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How can Scientists and Designers find better ways of working together? A case study of Playful Learning to Co-Design Visual Interpretations of Immunology Concepts.

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Abstract

In UK HE institutions there is a growing realisation and appreciation for academic disciplines to seek research partners beyond their own subject (QAA 2018). The rewards for developing understanding and sharing methodologies can extend beyond solving research questions to enhance the researcher and student learning experience. When academic researchers and students are given the opportunity to work together outside the confines of the curriculum and inhabit a space of 'otherness' in playful learning, liberated thinking and uninhibited ideation can transform patterns of learning and problem solving.

This study aimed to use interdisciplinary co-design workshops to create opportunities for bringing scientists and designers to work together, exposing them to the challenges of developing accessible immunology materials and to develop a pathway to reconcile them through empathy and reflective practice.

Our research evidence showed that projects like this are inclusive and engaging. Student participants were excited and inspired by each other's different knowledge and skills, but were also rewarded by overcoming different cultures of learning and communication. The efficacy of playful learning's 'otherness', and the 'out-of-hours' aspect were also interrogated and reflected upon in interviews.

The impact of this research will inform pedagogy on interdisciplinary learning, and be a persuasive argument for further Science and Design collaborations. More widely among the community, raised awareness of our immune system has the potential to modify behaviour and improve public health, as the student groups chose to focus on allergies, vaccinations and transplantation.

Introduction

Since 2000 there has been a rising awareness and research in collaborative practices across academic disciplines, particularly with those that interact with Design. The Design Council report, 'Multi-disciplinary Design Education in the UK' (2010), involved the participation of more than 30 universities and described how multi-disciplinary activity is being embedded in the UK's Higher Education Institutions (HEIs). Many involved collaborations with industry, Science, Technology, Engineering and Maths (STEM) subjects and demonstrated how Design and innovation are critical skills to be experienced by all disciplines, in order to reach future economic and social goals, largely shared across the globe.

In Science, The Royal Society of Biology values the development of student creativity and innovation in accredited programmes. This follows many modern scientific RandD organisations that are adapting insights and methodologies from design thinking (Simons et al 2011). The rewards for developing understanding and sharing methodologies can extend beyond solving research questions to enhance the researcher and student learning experience. When academic researchers and students are given the opportunity to work together outside the confines of the curriculum and inhabit a space of 'otherness' in playful learning, liberated thinking and uninhibited ideation can transform patterns of learning and problem solving. Differences in culture, in this case of learning and discipline, are the essential tools in creating the other (Abu-Lughod 1991; Bhaba 1994). How interdisciplinary research can be fostered within the structure and ecology of HEIs is a complex problem (Lindvig et al 2019; Townsend et al 2015; Lyall et al 2015), and some have even applied Design Thinking approaches to purposefully design an interdisciplinary culture (White and Deevy 2020).

Design and design methods are arguably ideally beneficial within interdisciplinary contexts, because it is a 'deeply human activity…(and) most people have the capacity to be creative whatever their disciplinary context' (White and Deevy 2020: 3). Design is inherent in human cognition, the process is human centric and collaborative, adaptive, iterative, diverging and converging in a non-linear and looping pattern (Cross 2001; Buchanan 1992; Friedman 2003). The nature of design practice in industry tends to bring designers into contact with clients and users from every walk of life and discipline. Building empathy and trust are paramount to successful creation and delivery of products and services (Redström and Wilste 2019; Lowgren and Stolterman 2004; Nelson and Stolterman 2000). As Cross (1982) argued, the academic

culture of Design came late following the established cultures of the Humanities (subjectivity and justice) and Science (objectivity and truth). If empathy is a key aspect of Design culture, it has to be practiced as a means, and not an end in itself, a designer must live in the shoes of 'others', and be aware of how others feel not just mentally, but physically in their space (Devecchi and Guerrini 2017).

Design Thinking, as established by the IDEO (2012) and Stanford Models (Brown 2009), provided a framework for our workshops, combining discovery and empathy, defining and interpretation, ideation, experimentation and testing in a presentation. Such a model embraces divergent thinking (all ideas are welcome in mind maps) (see fig. 1) and through dialogue and critical analysis leads to convergent thinking (synthesis and integration of ideas to identify a solution). This is similar to other models in education that facilitate engaged learning in iterative and reflective processes (Donaldson and Smith 2017; Jamal et al 2021).

Following recent studies that have sought to establish best practice for integrating 'interdisciplinarity' into higher education and research methodologies (Power and Handley 2019; Tobi and Kampen 2018; De Greef et al 2017) this study explored new methods of communicating and learning the principles of immunology, at a time when the concept of a pandemic was distant and seemingly remote. Recent student feedback from undergraduate Biological Sciences students at home and abroad studying with international partners indicated a demand for more visual aids and videos to assist in Learning and Teaching of complex immunological concepts. Verran (2019) concluded that 'combining art with science has been shown to be a way of enhancing understanding and communication' (2019, 1111). The subject discipline presents challenges for staff in the development and delivery of learning materials and experiences to facilitate the learning of these complex processes.

This study aimed to use interdisciplinary co-design workshops (Steen 2013; Steen, Manschot and De Koning 2011; Kleinsmann and Valkenburg 2008) to create opportunities for bringing scientists and designers to work together, exposing them to the challenges of developing accessible immunology materials and to develop a pathway to reconcile them through empathy and reflective practice (Schön 1992).

