout the untidiness. I found sharing my thoughts, decisions and work arduous at first, as this placed me in a vulnerable position and made me feel like myself and my work was being judged. However, I overcame this with regular monthly meetings and email dialogue.

As I participated in the research process at several levels and in various roles through the lifespan of the work, I needed to utilise critical friends (Andersen & Jones, 2017) because they provided another avenue to challenge observations made. These included the industry partners who owned the crowdsourcing technology, Clever Together Lab Ltd and the 'expert with lived experience' employed in my local faculty, mentioned in chapter two. Both groups would pose questions regarding my 'knowing'. Through regular meetings, responses from these critical friends on my thinking and writing helped move the work forward, revealing flaws in my arguments as the piece evolved (McNiff & Whitehead, 2009). These individuals pushed me to another level of understanding of the validity of my evidence and research claims. They achieved this by asking me to make explicit what they understood on a tacit level (Herr & Anderson, 2015).

One of many examples of the value of this input is the Clever Together team helping my understanding of where crowdsourcing fits in the co-production continuum. I learned that crowdsourcing has historically been an idea generation tool by researching the background chapter. Here I looked to the policy design literature citing Taeihagh (2017), who mapped crowdsourcing literature to Hood's NATO (1983) model and reinforced this viewpoint stating that the tool probably only achieved step five on Arnstein's ladder of participation (1969) - ***Figure* 3**. Yet working with the Clever Together platform, it was apparent that their tool was more collaborative in its approach, although it did not fit all the criteria for co-production. Hence the Clever Together team encouraged me to consider stakeholder engagement literature, current literature on crowdsourcing and future applications beyond idea generation. It

was not until the publication of work by Majchrzak and Malhotra (2020) that there was literature on the collaborative possibilities; however, working with Clever Together meant that I was already considering how this would look for the proposed thesis design principles. The publication of this book also brought into sharp focus how crowdsourcing was developing at pace and the need to keep up to date with this evolving field.

I applied other measures to ensure I was continually challenged to think about my actions. Eighteen months into the research, Dr Leslie Robinson accepted an invitation to join my research team. As an experienced diagnostic radiography educator who had also completed an educational doctorate (EdD), I knew Dr. Robinson would complement my doctorate supervisory team. Dr. Robinson had completed several projects within radiography relating to patient public practitioner involvement (SCoR, 2018) and the use of digital spaces to support this activity (Galpin et al., 2017, Robinson et al., 2019). Of particular note is the award-winning Word-of-Mouth Mammogram e-Network (WoMMeN) project, a network that operates out of several universities and health organisations to promote information about mammograms to local communities using Facebook. Dr. Robinson is also a fellow of the College of Radiographers in recognition of various workstreams, including championing patient, and public involvement in the field of radiography. Dr. Robinson's involvement as a member of my supervisory team further enhanced the credibility and trustworthiness of the research, as I was further challenged to view my work through several lenses.

I ensured that areas of my work were presented to external audiences through presentations and peer-reviewed articles as the doctorate work progressed. I would get defensive of peer-reviewed feedback. However, I began to find the process offered critical constructive feedback and soon saw this as an opportunity to listen and learn (McNiff & Whitehead, 2009). With that said, I did not always agree with the reviewers, especially in instances where they requested that the papers being reviewed use more qualitative method criteria approaches and checklists when demonstrating the rigour of the crowdsource undertaken. In the feedback for one paper, a reviewer noted that whilst

crowdsourcing data is different from interviewing or focus group data, they still wanted to apply traditional criteria to demonstrate the rigour of the work. In this case, the reviewer suggested adopting the consolidated criteria for reporting qualitative research (COREQ), a 32-item checklist for interviews and focus groups (Tong et al., 2007) to support the trustworthiness of the data presented. As the lead author, my response was that whilst the writing team agreed a checklist would strengthen the work, using traditional criteria from interviewing and focus groups would miss the nuances linked to crowdsourcing. Therefore, we proposed including the eight-point crowdsourcing verification tool used in this thesis (Estellés-Arolas & Gonzaléz-Ladrón-de-Guevara, 2015). To use this approach, we restructured the methods section and noted that this approach to write-up, which incorporated the verification tool, had been previously accepted by the peer-reviewed international journal 'Radiography' (St. John-Matthews et al., 2020).

Another feedback episode worth noting is publishing the first action cycle as a single stand-alone journal article (St. John-Matthews et al., 2020). Feedback on this occasion related to the paper's flow, and the results and discussion merged into a single section. The reviewers wanted these separated. Ponterotto and Greiger (2007) acknowledge that a significant challenge in preparing qualitative research studies for publication is the mandated structure and length of submitted manuscripts. I also note that adding quotations to illustrate points made staying within set word counts difficult. Hence, Ponterotto and Greiger (2007) suggest combining the results and discussion section to support the fluidity of a piece. In reply to the reviewers, I highlighted this viewpoint and how writing in this way would ensure the report was succinct given the 4000-word limit for the journal. This comment led me to consider how an action research thesis would need to be constructed to highlight the iterative process between the three action cycles. Thus the nine-chapter thesis layout I have presented emerged from learning on this occasion whereby I considered how I would navigate a reader through a three-action cycle piece of work on a new data collection tool.

9.5 Finding my community of practice

At the beginning of my doctorate, I found it difficult to frame my research using traditional established research paradigms such as positivism and constructivism. I was particularly conscious of this when articulating my work within my professional field of diagnostic radiography and my workplace of AHPs. A literature search suggests limited research using action research within the subject field of diagnostic radiography. Support for this observation comes from a paper by Metsälä and Fridell (2018). Their review aimed to give an insight into radiography as a discipline from the viewpoints of the methodological approaches adopted. Through reviewing articles published in the journal *'Radiography'* and the *'Journal of Clinical Radiography and Radiotherapy'*, Metsälä and Fridell (2018) identified and reviewed 198 papers. Two of these used action research. The lack of action research in the radiography literature is despite Munn et al. (2013) highlighting the value of adopting this approach within the profession.

To my knowledge, only one other doctorate has been written using this methodology (Robertson, 2019); a PhD in Education. However, additional action research papers may be in journals outside the profession. Illustrating the latter point is the article cited in chapter four (Burchell, 2010). They used action research in a pre-registration curriculum design process for a therapeutic radiography degree programme, and their findings were published in an education journal. That aside, I observed that the number of action research studies is still relatively low compared to other study types. For example, within the AHP department at UWE Bristol, only one action researcher was a member of the Centre of Health and Clinical Research (CHCR). Therefore, I often regarded myself as an outsider and felt that there was not much experience in the methodology around me in the spaces where I occupied and that the method I was using was not fully understood. At this point, I realised that I needed to look to the education and sociology research literature.

Consequently, when writing this doctorate, it has been highlighted that my tone has at times been defensive, and I have often found myself starting from the

position of defending action research as a legitimate research approach. However, defending (as in advocating) a methodology without becoming defensive (as in protective or uncritical) has not always been easy, an observation that echoes doctoral commentary by Fieldhouse (2019). I also had the extra challenge of working with a data collection tool that is new and evolving. The emergence of crowdsourcing from business rather than academia meant there are still questions about the type of knowledge crowdsourcing produces (Eklund et al., 2019), as I have previously discussed in chapter four. It could be debated that using an untested tool such as crowdsourcing in health professions education partnership working was a risk. My counter-argument is that the "*Vitae Researcher Development Framework*" note that researchers should take intellectual risks appropriately (Vitae, 2011). Moreover, as already debated in chapter three, applying a tool in an underrepresented field meant I was challenged to step outside of my subject discipline and consider how crowdsourcing is used in business, social policy, and computer science research, and how this could be adapted and applied within health professions education.

Researching in this space has been exciting, as it has allowed me to build on the evidence base within health professions education as championed by Brabham (2013). Nevertheless, working with a still-emerging tool was uncomfortable as I could not package crowdsourcing neatly into a traditional paradigm category and use standard research language. One such example is using the term ‘participant’ throughout this thesis. Within crowdsourcing, those participating are known as crowdworkers. However, following feedback from journal reviewers and my supervisors, I decided to revert to standard terms for the methodology and action cycle chapters to prevent confusion.

I realised that the difficulty in formulating which paradigm crowdsourcing belongs to echo my experiences of using the Delphi method. I use this example, as I had researched the Delphi method in depth during the taught phase of the Doctorate, as this was the tool I planned to use for this research (St. John-Matthews et al., 2017). I do believe this early work helped me occupy a space that is not black and white. In studying the Delphi method, I learnt that

whilst an established group consensus technique, it does not follow the usual conventions of formal scientific inquiry (Day & Bobeva, 2005). Instead, some researchers have positioned the Delphi technique within an interpretative paradigm viewing it as subjective and qualitative (Keeney et al., 2011).

On the other hand, researchers such as Blass (2003) claimed that attempting to ground the methodology in one single paradigm is unproductive. What is clear is that over 60 years after the seminal piece by Helmer-Hirsberg and Rasher (1959), the authors' stated fields have not yet developed for the Delphi approach the debates continue (St. John-Matthews et al., 2017). My experience of reading about and applying crowdsourcing is that it is a much newer tool, and similar arguments are emerging in the crowdsourcing literature, a personal observation supported by Eklund et al. (2019).

As my doctorate progressed, I started to consider who my community of practice were. A community of practice is a group of individuals who share their knowledge and expertise, learn from each other, and build their capabilities (Wenger, 1998). I started to look beyond being a diagnostic radiography educator to being a health professions educator interested in stakeholder engagement. As noted earlier, the audiences I presented to changed as my doctorate progressed. Of particular note was presenting at the Networking in Healthcare Education (NET) Advance HE conference in 2019 and 2021, thus disseminating my literature review and action cycle one findings. NET is deemed the leading international conference for networking in health professions education (Advance HE, 2021). Attending NET was equally as valuable as presenting at the meeting as it offered networking opportunities and informal discussions with researchers using the same methodology, action research, and who had similar areas of interest. Opportunities such as these were logged and reflected on within my doctorate diaries, although I note I am still to connect with researchers, specifically using crowdsourcing as a data collection tool in health profession education.

9.6 Impact of this research

In this section, I revisit the reflective portfolio submitted within the professional doctorate integrated portfolio in the summer of 2017. This submission at the end of the doctorate taught phase offered an opportunity to forecast the potential impact of the proposed research on the field of radiography education, on my role as a practitioner, and myself. I have chosen two areas to revisit concerning the impact on myself as both an educator as a student and the impact on my field. While I am aware that I am applying my reflections to individual situations, I have noted how these singular reflections led to systematic changes that have affected personal and professional behaviours at the end of each sub-heading reflection.

Impact on self (Educator as a learner)

I acknowledged how a strong identity as a diagnostic radiographer and working at a single HEI could have impacted my critical evaluation of my research area and my ability to create new knowledge. Yet, there is one area where I have multiple situational experiences that I believe added value to this work. This programme of study was the third occasion whereby I have simultaneously been both educator and student. The first was whilst completing a Master's in medical imaging (2006-2010), and the second was while completing a postgraduate certificate in teaching and learning in Higher Education (2013-2014). I argue that this dual role has provided an opportunity to evaluate the lived experiences of the modern-day university student critically.

Including an action cycle with student voices in this research came after submitting my doctorate plans before my progression viva. This plan materialised once I realised that the student voice in the design of the diagnostic radiography programme at UWE Bristol was not fully embedded, and reviewing the literature highlighted limited published research on the topic (Healy & Harrington, 2018). As presented in chapter two, within Higher Education student co-creation, the collaborative development of new concepts, solutions, products, and services with University staff has become increasingly important. This approach is distinct from the more standard and passive

student evaluation and feedback mechanisms that every HE programme will have (Dollinger & Mercer-Mapstone, 2019).

In this dual role of student as an educator, I have developed a mutual respect for the situational knowledge learners and the professional knowledge health professions educators possess. During this research, as a mature part-time student, I sometimes felt detached from the postgraduate student body at the university as I did not always have time to engage physically. In addition, living 50 miles from the campus made attending events and consultations at a set time in a set place difficult. Equally, I considered that I had the expertise I could share and wanted to participate in the student community actively. Although we had elected student representatives, they were full-time science doctorate students, so I did not think my minority voice was captured or understood. Hence the statement shared by email by a year 3 student resonated with me and demonstrated that this research positively reverberated with other learners.

YEAR THREE STUDENT: *"This crowd page [sic] is perfect where students can voice directly rather than going through a student representative; therefore, the opinions are not going to be communicated through another student*."

This observation was one of many that I needed to apply a meta-reflexive approach to my work (McNiff & Whitehead, 2009). Was I drawn to this statement because it confirmed my lived experiences of the challenges of the student representation system with nominated voices speaking for all? I acknowledged this thought process would positively support my view that crowdsourcing was an inclusive curriculum design tool. I, therefore, discussed the statement with my supervisors to assess the trustworthiness of including this account in the thesis to support my argument for crowdsourcing. They agreed this was also a common observation made by learners on their programmes of study at their institute i.e. how representative the student representation system is within Higher Education. Hence, I was confident this statement could be included to illustrate my point.

Impact on self (Dyslexia)

This was a portfolio sub-heading I chose to revisit as design principle two proposed by this thesis is ensuring that the crowdsourcing platforms should be developed and ensure they have considered accessibility. This originated from a personal reflection after the data collection phase of action cycle three.

On revisiting the integrated portfolio, I was taken aback when I read what I had written about having dyslexia, as it comes from a deficit viewpoint. In the portfolio, I highlighted the challenges with reading and writing in a coherent, logical way. I even named the title for this section 'managing my dyslexia'. Here I identified what support I needed to put in place to assist this. Unlike research in undergraduate healthcare learners with dyslexia, when writing my year two portfolio, I noted a lack of literature on the lived experiences of doctorate learners with dyslexia. Of the literature, the emphasis is placed on the supervisor and supervisee working relationship (Collins, 2015) and the onus on me to be self-aware and seek out support. The change in my viewpoint is partly due to the increasing awareness since starting my doctorate six years ago of the value dyslexic thinking brings to the workplace. Since 2015, Collins' paper has been cited 17 times, and a number of these papers focused on dyslexia and doctorates. Organisations such as Made by Dyslexia (2021) are now highlighting the added value of having a workforce that has dyslexia. Research by this charity mapped dyslexia traits to the World Economic Forum's (2016) "Future of Work Study", has shown a demand for dyslexic abilities in the changing world of work.