Definitions

In UK HEIs there is a growing realisation and appreciation for academic disciplines to seek research partners beyond their own subject (QAA 2018). Collaboration across faculties, institutions and industry is not new, but the terminology used continues to require

classification. Imagine the analogy of mixing a vinaigrette of oil and vinegar: they can exist separately, share a container floating distinctly from each other, or mix and emulsify.

For the purposes of our research and this paper we came together as Designers and Scientists in an interdisciplinary approach to solve a problem of communication and learning through seeing how theories and creative practice can work in other fields, and gain a more holistic view of the challenge under investigation. According to the terms defined by Townsend et al (2015) we do not identify or recognise the project as a multidisciplinary or transdisciplinary project. Multidisciplinary research infers that two or more disciplines keep to their boundaries of expertise in an isolated manner while working on a common subject. Transdisciplinary is the fusing of more than one discipline into a whole new entity, such as the fusion of biology and chemistry to create biochemistry.

Co-design

Sanders and Stappers (2008) describe co-design as a 'collective creativity', a 'specific instance of co-creation,' that is applied across the whole span of the design process, and identify the ambiguity often found at the start of the design process as the 'Fuzzy front end' (2008, 6). Co-design and co-creation fall under the term 'participatory design', which has been practiced in Europe for nearly five decades having originated in Scandinavia (Finland is a world leader in interdisciplinarity). Addressing social questions and issues, Participatory Design is an activity where designers and people without formal design training, usually the end-user, work together collaboratively on essentially human-centred design outcomes. The experts in the design situation are the non-designers, those that often, but not exclusively bring a lived experience or activity - 'a kind of design humanism aimed at reducing domination, and forming consensus' (Keshavarz and Mazé 2013).

A philosophical underpinning for co-design is provided by John Dewey, particularly his pragmatic perspectives on lived experience and community, which are as relevant today as when he wrote them nearly a century ago. Dewey advocated democracy, and 'promoted processes in which people are empowered to jointly reflect on their practices and experiences, to communicate and cooperate, and to improve their own or other people's situations' (Steen 2013, 18-21). He viewed lived knowledge as instrumental, to be used to inform the design process and so empower alternative positive futures through communication and cooperation.

Playful learning

Over the past decade, playful learning has become an emerging field following an increase of use in teaching and learning in higher education. Whitton (2018) highlights the dearth of research into the applicability and effectiveness of playful learning, and argues that there is 'a lack of understanding of the underpinning mechanisms that support the hypothesised links between play and learning, creativity and innovation. Playful learning in higher education currently lacks a coherent definition, evidenced pedagogic rationale or framework of implementation approaches' (Whitton 2018, 2). Recent conferences and journal issues have sought to lay a robust foundation and exemplify its many forms (Langan and Smart 2018).

> One of the appeals of play in education is an emphasis on exploration and experimentation in 'safe' environments. This is underpinned by the creation of places where failure is not only accepted, but valued and recognised as valuable for learning.
> (Langan and Smart 2018, 2)

In a Design Studio where creativity needs to thrive, it has to be welcoming and feel 'safe', and that can come from being a site of fun, where people can have space to be curious and find intrinsic motivation to socialise, learn and express their creativity through playfulness. 'Playfulness is a valuable trait, apparent in animal evolution and strongly linked to human creativity, learning and sociality. Often, it just needs an opportunity to emerge' (Langan and Smart 2018, 4). 'Having fun is a good reason to be playful' (Bateson 2015). This project mixes playful learning with a serious side of modern life: understanding the consequences of disease and the actions of our immune system remain as life threatening as ever.

Isaksen and Ekvall (2010) examine how difference and conflict affect creative climates and innovation. Here playfulness and humour are regarded as positive indicators of a relaxed atmosphere that bring spontaneity and ease. Difference can be accepted and appreciated, while allowing an advantageous creative tension through informed debate and expression of different ideas.

Schultz et al (2015) argue for a toolkit approach to 'serious play' as a means to foster creativity in innovation, particularly in a co-design and interdisciplinary context. Their toolkit-based model is built through playful action and is subsequently given meaning through storytelling (Sanders and Stappers 2008). Everyone 'gets' the story, it transcends difference. 'This 'storytelling' is also of playful character as it is more a dialogue with the model than an explanation. The storytelling is a reification of the result of serious play' (Schultz et al 2015, 5).

Storytelling

In the last 20 years, arts-based methods have emerged to challenge 'logical positivism and technical rationality as the only acceptable guides to explaining human behaviour and understanding' (Knowles and Cole 2008, 33). The emergence of digital storytelling (Robin 2016) has come at a time when the technology to record, edit and disseminate video has become more ubiquitous with mobile phones. This has made it easier to 'meaningfully capture participants' lived experiences and share research findings in a highly engaging manner' (Rieger et al 2018, 4). Early visual sociologists such as Gillian Rose (2016) argued that the visual is not simply a mode of recording data or illustrating text, but a powerful medium through which new knowledge and critiques might be created. Pink (2015) argues that images are part of contemporary reality and that a shift from text-based to image-based theory affords us a way of learning from images and how they might shape our thinking. Rice and Mundel (2018) reject storytelling as a prescriptive method rooted in a scientific or realist paradigm, but as 'a processual posthumanist one that emphasizes the qualities, relationalities, and potentialities of the specific localities, subjectivities, and technologies that present themselves in the moment' (Rice and Mundel 2018, 9). People are afforded agency to express themselves as they wish, and learn from the making of the story as much as the process of storytelling itself.

Robins (2016) proposes three categories of digital storytelling: personal narratives, historical documentaries, and 'stories that inform or instruct the viewer on a particular concept or practice' (2016, 18). For this research project the latter category was chosen by the PIs to direct a structured launch point for student creative enquiry that would lead to a learning and revision aid for use in Immunology classes.

Methodology

The project was proposed to an internal university Teaching and Learning award funding panel and on being granted funding went through ethical approval before commencing. Separate presentations were given to students from Product Design and Biological Sciences to explain the aims and structure of the project and information sheets and consent forms were provided and collated. On a voluntary and self-selecting basis students were motivated by the opportunity to work in interdisciplinary groups, to co-create designs and prototype displays. A structure of five Design Thinking workshops (Cross 2011; Lindberg et al 2010; Brown 2009):

1. Share and Capture
2. What's the Story and Medium
3. Define and Refine
4. Making
5. Presentation

The first four were held each month in the Design Studio on the Design campus and lastly presented in the classrooms at the Science campus. The researchers decided that the Design Studio was the most practical space to facilitate creative exploration in drawing and making materials.

At the launch event Science students brought examples of immunology concepts that they wanted to communicate and presented them to the group. This was an informal speed dating/round robin format, in small groups or a 1-min talk to the group. The Design students were able to ask questions and see what immunology concept interested them. From this point students were invited to form teams and which concept they wished to interpret in a story form (see figs. 1 and 2).

Fig. 1 Biological Science and Product Design students meet for the first time.

Fig. 2 Stories develop with visual research and concept boards.

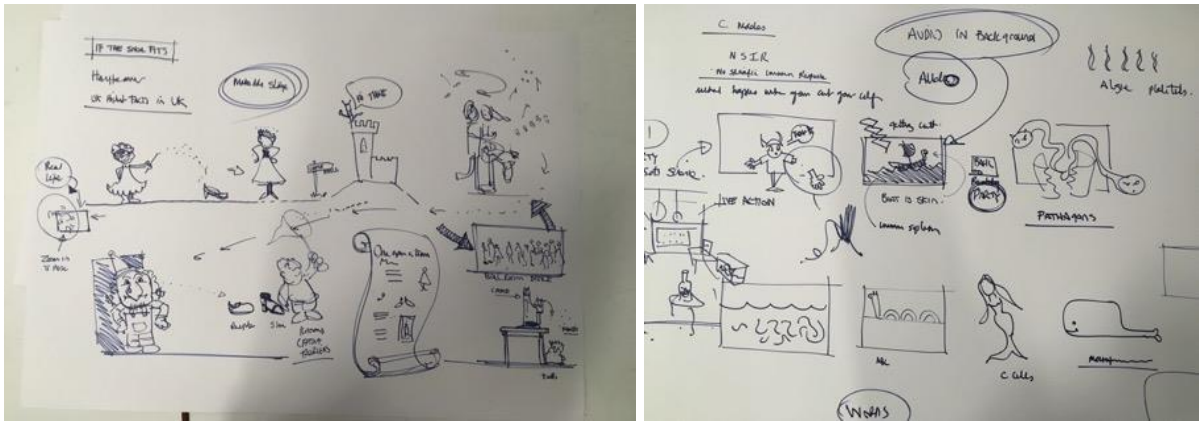

Fig.3 Product Design co-PI uses drawing to capture participant conversations to facilate concept development.

Using the principles of Storytelling (Robin 2016; Rice and Mundel 2018; Reiger et al 2018) the students developed concept boards, scripts and storyboards through an iterative process of presentations and idea selection. At the end of the two month project there were three teams comprising of a mix of six Product Design and six Biological Sciences students. Using their own initiative and craft skills each group created their own distinctive digital video using live action, model making and stop-motion animation as well as digital 2D computer rendering. A range of visual languages using contemporary and nostalgic cultural references employed pastiche, wit and drama to the complex scientific concepts of immunology (see figs. 6,7 and 8). Only the participating students have viewed these digital stories and so the study of the pedagogic efficacy of these videos is limited to their creators. A future study will be undertaken with a wider audience.

Data Gathering and Analysis

As the monthly workshops developed the researchers recorded visual and conversation observations of the student presentations and peer feedback (Blomberg et al 1993). The Product Design co-PI used drawing to capture the student conversations to help facilitate the communication between the different disciplines (see fig. 3). This method of visual thinking is a powerful tool for concept mapping and facilitating our understanding of abstract ideas (Averinou and Pettersson 2020). Semi-structured interviews (Neuman 2000) of the students in their groups were recorded on video to capture their reflections of the experience as the project progressed from ideation to production of their creative proposals (see appendix i). These explored their preconceptions, experience and future learnings of working in Science and Design interdisciplinary groups. Both positive and negative sides to the experience were questioned and discussed, ensuring each participant had an opportunity to give their personal

testimony. In follow up, a Likert questionnaire was distributed for anonymous data gathering to gauge some of the questions more empirically (see appendix ii).