My point here is that the evidence base in the field of dyslexia is growing, and this increasing positivity echoes my lived experiences throughout this doctorate. I have been repeatedly reminded of the positives that being neurodiverse has brought to this work. Innovation is seldom a brand-new idea; instead, it is often a result of someone taking an idea and applying it in a different context. I have used my imagination to create an original piece of work by applying a business and policy tool, crowdsourcing, and applying it in a novel way, to health professions curriculum design processes. I have been curious about student, public and patient involvement in health professions education and how all

voices can be captured. In trying to express my thesis creatively during a writing block, I designed a Lego scene to depict the golden thread of this research - ***appendix* 24.** I often use this simple image to describe this 80,000-word thesis when getting across my work to different audiences or to spark interest in my research. Hence, I believe undertaking this level of study over six years and half years has enabled me to reframe my neurodiversity.

Again this was another critical incident where I brought my observation to my critical friend group, on this occasion, the Clever Together Lab Ltd. team. I am personally aware that dyslexia presents on a spectrum, and no two people with dyslexia have the same profile on the spectrum. This acknowledgement of the needs of one group resulted in the broader conversation of the accessibility for those with learning disabilities, sight problems or language barriers of crowdsourcing platforms and then specifically the Clever Together Ltd. platform. Subsequently, an accessibility add on was purchased for the AHPs Listen project, described previously in chapter eight (Rastrick, 2021).

Impact on the field (diagnostic radiography)

Lundfren-Resenterra and Kahn (2020) highlighted significant value to be gained via learning on a professional doctorate, not simply in terms of personal growth but also in mastering a discourse that crosses both research and professional practice. However, they also noted that research on the impact of professional doctorates on students and their organisations had reported contested outcomes. I observe a plethora of literature exploring the impact of professional doctorates reporting positive results regarding the personal transformation of doctoral candidates (Costley & Stephenson, 2007; Burgess & Wellington, 2010; Davis & Frame, 2016). However, the evidence explaining how doctoral learning impacts an organisation is less common (Evans & Hickey, 2004; Burgess, Weller & Wellington, 2011; Costley & Lester, 2012; Maxwell & Wellington, 2013).

In my original reflective portfolio, I used a quantifiable measure of impact on my field of diagnostic radiography by highlighting the College of Radiographers agenda to ensure 1% of the profession held or were working towards a

doctorate by 2021 (CoR, 2016). Increasing the number of diagnostic and therapeutic radiographers holding doctorates was seen as an enabler to embed research in all levels of radiography practice through the development of skilled and motivated research-active members of the profession (SCoR, 2016a). A recommendation in the national radiography research strategy (2016-2021) was for a doctoral award as the preferred qualification for those working in academia. This professional document argues that having radiography academics with this level of education would expand doctoral supervision capacity and provide pre-registration learners with role models: something I am keen to engage with once I complete my doctoral degree. This quota was deemed necessary as it was estimated that 20% of the radiography teaching population was due to retire in the next five years, with a sizeable percentage of those retiring holding doctorates (Knapp, 2017). Hence completing this doctorate is a quantifiable outcome for the profession.

Despite the time it has taken to complete this research, the focus of this work on stakeholder engagement has remained relevant to the radiography profession. I make this statement noting that two critical professional documents have been published by the College of Radiographers over the last three years, showing the importance the professional body places on patient public involvement in professional activities. Namely, the "*Patient Public and Practitioner Partnerships within Imaging and Radiotherapy: Guiding Principles"* (2018) and the "*College of Radiographers Research Strategy"* (2021-2026), which puts the patient at the core of research in the profession. This observation is borne out by the design principles that this work has offered.

Alongside being part of this national cohort of diagnostic radiographers seeking to attain a doctorate level qualification, in 2017, I pledged to publish as I progressed through the doctorate. This commitment was due to the risk that another researcher or research group would publish in the area I was investigating as a part-time candidate, given the pace the field of crowdsourcing was developing. This situation added a threat that my work would not be seen as novel at the thesis viva-voce, resulting in the work not meeting doctorate level examining criteria and, consequently, the doctorate not being awarded.

Three papers are now available in the international peer-reviewed journal *'Radiography',* the official peer-reviewed journal of the Society and College of Radiographers and the European Federation of Radiographer Societies. This journal is indexed in nine international databases and is Scopus listed. These papers have had 23 citations, thus demonstrating the impact of this body of work. Furthermore, these citations extend beyond medical imaging journal collections. Additionally, these external peer reviewers have provided additional critical feedback through a fresh lens, as already discussed with examples in this chapter.

The QAA Characteristics statement for doctoral degrees (2020) outlines three categories of doctorates delivered in the UK. Here professional and practice-based (or practitioner) doctorates sit in category three. Two characteristics of this type of doctorate are that a candidate's research may result directly in organisational or policy-related change. Equally, the difference between this type of doctorate and the traditional PhD is that the:

> *"successful completion of the degree normally leads to professional and/or organisational change that is often direct rather than achieved through the implementation of subsequent research findings" (QAA, p9, 2020)*

In keeping with the latter statement during the write up of this research, as demonstrated in chapter eight, I was able to directly apply to learning presented in this thesis to two England wide AHP focused crowdsourcing projects between 2020 and 2022.

9.7 Dissemination

At the start of the research, a plan was articulated with dissemination opportunities timetabled in a Gantt chart. These opportunities extended beyond published papers, and I have presented aspects of this work at local, national, and international conferences. A list of these activities can be found in ***appendix* 25**. Within this appendix, the individual Almetric score, as of December 2021, has also been logged for the published papers. In addition,

Almetric (2021) collect and collate information across multiple web pages to demonstrate the online activity surrounding a single research output.
Events included presenting to educators outside my discipline locally at the UWE Bristol *"Festival of Learning"* (St. John-Matthews, 2018a; St. John-Matthews, 2020) and fellow doctorate candidates at the Swansea University Medical School postgraduate research conference (St. John-Matthews, 2018 (b); St. John-Matthews, 2019). I also had the opportunity to present to other health profession educators nationally (St. John-Matthews et al., 2019; St. John-Matthews et al., 2021) and internationally (St. John-Matthews et al., 2018). In addition, I was the invited speaker by the College of Radiographers to the Radiological Society of North America (RSNA) conference in Chicago (2020). Unfortunately, due to Covid-19, this event was postponed to a hybrid offering. Here I virtually presented chapter two of the thesis alongside highlights from my crowdsourcing work in health professions education (St. John-Matthews, 2021). I have also presented chapter five as a worked example at the *"Moving Beyond the Metrics: measuring what counts in higher education"* QAA online seminar (Cleaver et al., 2021).

I have been the lead author for all articles working with my supervisory team and Clever Together (St. John-Matthews et al., 2017; St. John-Matthews et al., 2019; St. John-Matthews et al., 2021). Combined, these publications have had twenty-six citations not just in medical imaging journals but also in journals outside the discipline, including *"Teacher and Teacher Education", "Teaching and Learning in Medicine",* "*The International Journal of Emergency Medicine", "Medical Education"; "Brilliant: Research and Conceptual Journal"* and *"College Teaching"*. These journals span several countries, incorporating India, Malaysia, Australia, Italy, and the US.

In the submitted ethics forms, I acknowledged an ethical consideration for this work with a 'crowd' related to co-ownership and dissemination of the findings **(*appendix* 14)**. I noted that this consideration is more closely aligned with participatory action research (Banks & Brydon-Miller, 2019) and whilst the overall results 'belong' to the doctoral candidate, I needed to highlight the role of the crowd. To address this, a description of action research was outlined in the

participant information sheets to ensure participants were aware of how their ideas, comments and votes would be used - ***appendices* 10 and 11**. In addition, I committed that acknowledgements of the crowd would be made in written articles and presentations of the findings. This commitment has been upheld.

In ***appendix* 25,** I listed the number of citations of published work to demonstrate the impact of this research thus far. However, NIHR (2019) described other measures. This observation echoes an editorial I wrote that logged the role of social media in raising the research profile (St. John-Matthews, 2016). Hence as detailed by Branford and Maulucci (2015) and Schnitzler et al. (2016), I harnessed Twitter™ to drive the impact of the papers linked to this research. One example of the reach of Social Media is a tweet I received on the 9th of October 2019 from the diagnostic radiography programme team at University College Dublin (USD), Ireland. This tweet noted that the article St. John-Matthews et al., (2020) was being used in a discussion as part of a 'Current Issues in Health Care' module discussion:

> *"And @jstjohnmatthews, your crowdsourcing paper in @radiogrpahyjour was also discussed in our session today here @UCDmedicine #UCDradiography #PPPP2019* (McNulty, 2019)*"*

Once the thesis and vice viva are completed, I plan to publish action cycles two and three. The goal is to submit to an international education journal outside of health professions education, such as *"The Journal of Curriculum Studies*" or *"The Journal of Higher Education Policy and Management.* A three-year embargo has been placed on the thesis as I wish to co-edit a book linked to this work. This proposed book will seek to consider broader crowdsourcing design discussions. This potential opportunity has come about due to the gap in published work on collaborative rather than idea generating crowdsourcing. Alongside traditional dissemination approaches, I plan to submit the Lego model image, depicting this research in a single image and accompanying 150-word description for consideration in the 2022 Swansea University International *'Research as Art'* competition, ***appendix* 24.**

9.8 Thesis conclusion

My reason for undertaking this research was to explore how a diverse and inclusive voice could be captured in health professions curriculum design processes at a single Higher Education Institute. Conducting background reading highlighted various stakeholders that should be engaged in the design process, including academic staff, professional services, employers, students, and graduates. This extended to those who accessed healthcare services, patients, and the public. However, looking at local practice, it became clear there was also limited input from students. Furthermore, exploring the literature on these specific groups demonstrated a lack of published evidence in the broader diagnostic radiography subject discipline.

This innovative research has proposed using a tool more commonly found in business, computer science and policy design to support diverse and inclusive access, crowdsourcing, and applying it in health professions curriculum design processes. Once I started exploring the topic, I realised that the evidence base of crowdsourcing in the broader context of health professions education was limited but evolving. Area's crowdsourcing had been applied to included assessment of simulated surgical skills, lesson planning, recruitment of students onto a surgical training programme and design of education instructional materials. Notably, the published evidence on the role of crowdsourcing in health professions curriculum design processes was non-existent. This finding demonstrated that this work would be novel. Therefore, this research has resulted in several contributions to the evidence base. Supported by publications in peer-reviewed journals, this work has contributed to understanding how crowdsourcing could be used in health professions education and how student partnership working could be enabled within the curriculum design process. The research has also demonstrated the value crowdsourcing adds to capturing stakeholder voices. In this case, students, patients, and the public.

A pragmatic methodology was applied to this research as I became a 'researcher-explorer', investigating if and how crowdsourcing would capture the

voices of students, patients, and the public in health professions curriculum design. Pragmatism focuses on practicality and adaption, using what works and producing cautious answers instead of truth. This research approach meant that I could use a range of research strategies to answer the research question:

"Can a crowdsource be deployed to support stakeholder (student, patient, and the public) involvement in pre-registration diagnostic radiography curriculum design processes?"

Using a pragmatic approach, the findings generated from my evolving experiences were supported by an iterative process as I tried to improve and build on each of the three action cycles. These reflections were based on my past understanding and how these experiences, supported by the available evidence base, fitted and worked in the world where I was operating. A vital aspect of a pragmatic approach is one of values and consideration of my role as a researcher. Hence a reflective chapter has been included in this write-up.

As per the QAA (2020) characteristic statement for doctoral degree programmes, findings from category three professional and practice-based doctorates may result directly in organisational or policy-related change. However, literature attests that this can be difficult to capture at the examination point for professional doctorates. Therefore, I thought my work would impact the curriculum design processes at UWE Bristol. However, as noted in chapter eight, learning from the three action cycles was applied in two England-wide projects during the write-up of the thesis. One project was with students (HEE AHP placement capacity project, 2020), and the other was with professionals, students, patients, and the public (AHPs Listen, 2021). Thus the impact of this thesis has been demonstrated, albeit not as I had predicted when I started the research phase of the doctorate in October 2017. Furthermore, writing up during a global pandemic and subsequent lockdowns has accelerated the use of digital data collection tools adding weight to their credibility alongside more traditional tools.

Through considering the opportunities and limitations of crowdsourcing experienced in this research, I have offered six practical design principles for

those seeking to use this tool within their local practices. These are important as operating in an online space requires different skills compared to traditional curriculum design tools. Whilst this work has added to the developing evidence base on crowdsourcing as a collaborative stakeholder engagement tool in health professions curriculum design process, much research remains.