Thematic analysis was undertaken to analyse the data collected in accordance with Braun and Clarke's (2006) guidelines of phases of familiarisation, generation of initial codes, searching, review and naming of themes. Interviews were transcribed verbatim with participant names replaced with codes (Designer coded A, Scientist coded B, followed by a number for group and respondent, eg A1.1 corresponds with a Designer in group1, respondent1) to ensure anonymity. Transcripts were stored on a secure data server with restricted access to project researchers. A triangulation of data collection from both the participants and researchers provided an opportunity to examine the experience from varied angles (Flick 2014).

Findings

From the qualitative triangulation of participant and researcher interviews and reflective accounts several key findings were identified and four themes emerged:

1. The influence of environment
2. Playfulness as a creative approach
3. Storytelling as a means of expression
4. Recognition of the value of Interdisciplinary working

1. The Influence of the Environment

Locating the workshops in the Design Studio had a profound effect on both sets of students. It was a very different environment to the sterile and organised laboratories that the Biological Science students associated with learning and their discipline (see fig. 4).

> … it's a routine that in the lab it's fixed in your mind since year one, coming in there it's not the same, it's a completely different, it's a more casual, more chilled space about it…in the lab I would start from A and get to B, in the creative arts room it's like no you don't go in there with a plan, you make the plan while you're there.
>
> (B3.2)

The studio had drawings and other images on the walls, shelves of models and cardboard prototypes, and also a break-out area with sofas and coffee making facilities (see fig. 5).

> …the classroom or the lab, where everything's, like, in its place,…because otherwise it can become contaminated or whatever, but the design studio was so, like, full of life and like, creativity.
>
> (B2.1)

The change in environment facilitated a change in their thinking, and encouraged them to relax , play and experiment.

> I was really more… what's the word, more… free, like, every time I looked at something, like, on the wall or something it would inspire me to be also creative. I don't know, it was weird, but I had that there.
>
> (B2.1)

> …felt like another home to me, you know, the lab was first and the creative arts room was kind of a second home where I just had to change my mentality and say 'okay no actually I have to work differently here than in the lab'.
>
> (B3.2)

The Science students not only adapted and became accustomed to the creatively liberating environment that the studios provided, but some regarded it as a 'second home'. It allowed them to identify with another way of thinking and working. They were not in the studio environment on their own, this was the domain of the Design students, and their influence is identified in the following findings. However, the Design students did not experience the Science laboratories first-hand, and so they could not experience an embodied empathy of 'otherness', it therefore put the emphasis on the Science students to adapt and empathise both mentally and physically to a different culture of learning (Devecchi and Guerrini 2017).

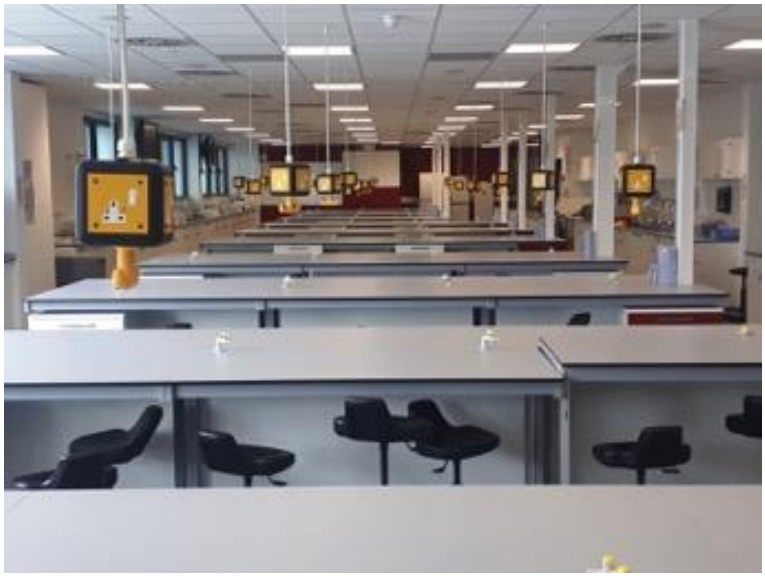

Fig. 4 Biological Sciences laboratory

Fig. 5 Product Design studio

2. Playfulness as a creative approach

As the project sat outside the curriculum for both the Product Design and Biological Sciences students, it brought freedom and a safe space, as an environment and in their timetable. There was an emphasis on exploration and creating a sense of fun. Giving the participants permission to play also helped forge personal relationships within the group. This created a relaxed atmosphere, which lead to more experimentation and courage to experiment with ideas and media. Playfulness provided an opportunity to embrace failure as a concept that is valued and recognised for its learning (Whitton 2018).

> I would say it's interesting, we also had fun, we had fun…
>
> (B2.1)

> … it's extracurricular so if you're signing up to it and committing to it you're doing it cause you want to and you enjoy it a lot more and when there's not a grade at the end it's less pressure and you just have loads of fun with it.
>
> (A3.1)

That sense of fun allowed the playfulness of idea generation and making, to explore the challenge of communicating immunology concepts, and to overcome the knowledge gaps between the different disciplines. They could openly share what they didn't know or understand and seek support from one another.

> I've got two favourite parts, it's the beginning and the end. At the beginning when everybody was just round the table and we were all just, like, throwing stuff and doodling stuff in a book, I really liked that…, like, flow of creativity.
>
> (A1.1)

> …we were really eager to learn and then if we had some problems we didn't have any problems with asking, like 'okay so you said that, I don't know what that means, can you simplify that?' or 'can you tell me a bit more about that?'
>
> (B1.2)

As the concepts developed it became clear that playful narratives were opening up innovative ways of explaining the complex science of immunology in a way that non-specialists could understand. These came in the form of storyboards and 'mood' or 'concept boards' that illustrated stylistic visual approaches of their idea using a broad range of cultural references that reflected the diversity of their backgrounds: European, Indian and Asian.

> For me it was a challenge trying to simplify such complex topics but I found it really entertaining and useful in a way because it is important that people know how important these topics are, even if there's a lot of new terminology that people may not be familiar with.
>
> (B3.2)

With these came a commitment to bring these stories to life through home-made videos and animation, using inexpensive software on readily available technology, such as their mobile phones and PCs.

> I think through making stuff it sort of forces you to get really invested in it in a way that you might not be if you were just, like, reading.
>
> (A1.1)

These were ambitious, given the scarcity of resources and extra-curricular demands on their time, forcing them to take responsibility for project management and delegation: all important soft-skills for future employment.

> …we started off as well with a really big project…then we sort of have to scale back, so that was a bit of a challenge.
>
> (B1.2)

> …it was all over the place a bit but we actually got something in the end.
>
> (B1.3)

> Yeah every meeting we would set goals, realistic goals, we would then go off and do what we needed to do and then in the next meeting we would organise, we would just bring everything back and discuss what things we would leave out/what things we would add in, and ultimately we always had an agreement on something and we were actually fascinated to see what were we going to make next. So yeah I think we didn't have that much difficulty, we actually enjoyed it.
>
> (B3.2)

> I think we developed a lot of soft skills that are not always covered within the modules that we do, like, the communication, working with other people, this sort of thing.
>
> (B1.2)

3. Storytelling as a means of expression

The playfulness led to the creation of stories to communicate complex immunological concepts. The immunology themes were decided by the student participants and as the Scientists explained the science the Designers began to find metaphors to visualise them.

> I think my skills, so these have been in translating messages, in translating information through visuals I think is what I brought to this…
>
> (A1.1)

> …weaving a narrative into that as well was… well, I mean, it was just kinda part of the process.
>
> (A3.3)

> …our concepts into more like loose ideas and metaphors, I think that wasn't easy at first.
>
> (B2.2)

The students were afforded agency to express themselves as they wished, and to learn from the making of the story as much as the process of storytelling itself. As the stories began to unfold, the learning became evident.

> …it is quite difficult because of the amount of stuff that's going on, so trying to find a balance on which ones are the most important ones, which ones can be left out and still manage to actually get a grasp of 'oh this is what the topic's about, this is why it's important' was, that was the challenge there but I think we managed to figure a nice balance between that.
>
> (B2.1)

> Well for us we were the ones in charge of telling the designer teams how to do it, so in a way I think it kind of helped us get more understanding of the topic in a way that, sort of, kind of teaching K how does it work, we internalise it and it was easier to learn for the exams and stuff.
>
> (B2.2)

As a learning aid, the process of explaining the concepts and visualising them for a new audience brought an enhanced cognition and retention, which were brought into play during the end of year exam.

Storytelling through the playfulness, afforded through the 'otherness' of the studio environment, allowed the participants to find innovative approaches to communicating complex scientific concepts.

> I never could've imagined that people would come up with ideas like this for immunology…
>
> (B1.3)

> …we were creating these connections, I feel like meeting us and…the stories and also cultures…trying to communicate, like, translate our minds and trying to tell us the concept or us trying to.

(B2.2)

The process of communicating these complex concepts by translating them into metaphors brought a powerful dynamic of interdisciplinary collaboration of creativity (see figs. 6,7 and 8).

> I feel connected to the topic and the classroom and I feel included in the whole dynamic.
> (B2.1)

Fig. 6 Storyboard and final video presentations (Vaccination).

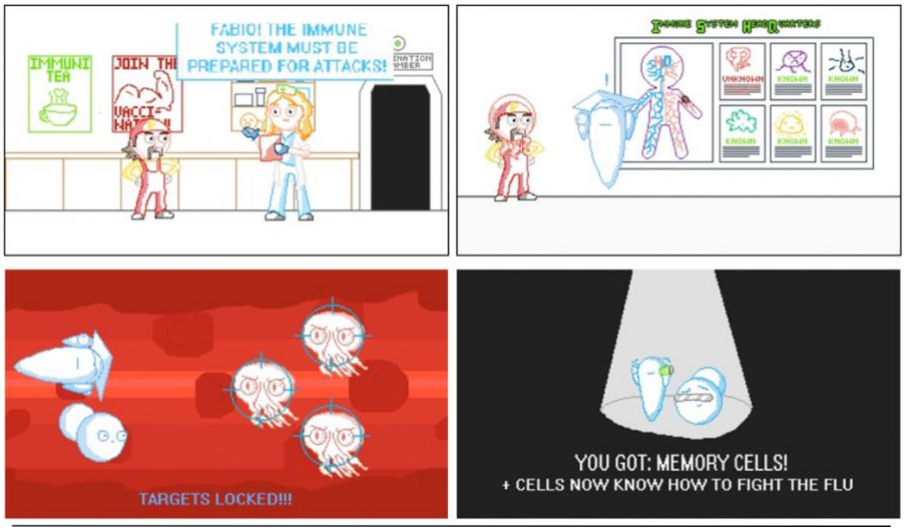

Fig. 7 Finished animation explaining immunology concepts of Vaccinations.