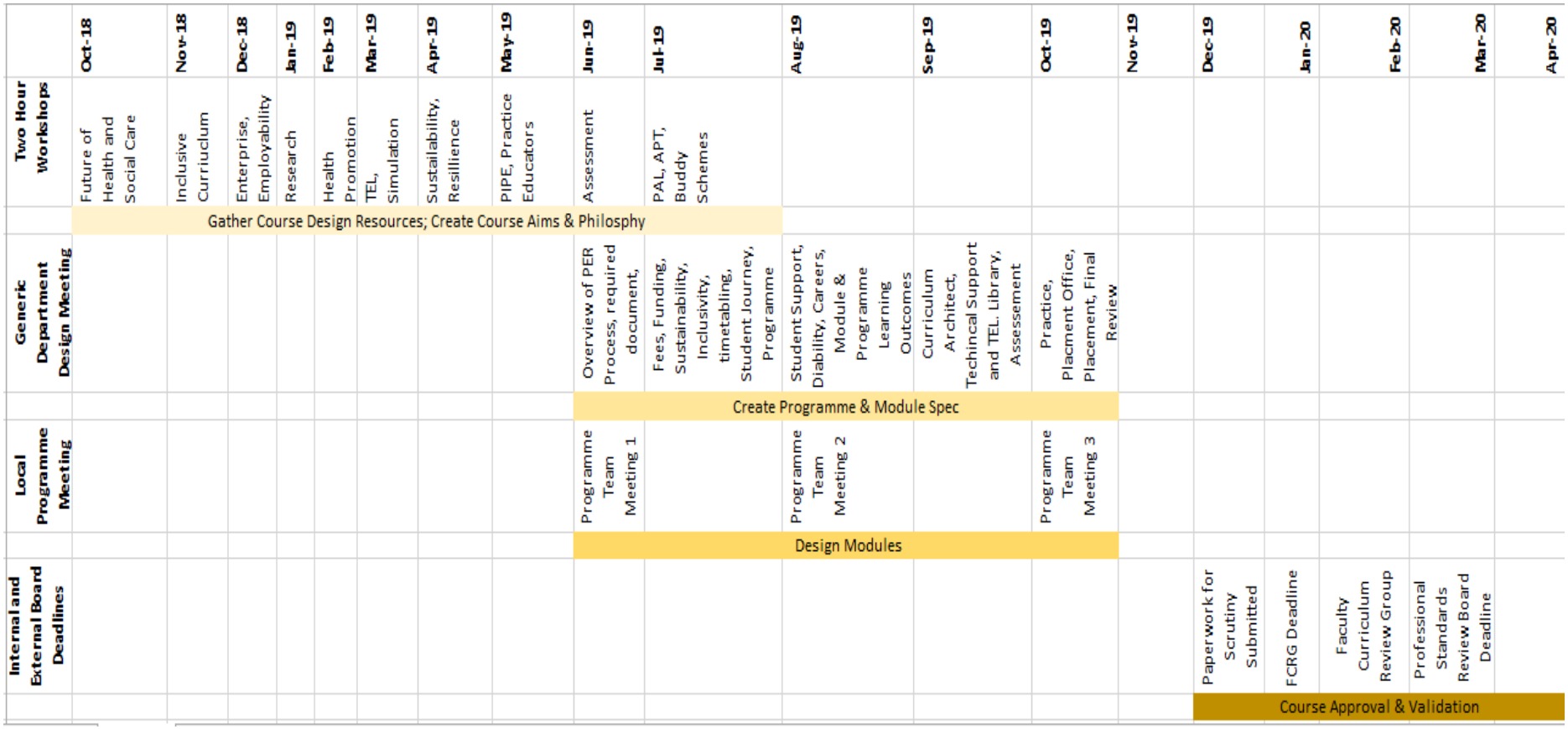
Appendices

Appendix 1. UWE Bristol BSc (Hons) Diagnostic Radiography re-approval timeline

2018	**20th June 2018, 15:00pm-17:00pm**
	Initial meeting with all department of Allied Health Professions programme leaders and the central quality team to introduce the re-approval schedule, 18/19 department comprehensive programme enhancement workshops, and 2019/2020 programme re-approvals timeline
	July 20, 2018
	AHP away day. Introduction of re-approval schedule, 18/19 department-wide -programme enhancement workshops, and 2019/2020 programme re-approvals timeline for the entire department
	September 2018- onwards
	Critical reflection in programmes commences, and department programme enhancement workshops held- programme leaders required to attend
2019	**January 18, 2019, 3pm**
	Briefing at programme leaders' meeting with AHOD quality and quality account manager.
	February 14, 2019
	AHP away day, Introduction of re-approval schedule, 18/19 department-wide -programme enhancement workshops, and 2019/2020 programme re-approvals timeline for the entire department
	April 2019-onwards
	Design team workshops (see appendix one, generic design meetings section). Programme leaders most attend
	November 18, 2019, 09.00am
	Deadline for programme paperwork. Module and programme specifications, assessment map, exam board date mapping of module assessments, department-specific evidence document
	December 2019
	The first week: Department scrutiny events, two x half days, scrutiny team will consist of five members not involved in the programme being scrutinised Second week: Deadline for changes to be made to paperwork by programme teams because of design team workshop 8 Third week: Faculty curriculum review group paperwork deadline
2020	**January 2020**
	Faculty curriculum review group. Programme leaders to attend
	February 2020
	Professional Standards Regulatory Body (PRSB) paperwork deadline
	March 2020
	Mock approval event

	****Covid-19 PANDEMIC LOCKDOWN****	
	PLANNED ACTIVITIES	**ACTIONED ACTIVITIES**
	April 2020	
	On-site re-approval events with the UWE programme enhancement review panel and the Professional Standards Regulatory Body (PRSB) Cancelled	
	September 2020	
2021		**February 2021**
		Virtual re-approval events with the UWE programme enhancement review panel and the Professional Standards Regulatory Body (PRSB)
		September 2021
		New curriculum starts

Appendix 2. AHP Department: 2020 Curriculum Design Meetings & Workshops



Appendix 3. Excluded studies

Excluded Paper	Reasons
Dai, J.C., Lendvay, T.S. and Sorensen M.D. 2017. 'Crowdsourcing in Surgical Skills Acquisition: A Developing Technology in Surgical Education' *Journal of Graduate Medical Education* 9 (6):697–705. doi: 10.4300/JGME-D-17-00322.1	A review of all studies to date that have used crowdsourcing in surgical assessment
Katz, J. 2016. 'The Role of Crowdsourcing in Assessing Surgical Skills'. *Surgical Laparoscopy Endoscopy & Percutaneous Techniques* 26 (4):271–277. doi: 10.1097/SLE.0000000000000293	A review of the potential role of crowdsourcing in assessing surgical skills

Appendix 4. Applying the MERSQI checklist
(Reed and Cook, 2007)

Domain	MERSQI Item	Score	Max Sore
Study design	Single group cross-sectional or single-group post-test only	1	**3**
	Single group pre-and post-test	1.5	
	Nonrandomised, two groups	2	
	Randomised controlled trial	3	
Sampling	*Institutes studied*		**3**
	1	0.5	
	2	1	
	3	1.5	
	Response rate		
	Not applicable		
	<50 or not reported	0.5	
	50-74	1	
	>75	1.5	
Type of data	Assessment by participants	1	**3**
	Objective assessment	3	
Validity of evaluation instrument	*Internal structure*		**3**
	Not applicable		
	Not reported	0	
	Reported	1	
	Content:		
	Not applicable		
	Not reported	0	
	Reported	1	
	Relationships to other variables		
	Not applicable		
	Not reported	0	
	Reported	1	
Data analysis	*Appropriateness of analysis:*		**3**
	Inappropriate for study design	0	
	Appropriate for study design, type of data	1	
	Complexity of analysis:		
	Descriptive analysis only	1	
	Beyond descriptive analysis	2	
Outcomes	Satisfaction, attitudes, perceptions, opinions, facts	1	**3**
	Knowledge, skills	1.5	
	Behaviours	2	
	Patient/ healthcare outcome	3	
Total Possible Score			**18**

Appendix 5. MERSQI applied to the retrieved literature

First Author	Date	Speciality	Study Design	Size Sampling	Setting	Assessment	MERSQI Score
Bow	2013	Teaching materials: General medicine	Single group pre and post-test	Experts in field (120)	Classroom	Knowledge Perception	8.5
Chen	2014	Simulated robotic surgical skills	Non-randomised 2 groups	Amazon MTurk (409) Facebook (67)	Clinical	Organisation benefit	10
Penciner	2015	Emergency care	Single group case study	Experts in field (13)	Conference	Knowledge Perception	6
White	2015	Simulated robotic surgical skills	Non-randomised 2 groups	Amazon MTurk: C-STATs (30) Experts (3)	Clinical	Organisation benefit	11
Holst	2015	Simulated robotic surgical skills	Non-randomised 2 groups	Amazon MTurk: C-STATs (50) Experts (7)	Clinical	Organisation benefit	11
Agadashi	2015	Simulated cricothyrotomy	Non-randomised 2 groups	Amazon MTurk (30) Experts (3)	Clinical	Organisation benefit	12
Malpani	2015	Simulated robotic surgical skill	Non-randomised 2 groups	Amazon MTurk (not provided) Experts (8)	Clinical	Organisation benefit	12
Blackwell	2016	Teaching materials: Neuroscience	Description of activity	Experts in field (102)	Conference	Organisation benefit	5
Polin	2016	Simulated robotic surgical skills	Non-randomised 2 groups	Amazon MTurk (448) Experts (3)	Clinical	Organisation benefit	12
Deal	2016	Laparoscopic skills	Non-randomised 2 groups	Amazon MTurk: C-STATs (203) Experts (6)	Clinical	Organisation benefit	11
Powers	2016	Simulated robotic surgical skills	Non-randomised 2 groups	Amazon M Turk (30) Experts (3)	Clinical	Organisation benefit	12
Ghani	2016	Robotic surgery: prostatectomy	Non-randomised 2 groups	Amazon MTurk: CSTATs (30) Experts (4)	Clinical	Organisation benefit	13
Kowalski	2016	Laparoscopic skills Urology	Non-randomised 2 groups	Amazon MTurk (60) Experts (5)	Clinical	Organisation benefit	13
Lewis	2017	Exam question: Radiology	Evaluation of process	Experts in field (170)	Professional body	Organisation benefit	7
Yeung	2017	Laparoscopic skills	Non-randomised 2 groups	Novices (4) Experts (5)	Clinical	Organisation benefit	11
Vernez	2017	Student selection surgery programme	Non-randomised 2 groups	Amazon MTurk (not provided) Experts (6)	Clinical	Organisation benefit	12
Lee	2017	Student selection in surgery: urology	Non-randomised 2 groups	Amazon MTurk C-STATs (not provided)	Clinical	Organisation benefit	13

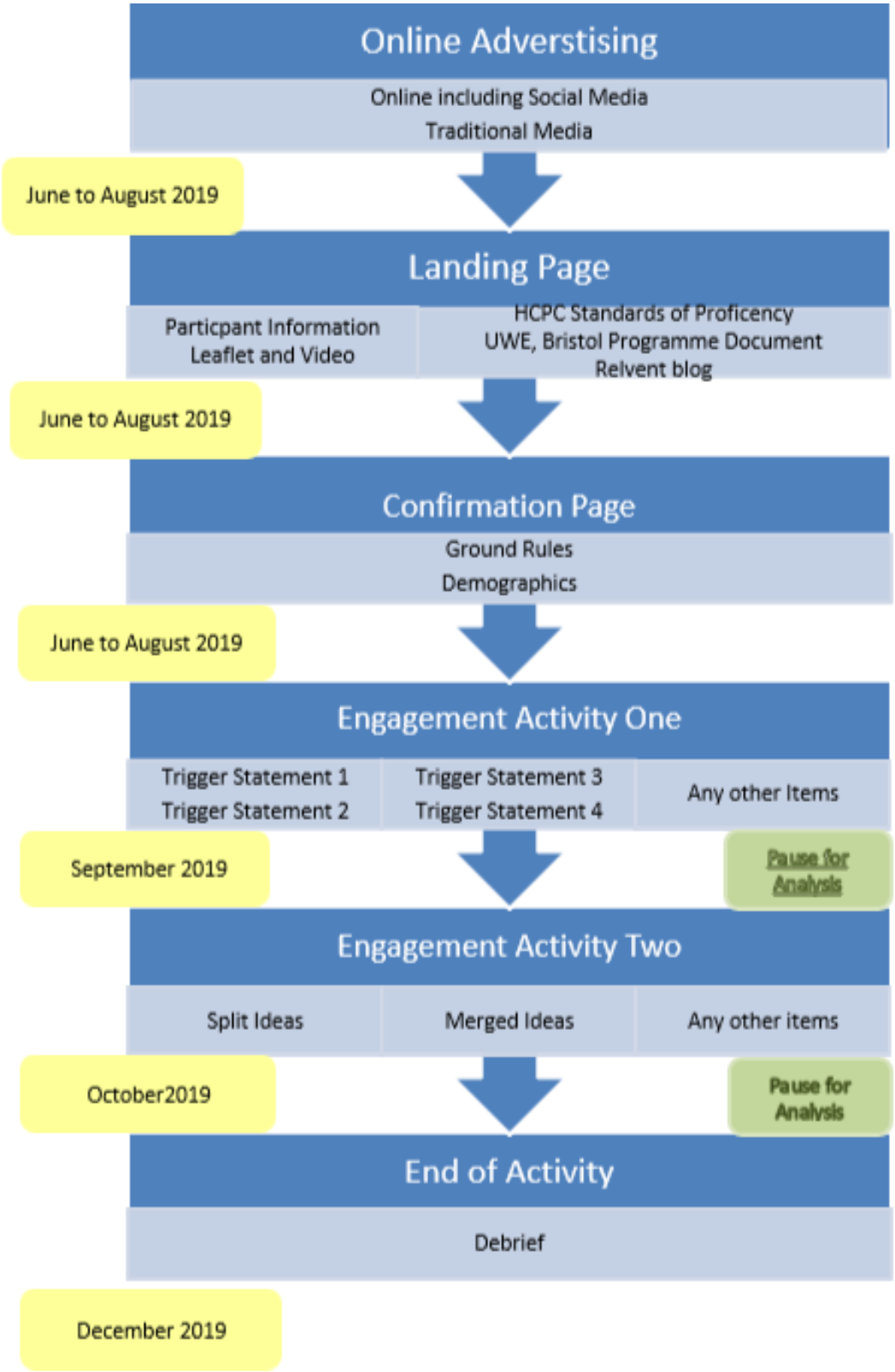
Appendix 6. Quality assessment scores of included studies using the MERSQI

First Author	Year	Study Design (0-3)	Sampling (0-3)	Type of Data (0-3)	Validity of Evaluation Instrument (0-3)	Data Analysis (0-3)	Outcomes (0-3)	Total (out of 18)
Bow	2014	0.5	1.5	3	0	2	1.5	8.5
Chen	2014	2	0.5	3	1	2	1.5	10
Pencier	2015	1	1	1	0	2	1	6
Holst	2015	2	0.5	3	1	3	1.5	11
White	2015	2	0.5	3	1	3	1.5	11
Malpani	2015	2	0.5	3	2	3	1.5	12
Aghdasi	2015	2	0.5	3	2	3	1.5	12
Polin	2016	2	0.5	3	2	3	1.5	12
Blackwell	2016	1	0.5	1	0	1	1.5	5
Deal	2016	2	0.5	3	1	3	1.5	11
Kowalewski	2016	2	1.5	3	2	3	1.5	13
Powers	2016	2	0.5	3	2	3	1.5	12
Ghani	2016	2	1.5	3	2	3	1.5	13
Lewis	2017	1	2.5	0	0	2	1.5	7
Yeung	2017	2	0.5	2	2	3	1.5	11
Lee	2017	2	1.5	3	2	3	1.5	13
Vernez	2017	2	0.5	3	2	3	1.5	12

Appendix 7. Surgical skills assessment crowdsourced feedback resources

Lead author	Average feedback Time		Expert Surgeon $/Task	Crowdworkers $/Task
	Crowdworkers	Experts (Surgeons)		
Chen	MTurk: 144hr Facebook: 600hr	576hr	not recorded	1.00
White	Task one: 8hr 52min Task two: 108hr 48min	not recorded	not recorded	Task one: 0.35 Task two: 0.50
Holst	2hr 50mins	26hr	not recorded	0.50
Agadashi	10hr	1,440hr	not recorded	0.50
Malpani	72hr	627hr	not recorded	$10 gift card (whole task)
Polin	16hr	not recorded	not recorded	0.70 $31.50 (whole task)
Deal	19hr 15min	240hr	not recorded	0.75
Powers	11hr 33min	312hr	not recorded	not recorded
Ghani	Task one: 21hr Task two: 38hr	360hr	not recorded	not recorded
Kowalewski	2d	1440hr	not recorded	0.67
Yeung	Not recorded	not recorded	not recorded	not recorded
Vernez	Task one: 3hrs 4min Task two: 3hrs 26min	528hr	not recorded	0.44
Lee	not recorded	not recorded	not recorded	not recorded

Appendix 8. Crowdsource timeline and sequence of events.
Action cycles two, three



Appendix 9. Action cycle three challenge questions

Challenge question	Challenge description
Year 1 Module: Diagnostic Radiography Clinical Practice 1	This module was taken in year one. Learners are taught the theory of taking routine x-rays at the University, where they practice through simulation and role-play. After six months in the University, learners then complete their first 14-week clinical placement at a local hospital or clinic. (Before the placement, they are also taught anatomy/pathology, how the equipment works and patient care on other modules) We would like your comments, ideas, and thoughts on what this module should include and how it should look
Year 2 Module: Professional Behaviour and Health Psychology (NEW MODULE)	This module was taken in year two. This is a new module under development. We would like your comments, ideas, and thoughts on what this module should include and how it should look.
Year 2 Module: Diagnostic Radiography Clinical Practice 2	This module is taken in year two and builds on the year one module: Diagnostic Radiography Clinical Practice 1. Learners are taught the theory of taking more complex x-rays and undertaking basic CT scanning at the University. They also explore imaging such as MRI, Mammography, Fluoroscopy, Angiography and Ultrasound. Learners then complete a second 14-week clinical placement at a local hospital or clinic. (In other modules teaching builds on year one. Learners are taught how the equipment works, pharmacology specific to imaging and more advanced patient care skills) We would like your comments, ideas, and thoughts on what this module should include and how it should look
Year 3 Module. Healthy Futures (NEW MODULE)	This module was taken in year three. This is a hew module under development. This is an inter-professional module taken by several professions in the department, including radiography, occupational therapy and physiotherapy learners. The module has been shaped around the digital future in the healthcare agenda (The Topol Review) and making our graduates informed and adaptable to the future. What do you think this module should include in supporting digital healthcare? We would like your comments, ideas and thoughts on what this module should include and how it should look
Any other ideas?	Is there anything else you would like to add?

Appendix 10 Action cycle one: Advertising and participant information (UWE Bristol diagnostic radiography students).

ACTION CYCLE ONE. ADVERTISING WORDING

Let's work together on updating the next BSc (Hons) Diagnostic Radiography programme

Are you a UWE Bristol diagnostic radiography learner?
Do you want to help us shape the future of radiography education?

The University of the West of England, Bristol, has been training radiographers for over twenty years. We would like your help in updating our next BSc. (Hons) Diagnostic Radiography degree programme. To achieve this, we are using an online engagement tool to create an opportunity for learners to have their voices heard.

From the 24th of June 2019, you can help by:

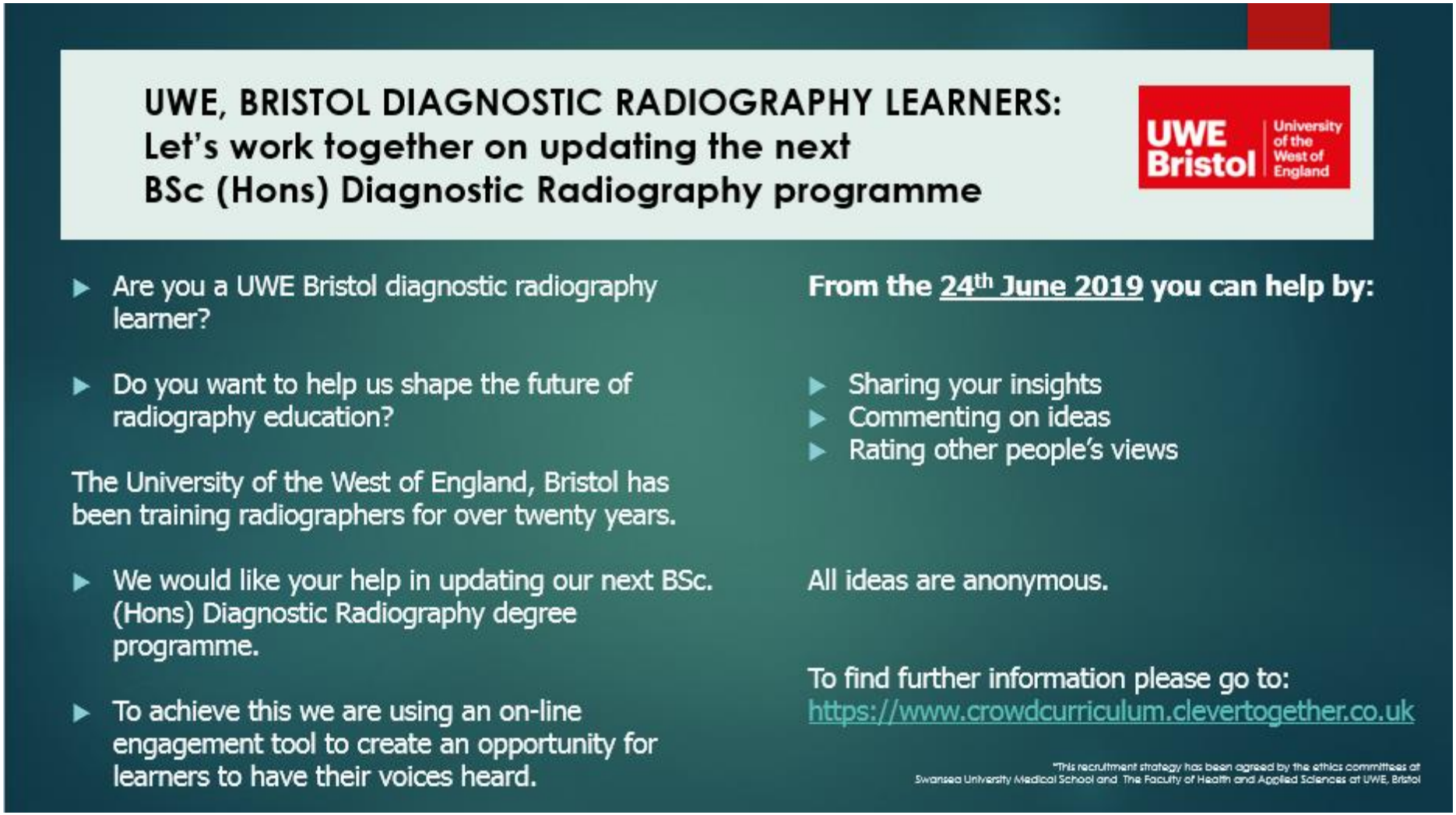
- Sharing your insights
- Commenting on ideas
- Rating other people's views

All ideas are anonymous.

To find further information and to join the conversation, please go to:
https://www.crowdcurriculum..co.uk

*This recruitment strategy has been agreed by the ethics committees at Swansea University Medical School and the Faculty of Health and Applied Sciences at UWE Bristol

ACTION CYCLE ONE. FLYER FOR USE ON SOCIAL MEDIA OUTLETS AND AS A HARDCOPY



ACTION CYCLE ONE. PARTICIPANT INFORMATION PAGE
(UWE RADIOGRAPHY STUDENTS)
PARTICIPANT INFORMATION PAGE

You are invited to take part in a research project. Before you make your decision, it is essential for you to understand why this research is being carried out and what it involves. Please take time to read the following information carefully. You may wish to talk to others about the study prior to contributing. Please ask if there is anything that is not clear or if you would like further information.

Study title

Using the "Wisdom of the Crowd" in the Curriculum Design of Diagnostic Radiography programme.

Invitation and brief summary

UWE has been training Diagnostic Radiographers for over twenty years, and we now want you to help us further shape our next degree programme, which goes live in September 2020.

The purpose of the main research project is to encourage more people to update the current radiography training programme at the University of the West of England (UWE Bristol).

The purpose of this *research project* is to carry out a small-scale study to better understand how the tool will work in the main study.

The research is also seeking to generate four to five trigger statements that will be used to start the conversation on the main study.

What's involved?

You will need to register with the online engagement activity via: https://crowdcurriculum.clevertogether.co.uk. A short survey will determine if you are eligible to take part. If you qualify and you provide consent, you will be taken to an online workspace.

The engagement activity (online workshop) will be open 24/7 from the 24th of June 2019 to the 5th of July 2019. During this time, you can comment and vote on ideas at a time that suits you. The workshop will then close, and the data analysed by the researcher.

In September 2019, a follow-up questionnaire will be sent to learn more about your experiences with the engagement activity. This is to help us better understand why people have taken part in this research.

The time commitment for the activity will be up to 60 minutes. Up to 30 minutes for the engagement activity and a further 30 mins to complete the follow-up questionnaire.

What are the possible benefits of taking part?

A participatory action research approach is being used for this study. Participatory methods (PMs) include a range of common activities: enabling ordinary people to play an active and influential part in decisions that affect their lives. This means that people are not just listened to but also heard and that their voices shape outcomes. Participatory action research (PAR) is an approach that emphasizes participation and action. It seeks to understand the world by trying to change it collaboratively and following reflection.

Possible benefits are being part of a group of people shaping a diagnostic radiography programme delivered at the University of the West of England, Bristol. We cannot change all of the curricula as the registering body, the Health and Care Professions Council, have core skills that must be met. These are set out in the *"Standards of Proficiency: Radiography"* https://www.hcpc-uk.org/resources/standards/standards-of-proficiency-radiographers/. However, there is an opportunity within this to shape part of the curriculum.

If the proposed tool is found to be successful, it could potentially transform curriculum design processes locally and nationally for various stakeholder groups, meaning more voices can be heard in the curriculum design phase. Furthermore, this work can be completed when it is convenient for those participating and we have a better understanding of what the public would like to see in future (diagnostic radiography) graduates.

What are the possible disadvantages and risks of taking part?

The project welcomes uncomfortable and controversial ideas. It is acknowledged that the variegated nature of the type of spontaneous community being developed in this research will potentially lead to conflict. However, personal, abusive, or offensive content will not be tolerated. The doctoral candidate will have the ability to remove the member from the group if the issues are ongoing.

When active, the engagement activity will be monitored by the doctoral candidate on a daily basis for the duration the crowdsource is live for public contributions. Ground rules have been set and must be adhered to. In these cases, the doctoral candidate will contact a participant via email. The doctoral candidate will not seek to identify individuals engaged with the crowdsource, unless a participant shares any personal, abusive, or offensive content.

Participants can ask for certain comments to be removed from final analysis if they change their minds. However, all contributions cannot be removed as this impact on the final data set.

Who has reviewed this study?

The study has been reviewed by the Swansea University Medical School Ethics committee and is supported by the Faculty of Health and Applied Sciences, the University of the West of England, Bristol. Ethical approval to undertake the study has been granted by both parties

Results of the study.

The results of the study will be used to inform a Doctoral thesis. It is planned to share the findings in suitable academic journals and to present them at relevant conferences. For all outputs, the input of the crowd in the co-design will be acknowledged as per participatory research guidelines. All analysis, and any data made public, will be completely anonymous

How will my information be kept confidential?

The online engagement activity will be managed by the doctoral candidate supported by the team who run the *Clever Together* platform. Any contributions submitted to the discussion platform will be visible to others taking part in the conversation. However, personal details will not be visible on the platform -participant information will not be shown next to an idea, comment, or vote. A link to the *Clever Together* information policy can be found here.

Further questions?

Do take time to decide whether or not you wish to take part.

Please contact the doctoral candidate, Janice St. John-Matthews, [redacted] you have any further questions.

☐ I have read the participation information and am happy to continue

Version control. v1.0

Appendix 11. Action cycle two: Advertising and participant information (Patients, and the public in Bristol).

ACTION CYCLE TWO. ADVERTISING WORDING

BRISTOL, let's work together and update the Diagnostic Radiography degree programme at The University of the West of England.

Have you ever had a 'health scan' or x-ray? If so, it is likely that this scan was taken by a radiographer**.**

The University of the West of England has been training radiographers for over twenty years.

We would like your help updating our next training course. We are using an online tool to create an opportunity for people to have their voices heard.

From the 09th of September 2019, you can help shape our future by:

- Sharing your insights
- Commenting on ideas
- Rating other people's views

All ideas are anonymous.

To find further information, please go to:
https://www.crowdcurriculum.clevertogether.co.uk

ACTION CYCLE TWO. FLYER FOR USE ON SOCIAL MEDIA OUTLETS AND AS A HARD COPY

ACTION CYCLE TWO. PARTICIPANT INFORMATION WEBPAGE

PARTICIPANT INFORMATION WEB-PAGE

Study title

Using the “Wisdom of the Crowd” in the Curriculum Design of Diagnostic Radiography programme.

Invitation

We'd like to invite you to take part in our research study. Joining the study is entirely up to you before you decide; we would like you to understand why the research is being done and what it would involve for you. We'd suggest this should take about 20 minutes. Please feel free to talk to others about the study if you wish.

Brief summary

Diagnostic radiographers are healthcare professionals who specialise in the imaging of human anatomy for the diagnosis and treatment of disease. Radiographers are regulated by the Health and Care Professions Council. To gain registration UK diagnostic radiographers must undertake degree or master’s level training to register. This is a mix of time spent learning and applying skills in University, hospitals, and clinics. Radiography programme content and structure is updated every five years as per the regulator requirements, the HCPC (Health and Care Professions Council).

The purpose of this research is to encourage more people to help co-produce an updated, relevant curriculum at the University of the West of England (UWE) Bristol. UWE has been training Diagnostic Radiographers for over twenty years. We now want you to help us further shape our updated degree programme, which will go live in September 2020.

What is involved?

You will need to register with an online workshop. https//crowdcurriculum.clevertogether.co.uk.

Workshop one will open in September 2019 for two weeks. Here you can comment and/ or vote on ideas. You can do this at a time that suits you.

There will be a pause while the data are analysed. This will then be shared with the programme development team at UWE Bristol.

Activity two will open in October 2019 for a further two weeks. Again, you can comment and/ or vote on ideas. You can do this at a time that suits you.

In December 2019, a follow-up questionnaire will be sent to learn about your experiences with the tool. This is to help us better understand why people have taken part.

The time commitment for the activity will be up to ninety minutes. Up to 30 minutes each for engagement activity and two and a further 30 minutes to complete the follow-up questionnaire.

What are the possible benefits of taking part?

A participatory action research approach is being used for this study. Participatory methods (PMs) seek to enable ordinary people to play an active and influential part in decisions that affect their lives. This means that people are listened to, and their voices shape outcomes.

Possible benefits are being part of a group of people shaping a radiography programme delivered in Bristol. We cannot change all of the curricula as the registering body, the Health and Care Professions Council, have core skills that must be met. However, there is an opportunity to shape part of the training.

It will give us a better understanding of what the public would do in future (diagnostic radiography) graduates. If the proposed tool is found to be successful, it could potentially transform curriculum design processes locally and nationally, meaning more voices can be heard in the curriculum design phase. This is because the activity can be completed when it is convenient for those participating.

What are the possible disadvantages and risks of taking part?

The project welcomes tricky and heated ideas. However, personal, abusive, or offensive content will not be tolerated. The researcher will have the ability to remove the member from the group if the issues are ongoing.