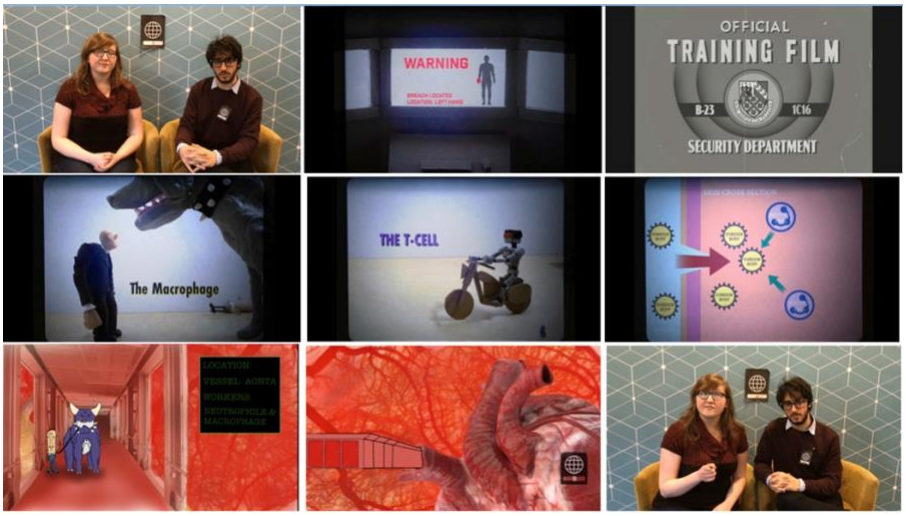

Fig. 8 Finished video explaining the immunology concepts involved in Transplantation.

4. Recognition of the value of Interdisciplinary working

The workshops began with a shared aspiration amongst the researchers to explore themes of co-creation between two different university faculties: Biological Sciences and Product Design. The student participants found their own voices and means of communicating through an emerging interdisciplinary approach, one that recognised the value of 'otherness' and different ways of seeing and making sense of the world.

> I just think it's amazing to see people with other talents doing something that I can't do myself, but sort of putting what I want to get through. So, I really like how that works together, that we sort of complement each other, like, stuff that I can't do but they can do so well, that's probably my favourite part of the whole experience.
>
> (B1.2)

> I think for designers it's a good way of showing how you can work with people outside of design and how that can produce really good results. I feel like we sometimes get stuck in a bit of a bubble in that we're right cause we're designers…
>
> (A1.1)

> I think it was maybe in the first meeting when we were all still immunologists and creative art students, but then it started to become, especially now, it's more of an us.
>
> (B3.2)

Through the interdisciplinarity of their work, the participants and researchers, both found unexpected value and learning that was over and above the objectives of the brief.

> It'll be less daunting, something like if you were met with something like this again you'd be up for it cause you're like 'ah, I have the experience, I've tried something like this before, I've enjoyed it, I wouldn't mind doing it again'.
>
> (B3.2)

> …being able to collaborate with other groups of students from different disciplines can sort of help you out as a person so you can look at different things that you could do with your degree as well,…working with other people that are not just scientists is really good for me as a scientist.
>
> (B1.2)

The experience opened their minds to ways of interacting with different subject areas, providing satisfying and enjoyable learning, which they would eagerly repeat and seek in the future, in whatever avenue and fields they found themselves as researchers, educators, scientists or designers.

DISCUSSION

Environment changes the person and context

Our findings from the interviews highlighted the novelty and 'culture-shock' (Page and Handley 2019) that the Biological Sciences students experienced when first entering the Design Studio for the workshops. In addition, access to the studio was at the end of the working day which added to the overall sense of calm in the building, and a developing sense of ownership of a creative environment that was their space and time. We also observed how the Product Design students had a different perception of their working environment through sharing their space with others. The Design Thinking process began with a Discovery phase that sought to establish empathy and understanding of the different cultures of Science and Design (Brown 2009; Devecchi and Guerrini 2017; Jamal et al 2021). Through the early conversations and 'getting to know you' stage that occurred naturally (Townsend et al 2015), the Designers began to appreciate their 'otherness' through the eyes of the Scientists. Compared to the descriptions of the sterile laboratories, they realised how unique their working environment is, and the power and significance of the tools and processes they use on a daily basis: objective Science experiments seeking truth beside iterative Design explorations using empathy and metaphor. We witnessed what was taken for granted now brought a sense of pride in the Design students as they showed others their 'creative', 'cool' world. Sennett (2009: 179) defines this as 'learning becomes local' where micro-environments can inspire and produce experiences and forms. There is greater potency for learning when difference is used as a catalyst and not homogenized or excluded.

> Tolerance, acceptance, and ability to combine different competencies in dialogue create rich learning environments...Some forms of knowledge can be codified and communicated as explicit knowledge…However, the most valuable knowledge is tacit. It is embedded and embodied in teachers and students.
>
> (Tellefsen 2000: 484).