Engagement activity will be monitored by the researcher every day for the duration the crowdsource is live for public input. Ground rules have been set and must be adhered to. In these cases, the doctoral candidate will contact a participant via email. The researcher will not seek to identify individuals engaged with the crowdsource unless a participant shares any personal, abusive, or offensive content.

Participants can ask for certain comments to be removed from final analysis if they change their minds. However, all contributions cannot be removed as this impact the final data set.

Who has reviewed this study?

The study has been reviewed by two ethics committees, Swansea University Medical School and the University of the West of England, Bristol. Ethical approval has been granted by both parties

Study results.

The results of the study will be used to inform a doctoral thesis. It is planned to share the findings of the research in suitable academic journals and to present at relevant conferences. For these, the involvement of the crowd in the co-design will be acknowledged. This is in keeping with participatory research guidelines. All analysis and any data made public will be anonymous

How will my information be kept confidential?

The online engagement activity will be managed by the researcher. They will be supported by the company Clever Together. Any ideas or comments submitted on the discussion platform will be visible to others taking part in the activity.

Personal details will not be visible. Personal details will not be shown next to an idea, comment, or vote. A link to the Clever Together information policy can be found here.

Further questions?

Do take time to decide whether or not you wish to take part.

Please contact the researcher, Janice St. John-Matthews, [redacted], if you have any further questions.

☐ I have read the participation information and am happy to continue

Version control. v1.0

By ticking the box, you will be taken to a list of ground rules for participation and a list of general questions. This is the final step prior to joining the crowdsource.

Appendix 12. Online platform ground rules webpage

When sharing your views on the website, we ask you to abide by a few simple guidelines. By taking part in our online engagement activity, you agree to:

Be considerate

Our input will be used by other people, and we, in turn, will depend on the input of others. Any choice we make will affect our colleagues; we should therefore consider them when doing so.

Be respectful

Disagreement is no excuse for poor manners. Assume good intentions, do your best to act in an empathic fashion, work together to resolve conflict. A community where people feel uncomfortable or threatened is not productive.

Take responsibility for your words and actions

We can all make mistakes; when we do, we take responsibility for them. If someone has been harmed or offended, we listen carefully and respectfully.

Be collaborative

Collaboration between teams and people with different experiences is essential. Collaborating transparently improves the quality of our work.

Value decisiveness, clarity, and consensus

Disagreements are normal, but we do not allow them to persist and fester, leaving others uncertain of the agreed direction. We expect participants in the project to resolve disagreements constructively.

Ask for help when unsure

Asking questions early avoids many problems later, so you're encouraged to ask questions, though do make sure to direct them to appropriate ideas and comments shared by colleagues. If you are asked, try to be responsive and helpful. In response, we commit to preserving the integrity of the conversation, by never revealing your identity publicly and by seriously considering all ideas which are prioritised through your likes and dislikes

I have read the ground rules and confirm I will abide with these

Version Control. v1.0

Appendix 13. Debrief webpage

Thank you for your participation in this study. We hope you enjoyed the experience. This section provides background about the research to help you learn more about why we are doing this study. Please feel free to comment in the box below.

The purpose of this study is to explore if adopting a crowdsource could increase the voices that contribute to curriculum design processes. In this research, we chose a diagnostic radiography degree programme.

As you know, your participation in this study is voluntary. If you so wish, you may withdraw after reading this debriefing webpage. You will not be penalised if you withdraw. Please get in touch with the doctoral candidate at the email address below.

If you would like to have a copy of the results e-mailed to you, please tick the box below and include your email address. The doctoral candidate will send you a copy of the aggregated results when they become available.

If you have any further questions about this study, please contact us.

Principal Researcher (Doctoral Candidate) Janice St. John-Matthews [redacted]

Doctoral Supervisor 1 Professor Philip Newton [redacted]

Doctoral Supervisor 2 Professor Andy Grant [redacted]k

I would like a copy of the results when they are available (predicated Summer 2020)

My email address is ……

Version control. v1.3

Appendix 14. SUMs and UWE ethics for action cycles one and two

SWANSEA UNIVERSITY MEDICAL SCHOOL ETHICS
Ethical Approval

Medical School Research Ethics Sub-Committee

Principal Investigator	Janice St. John-Matthews
Title of Proposed Research	Using the "Wisdom of the Crowd" in the Curriculum Design of a Pre-Registration Diagnostic Radiography programme
RESC Project reference number	2019-0013

Application approved	**Yes**		**No**		**Pending**	✓
Conflict of interest	**Yes**		**No**	✓		
If yes, please supply details						
Chair of SUMS RESC	Deya Gonzaléz Associate Professor of Molecular Medicine [redacted] Swansea University Medical School Singleton Park, Swansea, SA2 8PP, UK. Email [redacted] Tel [redacted]					
Date DD/MM/YY	Signature [redacted]					

Your recent Application for Ethical Approval was discussed by the Committee, who suggested and agreed that some revisions and amendments are needed for this application to be approved. The comments of the Committee are attached.

Please arrange to revise your application in line with the Committee's comments below and re-submit your revised application.

Reviewer comments:
Having read this application, I'd like to point out that it is a very well written, thought out project. I have added a few minor questions or issues below.

a) Consider rewording the documentation for the participants (info sheets, website wording) because they are, in my opinion, very technical and not suitable for the general public.

The work refers to a video that has not yet been produced and must be reviewed in the

b) future.

The flyers in appendix 1 are not for this study, and we need to view the final versions on

c) ce ready.

The work discusses (briefly) a pilot (section 7) but there is no documentation for this set of participants (course students) submitted. I've assumed that they would have different info sheets, etc given their bac

d) Backgrounds.

Section 5, third paragraph: *The researcher is seeking to address this by including a short questionnaire prior to individuals engaging with the crowdsource. Reporting on this data alone will offer insight not previously available in the li*

e) *modterature.*
Reviewer: This will need the crowd to consent to the data being collected, as well as consent to participate in the crowd. The current info sheet doesn't accommodate this.

f) The applicant is going to act as moderator of the public discussion and as such we'd need to see template text for reasons to contact participants e.g. inappropriate behaviour, identification, perhaps technical issues.

On page 11, the applicant mentions that diaries are going to be checked by a thir

g) Third party?
Reviewer: Who? Is the applicant referring to the project supervisors here?
Also need to describe how the information will be protected if this third party are not the academic supervisors

Committee comments:
This is a good quality application, providing extensive information on the project rationale, design, and execution of the research. We have the following comments:

1. The applicant describes that all data will be stored in the applicant's personal computer. The committee is unable to grant approval to projects storing data in personal computers. The committee recommends for data to be stored on the university S drive under a restricted folder in the first instance, so it's always backed up but can only be accessed by authorized people.
2. Section 9 statement, the committee recommends replacing the word candidate by researcher
3. A letter of support from the University of West of England (Department level or above) will be needed for this project application.

Please ensure that for the revised application, you use <u>either</u>:
a). Tracked changes or
b). Highlight the application changes so that the amendments are clear to the reviewer.

<u>Also</u>, a letter explaining how the reviewer points have been addressed (as for journals).

Please note that we will not accept revised applications unless they comply with the re-submission guidelines.
Please ensure that you quote project reference number _**2019-0013**_____ in any correspondence with the SUMS RESC

The time limit for applicant to respond	(Two months from receipt of email from ethics panel)

The Ethics Confirmation University of the West of England

Faculty of Health & Applied Sciences
Glenside Campus
Blackberry Hill
Stapleton
Bristol BS16 1DD
Tel: 0117 328 1170
Our ref: JW/lt

23rd May 2019

Janice St. John-Matthews
Academic Director (Student Journey)
Department of Allied Health Professions

Dear Janice

Application Number: HAS.19.05.185
Application Title: Using the "Wisdom of the Crowd" in the Curriculum Design of a Pre-Registration Diagnostic Radiography programme

SUMS RESC reference: 2019-0013

Your Swansea University Medical School (SUMS) RESC ethics application and approval conditions have been considered by the Faculty Research Ethics Committee on behalf of the University. It has been given ethical approval to proceed with the following conditions:

- You comply with the conditions of the SUMS RESC ethics approval.
- You notify the Faculty Research Ethics Committee of any further correspondence with the SUMS RESC.
- You must notify the Faculty Research Ethics Committee in advance if you wish to make any significant amendments to the original application.
- If you have to terminate your research before completion, please inform the Faculty Research Ethics Committee within 14 days, indicating the reasons.
- Please notify the Faculty Research Ethics Committee if there are any serious events or developments in the research that have an ethical dimension.
- Any changes to the study protocol, which have an ethical dimension, will need to be approved by the Faculty Research Ethics Committee. You should send details of any such amendments to the committee with an explanation of the reason for the proposed changes. Any changes approved by an external research ethics committee must also be communicated to the relevant UWE committee.
- Please note that any information sheets and consent forms should have the UWE logo. Further guidance is available on the web: https://intranet.uwe.ac.uk/tasks-guides/Guide/writing-and-creating-documents-in-the-uwe-bristol-brand
- Please note that the University Research Ethics Committee (UREC) is required to monitor and audit the ethical conduct of research involving human participants, data and tissue conducted by

academic staff, students, and researchers. Your project may be selected for audit from the research projects submitted to and approved by the UREC and its committees.

Please note that your study should not commence at any NHS site until you have obtained final management approval from the R&D department for the relevant NHS care organisation. A copy of the approval letter(s) must be forwarded to Leigh Taylor in line with Research Governance requirements.

The Faculty and University Research Ethics Committees (FRECs and UREC) are here to advise researchers on the ethical conduct of research projects and to approve projects that' meet UWE's ethical standards. Please note that we are unable to give advice in relation to legal issues, including health and safety, privacy, or data protection (including GDPR) compliance. Whilst we will use our best endeavours to identify and notify you of any obvious legal issues that arise in an application, the lead researcher remains responsible for ensuring that the project complied' with UWE's policies and with relevant legislation. If you need help with legal issues, please contact safety@uwe.ac.uk (for Health and Safety advice), James2.Button@uwe.ac.uk (for data protection, GDPR and privacy advice).

Please remember to populate the HAS Research Governance Record with your ethics outcome via the following link: https://teams.uwe.ac.uk/sites/HASgovernance.

We wish you well with your research.

Yours sincerely

[redacted]

Dr Julie Woodley Chair

Faculty Research Ethics Committee

Appendix **15.** SUMs and UWE ethic amendments for action cycle three

Swansea University Medical School Ethics Amendment

Ethical Approval

Ethics Committee Use Only

Principal Investigator	Janice St. John-Matthews
Title of Proposed Research	Using the "Wisdom of the Crowd" in the Curriculum Design of a Pre-Registration Diagnostic Radiography programme
RESC Project reference number	2019-0013A

Application approved	**Yes**		**No**		**Pending**	✓
Conflict of interest	**Yes**		**No**	X		
If yes, please supply details						
Chair of SUMS RESC	Deya Gonzaléz Professor of Molecular Medicine [redacted] Swansea University Medical School Singleton Park, Swansea, SA2 8PP, UK. Email [redacted] Tel [redacted]					
Date 07.10.19	Signature [redacted]					

This notice of the amendment to the application for ethical approval has been granted subject to the conditions specified below.

Conditions of the favourable opinion
The favourable opinion is subject to the following condition being met prior to the start of the amendment implementation.

1. Submission of an updated application incorporating all the changes requested.

Please ensure that you quote project reference number **2019-0013A** in any correspondence with the SUMS RESC

The time limit for applicant to respond	(two months from receipt of email from ethics panel)

UWE Amendment to Existing Research Ethics Approval

Please complete this form if you wish to make any alteration or amendment to a study that has already been scrutinised and approved by the Faculty Research Ethics Committee and forward it electronically to the Officer of FREC (researchethics@uwe.ac.uk)	

UWE research ethics reference number:	SUMS RESC reference: 2019-0013A HAS.19.05.185
Title of project:	Using the "Wisdom of the Crowd" in the Curriculum Design of a Pre-Registration Diagnostic Radiography programme
Date of original approval:	23.05.2019
Researcher:	Janice St. John-Matthews
Supervisor (if applicable)	Professor Phil Newton (Professor @ Swansea Medical School); Professor Andy Grant (Professor @Swansea Medical School); Dr Leslie Robinson (A/Professor @ Swansea Medical School)

1. Proposed amendment: Please outline the proposed amendment to the existing approved proposal.

The current research uses a participatory action research (PAR) approach. Following the completion of the first online workshop, we are asking the Chair of Ethics to consider the following proposed changes:

1. Change of target population.

SECTION FIVE (ORIGINAL ETHICAL APPLICATION, p7). Describe the participants.

Originally the study sought to invite only those who live in the city of Bristol to contribute. The reason for limiting this geography was to enable the researcher to manage potentially high levels of participants. There is no published data on crowdsourcing a curriculum, so I was unsure how many people would engage. After launching the first workshop, the researcher was approached by a small group of individuals who live outside the City of Bristol who had had imaging in Bristol and were keen to contribute and share their experiences. Including them will not impact on the research design or methodology. In total, workshop one has had 70 participants.

I am requesting to extend the participant pool to include those who have had imaging and/ or have been x-rayed at a Bristol hospital or clinic.

2. Change from observer to facilitator

SECTION SEVEN (ORIGINAL ETHICAL APPLICATION, p9). What procedures (e.g., interviews, computer-based learning tasks, etc.) will be used to gather information from participants?

It is noted in the original ethics submission the researcher did not explicitly ask to act as a facilitator within the online space. Having discussed this with my supervisors, I am keen to facilitate the second (and final) workshop to support the conversations that are happening. The researcher is an experienced educator in Higher Education and is confident that they will be able to manage the online conversation so as to uphold the trustworthiness of the data generated. A change in the researcher positionality is noted; however, there is no impact on the research design or methodology.

I request that my role as caretaker of the online engagement activity becomes one of the facilitators for the final workshop- workshop two.

3. Inclusion of additional demographic question

SECTION FIVE SECTION FIVE (ORIGINAL ETHICAL APPLICATION, p7). Describe the participants

Currently, I have ethical approval to ask the following as part of a gateway questionnaire: Name; Email address; High-level location (First three characters of the postcode); Demographic data (Gender, Age, Ethnicity); Job data (job role, i.e. employed, unemployed, student)

Reviewing data from the first workshop, some individuals have identified that they are health and social care workers. However, this has not been captured in the gateway questionnaire. The researcher wishes to capture this data for any future participants of the study to better understand who is contributing and their level of "insider" expertise on the topic. There is no impact on the research design or methodology.

I would like to ask one further question relating to whether the person participating has/ is working in Health and Social Care.

Do you or have you worked in Health and Social care?

No
Yes

If yes, are you currently:
An academic
Working in a health and/ or social care setting
A student
No longer working in Health or Social care

2. Reason for amendment. Please state the reason for the proposed amendment.

See section one above

3. Ethical issues. Please outline any ethical issues that arise from the amendment that has not already been addressed in the original ethical approval. Please also state how these will be addressed.

See section one above

To be completed by supervisor/ Lead researcher:

Signature:	Professor Phil Newton
Date:	07.10.2019

To be completed by Research Ethics Chair:

Send out for review:	☐ *Yes* ☐ *No*
Comments:	
Outcome:	*X Approve* ☐ *Approve subject to conditions* ☐ *Refer to Research Ethics Committee*
Date approved:	*23rd October 2019*
Signature:	*Julie Woodley (via email)*

Guidance on notifying UREC/FREC of an amendment.

Your study was approved based on the information provided at the time of application. If the study design changes significantly, for example, a new population is to be recruited, a different method of recruitment is planned, new or different methods of data collection are planned, then you need to inform the REC and explain what the ethical implications might be. Significant changes in participant information sheets, consent forms should be notified to the REC for review with an explanation of the need for changes. Any other significant changes to the protocol with ethical implications should be submitted as substantial amendments to the original application. If you are unsure about whether or not notification of an amendment is necessary, please consult your departmental ethics lead or Chair of FREC.

Appendix 16. Crowdsource engagement strategy

TWITTER		FACEBOOK COMMUNITY PAGE	FACEBOOK (BRISTOL) COMMUNITIES	COMMUNITY NEWSLETTERS
DAYS	Monday to Thursday			NIHR/ ARC West
FREQUENCY	Multiple Times	Daily	Daily	Bishopston Matters
PEAK TIMES	13:00pm-15:00pm	13:00pm-16:00pm	13:00pm-16:00pm	Frampton/ Winterbourne Matters
OTHER	No more than 2 Hashtags			Little Stoke Gifford
JULY				
15.07.2019	#MondayMotivation. Scholarly Activity			
16.07.2019	#Throwback Tuesday. WoMMen			
17.07.2019	#WednesdayWisdom			
18.07.2019	#ThankfulThursday. Supervisor			
19.07.2019	#FridayFollow. Clever Together Team			
22.07.2019	#MondayMotivation. Self-Care			
23.07.2019	#Throwback Tuesday. Sloane & Miller			
24.07.2019	#WednesdayWisdom			
25.07.2019	#ThankfulThursday			
26.07.2019	#FridayFollow. SUMs PhD Students			
29.07.2019	#MondayMotivation			
30.07.2019	#Throwback Tuesday. #SoMe Guidance			
31.07.2019	#WednesdayWisdom			
01.08.2019	#ThankfulThursday. Collaboration			
02.08.2019	#FridayFollow. UWE Doctorate Holders			
AUGUST				
05.08.2019	#MondayMotivation			
06.08.2019	#Throwback Tuesday			
07.08.2019	#WednesdayWisdom			
08.08.2019	#ThankfulThursday			
09.08.2019	#FridayFollow. Happenistas			

Holidays

12.08.2019		#MondayMotivation	
13.08.2019		Weekly. Countdown to Launch. 4	
14.08.2019		#WednesdayWisdom	
15.08.2019		#ThankfulThursday	
16.08.2019		#FridayFollow.	
19.08.2019		#MondayMotivation	
20.08.2019		Weekly. Countdown to Launch. 3	
21.08.2019		#WednesdayWisdom	
22.08.2019	Holidays	#ThankfulThursday	
23.08.2019		#FridayFollow	
26.08.2019		#MondayMotivation	
26.08.2019		Weekly. Countdown to Launch. 2	Monthly Newsletter Advert
27.08.2019		#WednesdayWisdom	
28.08.2019		#ThankfulThursday	
29.08.2019		#FridayFollow	
SEPTEMBER			
02.09.2019		#MondayMotivation	
03.09.2019		Weekly Countdown to Launch. 1	
04.09.2019		Daily. Countdown to Launch. 5 days	Monthly Newsletter Advert
05.09.2019		Daily. Countdown to Launch. 4 days	
06.09.2019		Daily. Countdown to Launch. 3 days	
09.09.2019	Crowdsource: Action Cycle Two NET Conference	Launch: Public crowdsource one	
10.09.2019		Daily Update	
11.09.2019		Daily Update	
12.09.2019		Daily Update	
13.09.2019		Daily Update	
16.09.2019		Daily Update: Word cloud	
17.09.2019		Daily Update	
18.09.2019		Daily Update	
19.09.2019		Daily Update	
20.09.2019		Daily Update; Close and Next Steps	

23.09.2019		
24.09.2019		
25.09.2019		
26.09.2019	Analysis Data	
27.09.2019		
30.09.2019		
OCTOBER		
01.10.2019		Reminder of second crowdsource
02.10.2019		Countdown second crowdsource
03.10.2019		Countdown second crowdsource
04.10.2019		Countdown second crowdsource
07.10.2019	Crowdsource: Action Cycle Three	Launch: Public crowdsource two
08.10.2019		Daily Update
09.10.2019		Daily Update
10.10.2019		Daily Update
11.10.2019		Daily Update
14.10.2019		Daily Update: Word cloud
15.10.2019		Daily Update
16.10.2019		Daily Update
17.10.2019		Daily Update
18.10.2019		Daily Update

HASHTAGS			ACCOUNTS	CHAMPIONS
	BRISTOL	**GENERIC**	@Bristol247	@Bristollive
#CrowdCurriulum	#instabristol	#ThankYouThursday	@UWEBristol	@BNSSGResearch
#Radiography	#CityofBristol	#FridayFollow	@UWE_AHP	@CAPHRSW
#300radiographydoctorates	#UWELife	#MondayMotivation	@Bristolcouncil	@SCoRMembers
#academicmum	#Bristolcity	#ThrowbackTuesday	@BBCPointsWest	@Western Daily Post
#curriculumdesign	#Bristol247	#WednedayWisdom	@BristolHealthP	@Bishopstown matters
#crowdsourcing	#UWEBristol		@BSNGG_CCG	@Bristollife
	#UWELife		@WEASHN	@Bristol_People

Appendix 17. Facebook community groups where advert was adopted

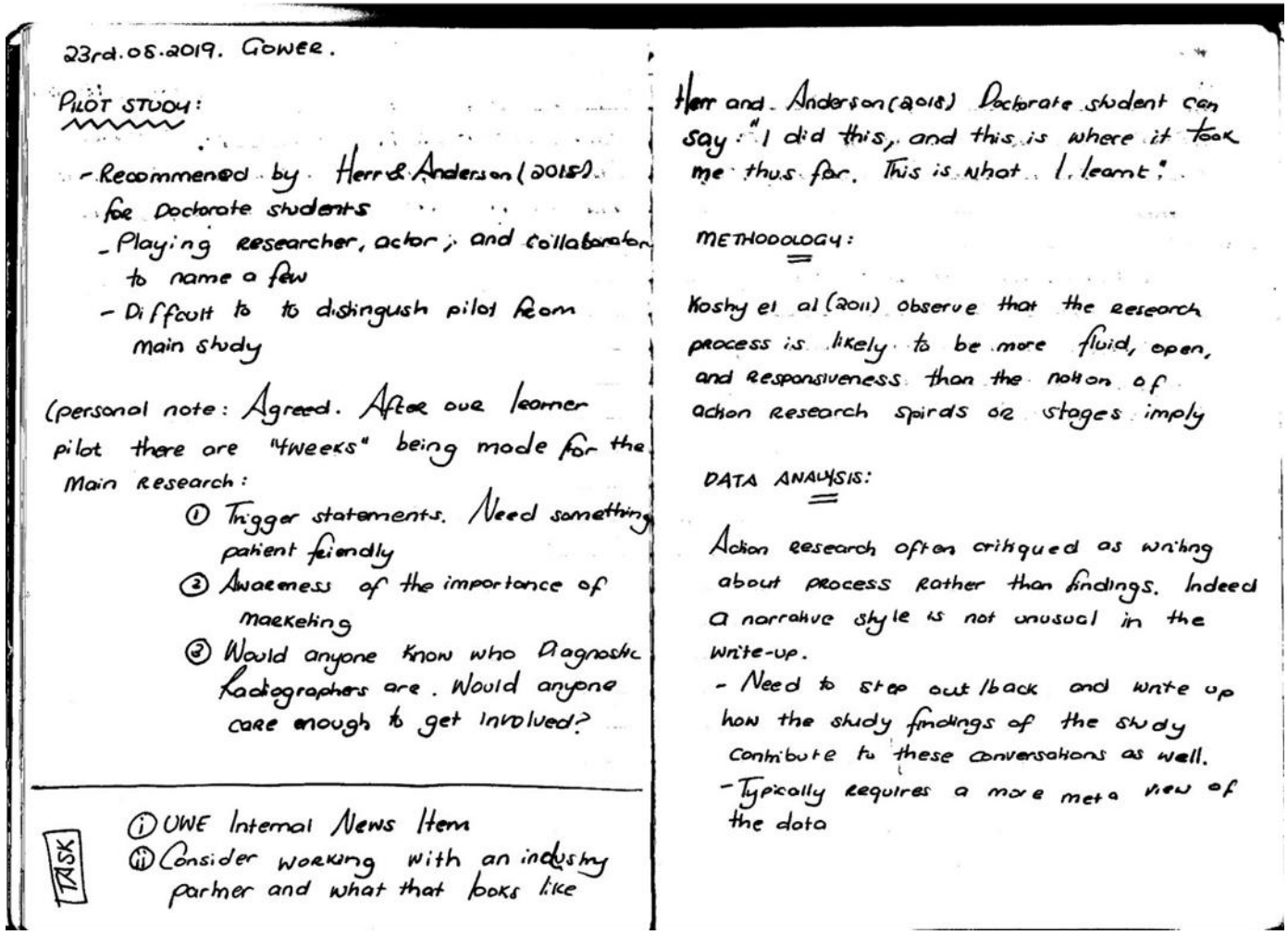
Name of Facebook community	Group type	About these groups (Facebook wording [sic])	Followers
Bristol City-BS3	Private	GIp Rules... No Personal attacks or threats, or racism No adverts or selling things as there is already plenty of pages for that already elsewhere.	4,800
BS5	Public	A catch-all group for pretty much anything in the BS5 area of Bristol. Not reading and following these rules will likely lead to the immediate deletion of post and potential deletion from group.	5,200
Buy and Sell Bristol	Private	Private group for buy and sell around Bristol	69,000
North Bristol NHS trust staff group	Private	A group for all North Bristol NHS Trust Staff. Past or present. Feel free to post your trust related posts, events. Non-profit advertising only, if you wish to advertise a business/event/product it must have a discount to NHS employees. All advertising is welcome on the classifieds page linked to this one. Thanks!	3,400
Greater Fishponds news and views	Public	General information and good news about the Greater Fishponds area.	10,000
Love Westbury on Trym	Public	Group by Westbury welcome and Westbury on Trym village show	280
BS3	Public	A community group for BS3 residents and enthusiasts. Buy, sell, and share.	5,500
Bristol LGBT Network	Public	An open group aimed at uniting the LGBT network of Bristol and Somerset. Feel free to post any relevant information or news to our members.	3,200
BS1 Connect	Public	Welcome to BS1 Connect, where community members can get together to share news, views, recommendations; sell/buy and generally show their love and knowledge of our area.	1,200
#Bristol Girl	Private	Bristol Girl is a project dedicated to empowering, inspiring, and supporting young women living in Bristol. We are running monthly meet ups, which will range from coffee chats to activities, to aspirational panel events, in order to connect the Bristol Girl community and create a support network for young women. We want to help each other make the most of this wonderful city that we call home.	5,800
Bristol Parents club	Public	Welcome to Bristol mums and dads, a community for parents in Bristol, South Gloucestershire, North Somerset, and Bath.	2,400

		This is a place for parents to chat and hear about what happenings in the Bristol area and discuss issues important to them. We want everyone to get involved, so if you have a tip you want to share with other parents, then feel free to post in the group. We will soon be arranging parenting socials and exciting deals for places across 'the area. We're happy to share events/classes that are going on in the area but please don't keep posting the same event/class every few days.	
BS9	Public	Hi everyone. This group is open to anyone connected to the BS9 postcode in Bristol. Please feel free to post any news, business promotions, sporting results. Anything you think that we will all find interesting. Thanks in advance	8,600
Bishopton, Clifton, Redland, Cotham, Bristol Local Services	Public	Local services advert some companies may be checked	2,100
Bedminster Down	Private	A community page for Bed–minster Down - this page has been created for the people of Bedminster Down to share archive photos, memories, information about local businesses, and events	3,500
Bristol selling page	Private	Please invite your friends and family to this group to share, sell and buy items from those uploaded by other users. All are welcome to this this site. Thank you! Welcome to new members, please be aware spammers will be deleted and banned	7,100
Bristol selling page	Private	No rules, Buy Sell Swap & freebies, ask questions, be nice folks	7,500
Buy and Sell BS34 BS5 BS6 BS7 BS9 BS10	Public	Buying and selling free items or swaps. Local events. No bumping business post more than once every two weeks. No animals. No Ann summers or similar. No smoking equipment or sell of tabaco. No fake goods. Items must state price and location. If you fail to collect on more than two occasions and the admin are informed, you will be removed. Free items are not to be sold on. Please respect others. Do not say yes unless you can collect the item. First to say please is whom item should be sold to Any issues inform admin I will sort	8,200
Hotwells, Cliftonwood and– Harbourside - Bristol, UK	Public	PLEASE read the Group rules be–ore posing - CLICK "See more" below - A place to post information, events, and discuss things going on that affect us in the Hotwells & Cliftonwood (and Harbourside) community.	1,200

		- All posts must be made in a community-spirited way, and always make a personal introduction t' any 'shared' post you make, so you are not posting a hard link such as an image with tiny text which forces people to click on the link t' see what it's about. - Do not post about lost or found items, please contact "”lost Property" - > www.avonandsomerset.police.uk/advice/property-and-money/lost-property - Do not post about missing cats, dogs, pets, etc, as notices posted in the immediate area are far more effective for locating lost pets. - It is ok to advertise for accommodation to let or wanted, but only include text details and no images uploaded to the group. - Businesses advertising their services or opportunities must not post more than once in every seven days.	
Bradley stoke and surrounding areas sell and buy	Public	Feel free to sell what you like as long as its legal. No arguing. Buy as seen. Add as many people you can to get this sight going :)	10,100
Bristol and surrounding areas	Public	No Business Thanks admin Marketplace in Bristol & surrounding areas	38,600
BS13 Connect	Public	For anything –S13 related - notices, events, news, groups, clubs, local offers etc **NO SELLING**	2,500
For sale in and around Bristol	Public	You can post what you like There is no rules Advertise your business Only bump every 5 hours First-person to comment should be priority sale unless they have 'aid they don't want i' if they don't come back to you within 5 hours sell to the next person	10,200
Southville, Ashton and Bedminster Information Board	Public	A group of interest to the (diverse) local community, no business ads more than once a week no abuse/name-calling if you don't like it, scroll on down or walk away	10,600
Bristol Buy, Sell & Service	Private	No work from home posts. No Recruitment Posts. No 'Looking For' or 'Wanted' posts. No weight loss or diet posts. No 'Animal/Pet Free' Posts. Only Businesses that are Local are to be posted unless offering a Nationwide service or product.	27,800

		No swearing or abusive comments. No reporting of 'competitor' or 'complying' posts. You will be removed and blocked if you breach these rules	
Kingswood Bristol (People)	Public	A Page for Kingswood people to chat about any subject, Family announcements, Birthdays, weddings deaths, also Garden fetes, Jumble sales, musical events, a virtual Chat Over the Garden Fence Gossip and Nostalgia page for KINGSWOOD BRISTOL People. No Politics or Religion postings, please, treat everyone else with the same respect you want from them, keep it civil and friendly, and bad language or bullying will NOT be tolerated, and the aggressor(s) will be removed from the room	5,300

Appendix 18. Sample reflective diary entry



23rd.08.2019. Gower.