Dialogue, in both verbal and visual mind mapping/storyboarding forms, is the key that reveals the differences in tacit knowledge.

Playfulness as a creative approach

One noticeable difference between the students from different disciplines was their approach to learning. The Product Design students were perceived to have a playful, random and experimental thinking when problem solving. This was countered by a more detailed analytical and precise thinking of the Biological Sciences students. Rather, we observed that the Scientists were naturally communicating more freely and generally. They were mindful not to allow the details and complexity of their subject matter get in the way of the descriptions of immunology. This was driven by a need to quickly communicate and interpret complex scientific concepts to their non-subject specialist counterparts. It could be argued that they were passively and indirectly inviting the Designers to engage with this other discipline by using the method of 'fuzzy thinking' which is a thinking approach often used within the design realm.

> Contrary to our normal thinking, concepts are often more useful when they are blurred/vague/or fuzzy, because then they have more potential. If they are too detailed, they cover too little, on the other hand, if they are too general, they cover too much and provide little direction.
>
> (De Bono 1992: 65)

It is interesting to see how much the word simplicity features in the students account of their experiences, plus how much of the projects were driven by fun and a freedom to experiment and learn by failing, as one interviewee comments:

> I feel like it's really important as well, and useful and fun to get to see another person's view on something that you are studying and how they translate that into a video or animation…
>
> (B2.2)

As in previous studies (Whitton 2018), the 'magic circle' where playfulness can occur is constructed by the participants over a period of time where trust can be developed through shared intrinsic motivation. 'Playful learning provides a space where participants have freedom to fail, where failure does not have serious consequences in the real world' (Whitton 2018, 3), and while some outputs were better than others. it stretched the creative and conceptual thinking of all. The fantasy video game and multimedia videos corresponded with the another characteristic of playfulness (Whitton 2018), the immersion into a world of make-believe without fear of ridicule. The fantasies that the different groups played out reflected their own cultural influences and childhood/adolescent experiences, crossing European, Indian and Asian ethnic backgrounds.

According to de Bono (1992) humour and creativity are based on the same processes where sequences of experiences that set up patterns of perception and conditions, 'side-patterns', are unable to be accessed merely through linear thinking. Creating situations which can help us switch across patterns is the basis of lateral or sideways thinking. He suggests that when we have access to side patterns, we have either humour or creativity. In this theoretical context it is less surprising that the creative concepts were communicated through storytelling metaphors, using playful characters and cultural references that would entertain their peers.

Storytelling as a means of expression

We observed that the Biological Sciences students took the lead in editing and making choices on what bits of information were important to tell their story. During this process the students self-reflected on their learning. They were also reinforcing their learning through teaching the Product Design students.

> … we chose transplantation, and it is quite difficult because of the amount of stuff that's going on, so trying to find a balance on which ones are the most important, which ones can be left out, and still manage to actually get a grasp of 'oh this is what the topic's about, this is why it's important', that was the challenge there…
>
> (B3.2)

Storytelling facilitated the communication and translation of complex scientific terminology and processes into audio, though largely, visual outcomes. As Pink (2015) argues, images are part of contemporary reality, and cultural and visual references, such as the Super Mario-like character in a video game, or the faux 1950s B-Movie styling in another video, are landmarks of a shared language that brought the different disciplines together. This also assisted recall and cognition of the scientific principles when students were later in examinations.

> I remember like the T cells, I was like 'oh this is how A drew them'. So when I was preparing for my exam I think that bit came really easy to me, just because of the extra work we put into it, because I could see it in my head how that works.
>
> (B1.2)

Using cultural references in this way was both a contribution to and a result of the playfulness inhabiting the workshops. It was a safe and shared space of cultural identity that they could explore together, rather than having to negotiate the more ethically challenging approach of personal testimonies (Robins 2016).

Recognition of the value of Interdisciplinary working

Our findings support recent studies of interdisciplinarity and acknowledge that interdisciplinarity is best fostered outside the curriculum, not forced upon, and supported by authentic leadership from those who practice interdisciplinarity (White and Deevey 2020; Page and Handley 2019; Townsend et al 2015).

> …for disciplines to work together, there needs to be discipline respect, appreciation, ground rules, understanding of bias and genuine understanding and appreciation of cultural differences…. It was suggested that there needs to be an exchange of cultures which, as McLeish and Strang (2014) recognised, may be a disconcerting and challenging process, perhaps even resulting in a culture-shock and creating discipline insecurities. However, without this, there will never be a true understanding of being.
> (Power and Handley 2019, 567)

The findings show an emerging realisation that the experience of interdisciplinarity has revealed a new way of viewing their discipline and future path, and have enriched their experience of university. 'As a result, they navigate differently through the interstices, thereby playing a vital role in creating interdisciplinary activities in structures that were not originally built for it' (Lindvig 2019, 357).

Both sets of students reported their use of soft-skills to engage with each other and move the projects forward. Such skills are imbedded in the Product Design students' learning, but are not explicitly taught on the programme. The workshops and interviews revealed this skill to the students. They moved from being the makers and producers within the team, to the facilitators and strategists enabling the sharing of knowledge and skillsets. The changing role of the designer from one who not only designs tangible outputs but who uses their design thinking skillset to gain 'a deeper understanding of the nature of the design process and a developed sense of how each personalised and particular design process should be designed' (Nelson and Stolterman 2012, 259) is demonstrated here. Sanders and Stappers (2008, 15) continue the debate proposing that 'designers will need to play a role on the co-designing teams because they provide expert knowledge that the other stakeholders don't have'.