PILOT STUDY:

- Recommended by Herr & Anderson (2018) for Doctorate students
- Playing researcher, actor; and collaborator to name a few
- Difficult to to distinguish pilot from main study

(personal note: Agreed. After one learner pilot there are "tweeks" being made for the Main research:

① Trigger statements. Need something patient friendly
② Awareness of the importance of marketing
③ Would anyone know who Diagnostic Radiographers are. Would anyone care enough to get involved?

TASK
ⓘ UWE Internal News Item
ⓘⓘ Consider working with an industry partner and what that looks like

Herr and Anderson (2018) Doctorate student can say: "I did this, and this is where it took me thus far. This is what I learnt".

METHODOLOGY:

Koshy et al (2011) observe that the research process is likely to be more fluid, open, and responsiveness than the notion of action research spirals or stages imply

DATA ANALYSIS:

Action research often critiqued as writing about process rather than findings. Indeed a narrative style is not unusual in the write-up.
- Need to step out/back and write up how the study findings of the study contribute to these conversations as well.
- Typically requires a more meta view of the data

Appendix 19. Action cycle one: Ideas, comments, and votes

RANK	CHALLENGE QUESTION	IDEA	IDEA	COMMENT	VOTES	CONTRIBUTIONS
1	**Stop/Start/Different**	Placement Module Grading	1	7	35	43
2	**Updating Programme**	Engaging Lectures	1	8	16	25
3	**Stop/Start/Different**	General Imaging	2	7	11	21
4	**Stop/Start/Different**	Imaging Larger Patients	1	6	10	17
5	**Updating Programme**	Image Interpretation	1	1	13	15
6	**Updating Programme**	Practical Skills	1	0	10	11
7	**Stop/Start/Different**	Guidance after Dissertation	1	2	7	10
8	**Stop/Start/Different**	Imaging Modalities	1	3	5	9
9	**Technical skills Needed**	Patience	1	4	4	9
10	**Updating Programme**	Behaviour in X-ray Room	1	1	6	8
11	**Stop/Start/Different**	Placement Appraisal	1	0	6	7
12	**Updating Programme**	Professionalism	2	1	4	7
13	**Technical Skills Needed**	Interpersonal	1	0	6	7
14	**Technical skills Needed**	Communication	1	1	4	6
15	**Updating Programme**	More than a Uniform	1	1	4	6
16	**Mental Wealth**	More Time with Vulnerable Patients	1	1	3	5
17	**Technical Skills Needed**	Confidence	1	1	2	4
18	**Mental Wealth**	Range of People Imaged	1	0	2	3
19	**Mental Wealth**	Recognising student actions	1	0	2	3
20	**Updating Programme**	Peer Assisted Learning	1	1	1	3
21	**Technical Skills Needed**	Supportive	1	1	1	3
22	**Updating Programme**	Logbooks	1	0	0	1
					Total Contributions	**222**

Appendix 20. Action cycle two: Thematic analysis (Worked example)

Theme	Category	Code	Selected quotes
Patient Care Skills	**Empathy**	viewpoint	*They should be empathetic because an investigation may be routine to them but can be a very worrying and frightening experience for the patient.*
		listening	*Good listening skills is so important and patience to allow a patient to tell their story. The results of the scan may be life changing. Therefore having compassion and showing empathy is also essential*
		patience	*…. patience to allow a patient to tell their story. The results of the scan may be life changing*
	Compassion	sympathetic	*If the radiographers at least tried the position themselves, they would appreciate what the patients go through and what small changes could improve the experience*
		kind	*They should be able to think about what they need to say to patients but to say it in a kind way. "I need to protect your arms because of the angle you are going to the scanner, in it is possible to make your skin sore if your arms catch on the sides so I'm going to pop them in some pillow cases". Rather than "put her arms in pillowcases, she's so obese I don't want her skin ripping on the way in".*
		care	*Being good at performing the scan is not enough, it's important that the profession attracts individuals with a passion to contribute the care of patients.*
	Appropriate Information	results	*They explained what was going to happen and how I'd get the results.*
		supportive	*Be able to assess patients and support them, if someone is nervous talk to them and comfort them*
			She warned me that there were times that she was going to hurt me due to the positions she needed to put me in. Knowing that was helpful as I was prepared.
	Communication	adaptive	*Diagnostic radiographers will need excellent communication skills as they often only meet a patient once and they need to build a quick rapport with the patient to help them through the examination. They will be dealing with a variety of people- patients of all ages, carers, families, other healthcare*

			professionals so they need good communication skills which help to demonstrate their caring professional manner.
		#hellomynameis	*Sometimes the person performing the scan doesn't introduce themselves but goes straight into what they want you to do. If the radiographer says who they are and tries to put you at ease relaying instructions, it will make the whole experience a lot better.*
		clarity	*They need to speak with clarity and be aware of the stressful situation the patient may be in.*
		simple	*The scan and findings have been explained in simple terms I can understand.*
		Verbal non-verbal	*excellent verbal skills to explain to the patient what to expect during the procedure*
		Physical space	*When the scan was done, I had to ask if I was finished as radiographer went behind wall without any acknowledgement. I knew what would happen, but communication is so important.*
		Interpersonal	*They were so friendly but professional.*
	Partnership	Two-way street	*I have had regular scans CT and MRI before and since the removal of a brain tumour. All Radiographers I have had to deal with have been pleasant, informative, and encouraging. I always seek to remain calm, and this is as encouraging to them as much as it is for me.*
	Professionalism	attire	*UWE students generally come across quite professionally although they at times will wonder into placement when it suits them or wear trainers. It doesn't only reflect poorly on UWE but their clinical placement site too.*
			I can understand the need for this appearance of a member of staff, but everyone is different, so this is a hard thing to judge. In difficult situations, I think it is important for the radiographer to be honest and converse with the patient if possible if the examination is likely to be difficult and try to work with them to make it as easy possible. I think sometimes having the confidence to tell a patient they need their help to make it work, is a hard thing to get to grips with.
		actions	I *had a scan where I had to lay in the scanner for 2 hours, having a scan 15 minutes. No one really talked to me during that time and the person in the room with me was playing solitaire on the computer!*

Patient Needs	**Adapting imaging techniques**	alternative technique	*Be prepared to be adaptive, if a patient needs additional support transferring to the position for the scan and assessing if a patient is well enough to* stand for an x-ray for example.
		problem solving	*When things don't go to entirely to plan, the radiographers need to be quick thinking, confident, with a broad enough technical, anatomical, and interdisciplinary knowledge to be able to problem solve / refer / create a solution or alternative, ideally without the patient having to go home and come back again. This of course need to be done whilst communicating well with the patient.*
		mental health	*….acknowledge all patients may have anxiety, mental health, physical or development issue and it is the role of anyone in the NHS to ensure their needs are met whether on the ward, in clinic or in the imaging suite…….*
		Learning disability	*In my role as a learning disability nurse I have had to support adults with a learning disability (LD) access MRI, Mammography and X Rays. I have had mixed experiences in this role. Even though people are known to have LD, radiographers are not always confident or competent in knowing how to support the person most effectively. Key in this is having enough time and information in the correct format to enable the person to understand what is happening to them, so that they feel reassured and able to give informed consent for what is required. I remember one radiographer telling me that she would have appreciated knowing that the woman was " mentally handicapped" before she attended for her mammogram...that language and comment made within ear shot of the person, was not reassuring. All radiographers (already qualified and new) need to understand their legal duty to make reasonable adjustments. I suggest they receive training in their curriculum that includes people with an LD sharing their lived experiences...good and poor.*
		lymphedema	*My Mum had severe lymphoedema and had difficulty getting onto the scanning table. The radiographer seemed nonplussed by that*
		Parkinson's epilepsy	*My Mum has Parkinson's and can't lie flat and can be in a great amount of pain from doing so. I have epilepsy and, in the past, have been concerned about having a seizure whilst in an MRI scan as I would hurt myself. I would hope that the radiographer had a good understanding of the implications that other issues can have and the concerns that they would raise for the patient. I don't expect them to be experts in anything other than their field but would*

			hope that they have the awareness and ability to research the other issues that affect the patient.
		obesity	*They should be able to think about what they need to say to patients but to say it in a kind way. "I need to protect your arms because of the angle you are going to the scanner, in it is possible to make your skin sore if your arms catch on the sides so I'm going to pop them in some pillowcases". Rather than "put her arms in pillowcases, she's so obese I don't want her skin ripping on the way in".*
	non-discriminatory manner practice	religion	*I use a wheelchair. I am also a Muslim so less comfortable if the technician is male. However I was lucky that the staff (at XXXXX hospital for x-rays and XXXXX for an MRI scan) were consistently both patient and supportive to ensure that they took the image they needed, with minimum discomfort to myself but still maintaining the efficiency of the service's 'throughput' of patients.*
Professional Capabilities	**autonomy**	Understand patient pathways	*I feel strongly that the person carrying out the scan/Xray/MRI should be able to advise the referrer of a possible next step. I had a really positive experience when having an ultrasound scan, with the health care professional writing her findings for me (I am a healthcare professional myself) and I understood my shoulder problem. I just wish that action was taken quickly afterwards by my GP, and maybe a clear advice with recommendations would prompt the next step*
			It is important to be very with the patient as to what will happen after the appointment, as anxiety can be difficult to manage especially when very poorly
			It is important to be very clear with the patient as to what will happen after the appointment, as anxiety can be very difficult to manage especially when very poorly.
			My mum has waiting 3 weeks for the reporting of her CT scan which was urgently requested by her heart specialist. she had her follow up without the results being available meaning a pointless trip to the hospital. Her GP, the secretary and nurse specialist had chased the report. It would be nice to think that radiographers could also be involved in ensure smooth pathways and positive patient experiences rather than just doing what they have always done. Taking an example for cancer specialist nurses in breast cancer would make a huge difference to patient care
		Image acquisition skills	*The diagnostic radiographer should be technically competent to perform a procedure or have the relevant supervision*

	technical competency	limits of skills	*Skill to do it right the first time. Until they get to that stage, a new radiographer should always be helped and supervised on each case by an experienced one.*
	image reporting	preliminary comments and evaluations	*I had a fall and hurt my ribs. I had to have an Xray. It would have been really great to get the results there and then rather than wait for the Nurse Practitioner to give me the results.*
		formal radiographer lead reporting	*I think it must be possible to train radiographers to report - even if it is within a limited scope of practice. Would save more expensive doctors reporting on simple fractures that even a lay person could spot*
			I had a fall and hurt my ribs. I had to have an Xray. It would have been really great to get the results there
			2.5 hours for triage and X-Ray and a further 5 hours (until 1.30am) to be told that there was only one doctor for A+E, who could not review the x-Ray, so we would have to return next day. She spent the night in a tent, in significant pain with a broken arm before the-visiting waiting again and being cast. So I think it's very important that hospitals are using radiographer's expertise for this, not waiting on doctors.
Other Knowledge	**human body**	Anatomy Physiology	*I know very little about their job but would imagine it involves a good knowledge of anatomy and physiology along with technical skills to operative the machinery. health and safety for themselves and the patient.*
	tasks beyond imaging procedure	Pharmacology	*This was a harrowing experience because my body reacted badly to a pre op injection of buscopan. The technicians were extremely nice again, knew what they were doing and handled it really well, helping me complete the scan successfully.*
		ECG	*……. also think that radiographers should have some basic understanding of what it's like on a ward. Interpreting a basic ECG……*
		Manual Handling	*Safety is partly taught in manual handling when learning how to slide patients. However I learnt a lot about safety through experiences as a student on placement*
		Wheelchair manoeuvring	*Useful to be taught safety tips such as driving patients in wheel chairs up to the bed, so they don't have to hop far etc.*

Appendix 21. Action cycle two: Ideas, comments, and votes

No	Question	Idea Name	Idea	Comment	Votes	Total Contributions
1	**Radiographer skills**	Essential skills	4	5	17	**26**
2	**Radiographer skills**	Problem solving	1	4	20	**25**
3	**Imaging experience**	Types of imaging	13	0	9	**22**
4	**Radiographer skills**	Experience	1	0	14	**15**
5	**Imaging experience**	Confidence	1	4	4	**9**
6	**Radiographer skills**	Good understanding of other issues	1	4	4	**9**
7	**Radiographer skills**	Empathic and reactive	2	2	5	**9**
8	**Radiographer skills**	First priority should be safety	1	3	5	**9**
9	**Imaging experience**	Working with those with learning disabilities	1	3	3	**7**
10	**Did not work well**	It is how you say it	1	2	4	**7**
11	**Worked well**	Saying hello	1	0	6	**7**
12	**Imaging experience**	Breast clinic	1	0	5	**6**
13	**Radiographer skills**	Right first time	1	0	5	**6**
14	**Did not work well**	Talk about what is wrong with me	1	2	3	**6**
15	**Did not work well**	A warm and welcome reception helps build a rapport	1	1	3	**5**
16	**Imaging experience**	Technical skills aren't enough	1	1	3	**5**
17	**Imaging experience**	Good communication	1	1	3	**5**
18	**Did not work well**	Try the experience yourself (if possible)	1	1	3	**5**
19	**Did not work well**	Ask permission	1	1	3	**5**
20	**Radiographer skills**	Student training	1	2	2	**5**
21	**Radiographer skills**	Reporting skills	1	0	3	**4**
22	**Worked well**	Explain what is happening	1	0	3	**4**
23	**Imaging experience**	More reporting radiographers	2	1	1	**4**
24	**Worked well**	Kindness	1	1	2	**4**
25	**Imaging experience**	Adapting technique	1	0	2	**3**
26	**Imaging experience**	How you communicate	1	1	1	**3**
27	**Imaging experience**	Results straight away	1	0	2	**3**
28	**Did not work well**	It's my body and I have a right to know what you see	1	1	1	**3**
29	**Worked well**	It's my body and I have a right to know what I see	1	1	1	**3**

No	Question	Idea Name	Idea	Comment	Votes	Total Contributions
30	**Worked well**	Professional on all occasions	1	0	2	**3**
31	**Worked well**	It is how you say it	1	1	1	**3**
32	**Did not work well**	Don't ignore me	1	1	1	**3**
33	**Imaging experience**	Work with the person to get the best outcome	1	0	1	**2**
34	**Radiographer skills**	Advice to GPs regarding advice and referrals	1	0	1	**2**
35	**Imaging experience**	Bad experience	1	0	1	**2**
36	**Imaging experience**	Same day service	1	0	1	**2**
37	**Did not work well**	Some points to ponder	1	0	1	**2**
38	**Imaging experience**	Each day I wanted empathy	1	0	0	**1**
39	**Radiographer skills**	First priority should be safety	1	0	0	**1**
40	**Worked well**	Community help	1	0	0	**1**
					TOTAL CONTRIBUTIONS	**245**

Appendix 22. Action cycle three: Ideas, comments, and votes

	Challenge Question	Idea Name	Idea	Comments	Votes	Total Contributions
1	**Year one module. Practice**	Six months in the University followed by 14 weeks in a hospital needs reviewing	1	18	38	**57**
2	**Year one module. Practice**	Learners should spend time on a hospital ward	1	15	28	**44**
3	**Year one module. Practice**	Learners should demonstrate care, empathy, and good listening skills	1	9	26	**36**
4	**Year one module. Practice**	Learners should demonstrate safe practice	1	8	22	**31**
5	**Year two module. Professional Behaviour and Health Psychology**	Learners should work with different patient groups	1	12	18	**31**
6	**Year two module. Practice**	Learners should undertake a placement with a mental health trust	1	10	16	**27**
7	**Year two module. Professional Behaviour and Health Psychology**	What is professionalism?	1	11	10	**22**
8	**Year one module. Practice**	Balance between talking to patients and carrying out the necessary procedure	1	2	12	**15**
9	**Year two module. Practice**	When an image need repeating, the radiographer should be able to tell you why	1	4	7	**12**
10	**Year two module. Professional Behaviour and Health Psychology**	LGBT: what expectations they may have of you as a professional	1	5	6	**12**
11	**Year one module. Practice**	Simulation in a placement hospital	1	2	8	**11**
12	**Year two module. Practice**	Diagnostic radiographers should be able to adapt their imaging technique	1	4	5	**10**
13	**Year two module. Professional Behaviour and Health Psychology**	This module should include informed consent, capacity, confidentiality, justice, fairness, and resource allocation	1	3	6	**10**
14	**Year two module. Professional Behaviour and Health Psychology**	To have discussed different ethnic minority groups	1	2	6	**9**
15	**Year two module. Practice**	Learners should be developing skills on how to communicate with a range of patient groups	1	5	2	**8**
16	**Year three module. Healthy futures**	Medical Students: Is this not already happening?	1	3	2	**6**

	Challenge Question	Idea Name	Idea	Comments	Votes	Total Contributions
17	**Year three module. Healthy futures**	Inclusion of Medical Students in this module	1	1	2	**4**
18	**Year two module. Practice**	Learners need the skills to treat children	1	0	2	**3**
19	**Any other ideas**	Placement position in 3rd year	1	2	0	**3**
20	**Year two module. Practice**	Better marking system for appraisals with a higher pass mark	1	0	1	**2**
21	**Year three module. Healthy futures**	Modality Specialist Module	1	1	0	**2**
22	**Year two module. Practice**	More focus should be on echocardiograms	1	0	0	**1**
23	**Year three module. Healthy futures**	Leadership	1	0	0	**1**

Appendix 23. Combined mapping of curriculum changes as a result of action cycles

Crowd said (Theme)	Programme will maintain	Programme will develop
Syllabus content	*Reflective practice *Using service user stories *Using standardised patients and service users for simulations *Role-modelling by academic staff	*Further develop service user input *Increase clinical practitioner involvement in practical teaching sessions at the University *Consider accessing local clinical hospital (placement) capacity for simulation using medical imaging equipment *Explore links shared in the crowdsource and how these can be integrated into the programme: Sari, the King's Fund, the point of care foundation, healthtalk.org, e-learning for health safeguarding modules *Working more closely with the UWE Bristol, Patient Public involvement (PIPE Team) *Consider leadership (teaching of) within the curriculum
Assessment and feedback	*Clinical portfolio consisting of weekly reflective logs, logbook *Assessed through reflection on practice through the medium of presentation with Q and A	*Reflective presentation will remain in Year two *A self-audit of practice being introduced in year three. This assessment has been designed with clinical partners and will be aligned to newly qualified radiographer competency requirements.
Learning environment	*****Current technology-enhanced learning and teaching activities	*****Use of lecture recording for all suitable teaching sessions *Integration technology-enhanced learning across more modules

	*Current simulation activities within the programme for plain imaging, including inter-professional simulation opportunities	*CT simulations through the increased use of newly purchased CT scanner *Increased involvement of clinical practitioners in the delivery of simulation activities within the University
Academic support	*Academics supporting learners on 14-week clinical placement blocks	*Embedding the institutional Mental Wealth strategy into the curriculum *Using the toolkit being developed as part of the Office for Students SHIED project within the diagnostic radiography programme
Patient care skills	*Attend practical assessments in full uniform and graded on professionalism *Weekly written reflective logs when on placement, including professionalism	*Ensure a diverse range of service users supporting learning and teaching activities (across the eight protected characteristics) *Removal of a single year one patient care skills module and map this learning into modules that support care and technical learning across years one, two and three
Patient needs	*Continue to teach a range of patient conditions across the three year groups *Extracurricular study day on Suspected Physical Injury (SPI) for year three learners *Annual safeguarding mandatory training modules before attending clinical placement (e-learning for health platform)	*Ensure a diverse range of service users supporting learning and teaching activities (across the eight protected characteristics and a range of clinical conditions) *Specific teaching opportunities on supporting the LGBTQIA+ community *Consider teaching and learning opportunities across all the protected characteristics

Professional capabilities	*Continue teaching image interpretation during the year one, two, three with a final module which ensures graduates of the programme can offer a clinical comment on general x-raying images they take	*Session on patient, public co-design, and coproduction in the context of national health and social care strategies such as the NHS Long Term Plan (2019)
Other knowledge	*Practical manual handling training *Yearly basic life support training *IV cannulation training in year three using the SCoR IV competency framework	*Consider alternative placements in care homes, on hospital wards or following patient pathways
Clinical placement logistics	*Current positioning of clinical placement within the academic year *For year three, have a simulation fortnight in early May before students graduate and take first posts	
Interprofessional Learning	*Continue to deliver this programme with the other five Allied Health Programmes in the department *Develop teaching and learning opportunities with the UWE Bristol Physician Associate programme	*Explore learning and teaching opportunities with the Medical school at the University of Bristol

Appendix 24. Lego depiction of thesis

In the image foreground, traditional health professions pre-registration curriculum design meetings often happen in physical spaces, at set times with set agendas. The results are the same types of people contributing in a set way. This is a particular challenge in broader health research where those contributing as curriculum stakeholders, specifically patients with lived healthcare experience, are often white, retired middle-class individuals. Thus through the processes adopted, the homogenous voices are captured as the voice of everyone. In this image, crowdsourcing is a digital tool depicted by the "computer" at the top of the ramp. Here a diverse group of individuals can join in and have their say on curriculum design at a time and place that works for them. Thus the heterogeneous characters outside the walls are diverse, representing the broad spectrum of people who ultimately will be cared for by those undertaking health professions educational programmes.

Appendix 25. Doctorate outputs as of December 2021

Journal Articles		
Article	**Citations**	**Almetric score**
St. John-Matthews, J., Wallace, M., & Robinson, L. (2017). The Delphi method in radiography education research. *Radiography*, *23* (1), S53-S57. https://doi.org/10.1012/j.radi.2017.03.007	20	**22** In the top 25% of all research outputs scored by Altmetric. **59** tweets from **30** users, with an upper bound of **90,572** followers.
St John-Matthews, J., Newton, P.M., Grant, A.J., & Robinson, L. (2019) Crowdsourcing in health professions education: What radiography educato can learn from other disciplines. *Radiography, 25* (2), 164-169. https://doi.org/10.1016/j.radi.2018.22.006	3	**18** In the top 25% of all research outputs scored by Altmetric. **Forty-four** tweets from **24** users, with an upper bound of **77,149** followers.
St. John-Matthews, **J**., Robinson, L., Martin, F., Newton, P., Grant, A. (2020) Crowdsourcing: A Novel Tool to Elicit the Student Voice in the Curriculum Design Process for an Undergraduate Diagnostic Radiography Degree Programme. *Radiography, 26* (S2), S54-S6. https://doi.org/10.1016/j.radi.2020.04.019	3	**23** In the top 25% of all research outputs scored by Altmetric. **53** tweets from **30** users, with an upper bound of **57,648** followers.
Presentations delivered		
St. John-Matthews (December, 2021*) Public Patient Involvement (PPI) in radiologic technologist education: Navigating the ladders, pathways, bridges, mosaics, and EDGEs*. Radiological Society of North America (RSNA) Hybrid Conference. Chicago. (Presented virtually).		
St. John-Matthews J., Robinson, L. Martin, F., Newton, P. & Grant, A. (September, 2021) *Crowdsourcing: A Novel Tool to Elicit the Student Voice in the Curriculum Design Process for an Undergraduate Diagnostic Radiography Degree Programme*. Advance HEA Virtual NET Conference.		
St. John-Matthews, **J.** (June, 2020) In: Crowdsourcing: A Novel Tool to Elicit the Student Voice in the Curriculum Design Process for an Undergraduate Diagnostic Radiography Degree Programme. UWE Festival of Learning, Virtual Conference, Bristol, England		

St. John-Matthews, J., Robinson, L., Martin, F., Newton, P., Grant, A. (September, 2019). *Using the "Wisdom of the Crowd" to support teaching and learning in health professions education.* Advance HEA NET Conference, Keele University.
St. John-Matthews, J. (December, 2018). *Using the "Wisdom of the Crowd" to support teaching and learning in radiography education*. In: Heads of Radiography Education conference, Leeds.
St. John-Matthews, **J.** (June, 2018). *Using the "Wisdom of the Crowd" to support teaching and learning in higher education*. In: UWE Bristol Learning and Teaching Conference, Frenchay Campus, Bristol, England.
St. John-Matthews, J., Newton, P., Grant, A., & Robinson, L. (March, 2018). *The role of crowdsourcing in health professions education.* Poster presented at Ottawa-ICME Conference, Abu Dhabi.
Swansea University Medical School (SUMs) events
St. John-Matthews, J. (May, 2018). *The role of crowdsourcing in health professions education*. Swansea University Medical School (SUMS) postgraduate research conference, Swansea.
St. John-Matthews, J. (May, 2019)*. Using the "Wisdom of the Crowd" in the Curriculum Design of a Pre-Registration Diagnostic Radiography Programme*. Swansea University Medical School PGR conference, Swansea.

Glossary

Advance HE
Advance HE is a member-led, sector-owned charity that works with institutions and higher education worldwide to improve higher education for staff, students, and society. Their strategic goals are to enhance confidence and trust in HE, address systemic inequalities and advance education to meet the evolving needs of students and society (Advance HE, 2022).
Allied Health Professions (AHP)
Clinical healthcare professions distinct from medicine, dentistry, pharmacy, and nursing. In England, this includes fourteen professions. Art Therapists; Dramatherapists; Music therapists; Chiropodists/podiatrists; Dietitians; Occupational therapists; Operating Department Practitioners' Orthoptists; Osteopaths; Paramedics; Physiotherapists; Prosthetists and Orthotists; Radiographers (diagnostic and therapeutic); Speech and language therapists (NHS England and NHS Improvement, 2022).
Crowd
An online community of individuals engaged in crowdsourcing activities (Howe, 2006).
Crowdfunding
The use of an online community to bring an idea or product to market through collective funding of several donors in the community (Fundable, 2022).
Crowdlearning
The development of online teaching and project work that brings together groups of learners to work together in the online environment (Llorente & Morant, 2016).
Crowdsourcer
An individual or organisation that operates a crowdsourcing application (Howe, 2006).
Crowdsourcing
Using an online, distributed problem-solving model to leverage the collective intelligence of online communities to serve organisational goals (Howe, 2006).
Crowdworker
The name given to those who voluntarily participate in crowdsourcing. Sometimes crowdworkers are paid for their time and effort; other times, the transaction is completed without monetary payment (Howe, 2006).
Diagnostic radiographer
Diagnostic radiographers use various techniques to produce high-quality images to diagnose an injury or disease. They are responsible for providing safe and accurate imaging examinations and the resulting report. Diagnostic imaging is a component of most care pathways (Society and College of Radiographers, 2022).

Higher Education Institute (HEI)
An institute that provides third or tertiary-level education, the educational level that follows the completion of a school providing secondary education. In the United Kingdom, HEIs provide undergraduate and postgraduate diagnostic radiography education (IGI Global, 2022).
Health and Care Professions Council (HCPC)
A regulator established to protect the public by keeping a register of health professionals who meet their standards for their training, professional skills, behaviour and health. Currently, there are fifteen professions accredited by the HCPC (Health and Care Professions Council, 2018).
Mental Wealth
The term mental wealth is a combination of mental health and wellbeing. It is the preferred term for policy at UWE Bristol, framing mental health as a positive consideration (UWE Bristol, 2022a).
NHS England and NHS Improvement (NHSEI)
NHS England and NHS Improvement is an arm's length body that seeks to support the NHS in England to deliver improved patient care. The two organisations came together in April 2019 (NHS England and NHS Improvement, 2022).
Quality Assurance Agency (QAA)
The Quality Assurance Agency for Higher Education is the independent body that checks on standards and quality in UK higher education. It conducts quality assessment reviews, develops reference points and guidance for providers, and conducts or commissions research on relevant issues (QAA, 2018).
Society and College of Radiographers (SCoR)
Responsible for the radiography communities' professional, educational, public and workplace interests. Over 90% of the United Kingdom radiography workforce is a member (Society and College of Radiographers, 2018). The Society of Radiographers (SoR) represents the trade union arm.
The University of the West of England (UWE Bristol)
A modern civic university with campuses across the city of Bristol. The institute received university status in 1992 (UWE Bristol, 2022).
Universal Design (UD)
Universal design means planning to build physical, learning and work environments so that they are usable by a wide range of people, regardless of age, size, or disability status (Connell et al., 1997).

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