> I really value these interdisciplinary activities because I feel like that's what designers could do a lot, they have to interact with a lot of other people from different areas.
> (A1.1)

Sanders and Stappers (2008) affirm that designers will be key in the development of future tools and processes for design-thinking. They assert the designer will be instrumental in making tools for non-designers to convey creative ideas. As practicing Designers and academics, our professional practice has been to act as a catalyst to bring communities together and encourage innovation, what some would describe as 'cross-pollinators'

(Kelley and Littman 2006). White and Deevey (2020, 3) argue that 'Design is also suited within interdisciplinary contexts as they both share a requirement for 'T shaped' research practice. 'T' Shaped researchers are those who can work broadly across disciplines and deeply within their own discipline'. This allows cultivation of both their own discipline and those beyond it (Hansen and von Oetinger 2001). For both disciplines, the experience encouraged the students and staff 'to obtain divergent thinking for innovative design ideas' (Kim, Ju and Lee 2015, 102). Yet, as the following student comments suggests, the project became a collaborative enterprise where individual skills are developed which complement rather than rival each other (Adams, et al, 2011). 'The way of being for the designer is to be a translator, developing outcomes from multiple pieces, ideas, and perspectives' (Adams et al 2011, 10).

> I think it was maybe in the first meeting when we were all still immunologists and creative art students, but then it started to become, especially now, it's more of an us.
>
> (B3.2)

While 'T' shaped and co-creation attributes are tacit amongst Designers it has been arguably more impactful and explicit for the Biological Scientists, opening doors to a new conception of future employment.

> I think being able to collaborate with others from different disciplines can sort of help you out as a person, so you can look at different things that you could do with your degree.
>
> (B1.2)

Staff participation and institutional support for interdisciplinarity

Stierer and Antoniou (2004) observe 'that pedagogic research in UK Higher Education is so diverse…that is unreasonable…to apply the same standards and criteria uniformly when judging its quality' (2004, 282). Creating new and distinctive *hybrid methodologies* requires support and the development of new skills amongst researchers as active co-creators.

> Indeed, McLeish and Strang (2014) went as far as stating that interdisciplinary research requires a complex skill set which is underdeveloped within HE, providing further underpinning for the value of embedding interdisciplinarity into the student experience to enhance employability.
>
> (Power and Handley 2019, 560)

From the perspective of pushing towards institutionalisation of more interdisciplinary education, the findings presented by Lindvig (2015), Townsend et al (2015) and Power and Handley (2019) appear quite discouraging. Those studies entail a few larger programmes and the interdisciplinary opportunities are mainly set up as one-off elective courses with no

subsequent embedding. These are not developed systematically and are very much dependent on the interest and engagement of individual faculty members in addition to volunteering students with no formalised attachment.

> While these activities are given little space in official reports and learning accreditations, they are nonetheless shaping the university landscape by revealing otherwise hidden interstices and thereby creating stronger connections between research projects, students and teaching structures.
>
> (Lindvig 2015, 358)

We, the authors of this study, would identify as 'pioneering champions often working against the status quo' (Lindvig 2015, 357), taking an entrepreneurial role to work within institutional gaps, and forging allegiances across disciplines through unforced social interactions. It has exposed insecurities and prevailing approaches to try to guarantee results, or 'over analyse to paralyse' creative freedom.

> The outputs were not what I expected, I took a backseat, was surprised, and glad they were not a mirror image of my own work, which I used to present to them. By keeping it relaxed it allowed the students to find their own voice.
>
> (Author A)

> Working on this interdisciplinary project has fundamentally change me professionally. The project exposed me to a new way of working and new colleagues with different expertise, training and perspectives. I felt insecure in a way I hadn't felt before nurtured by the multiple differences around me. I had to draw on my professionalism and confidence, be open and question, and allow myself to feel vulnerable.
>
> (Author B)

The experience has allowed a reconceptualization of what 'failure' really means, and that a greater degree of flexibility in delivery and thinking can come through mutual trust and respect of discipline expertise, something different to what might have come from a different approach. 'Multidisciplinary approaches allow the disciplines to pursue their silo thinking. Interdisciplinary approaches are more difficult, and insecurity still exists within staff members' (Townsend et al 2015, 672). These new ways of learning are shared amongst all participants, students and academics.

This is a project that has yet to realise further phases of development with wider audiences and learners. 'The only failures would be to not allow those that wanted to join in, to have the chance to be invited and decide for themselves and for those with good ideas to encourage play to not try out their ideas and share them' (Langan and Smart 2018, 4).

CONCLUSION

Evidence from our research showed that projects like this are inclusive and engaging to the wider student body. Student participants were excited and inspired by each other's different knowledge and skills, but were also rewarded by overcoming different cultures of learning and verbal/visual communication. The efficacy of playful learning's 'otherness', and the 'out-of-hours' from the scheduled university timetable provides a potent space for enriching student engagement and learning, preparing them with critical and creative interdisciplinary skills that are in such demand in the workplace.

The impact of this research will inform pedagogy on interdisciplinary learning, and provide valuable learning aids for immunology, which is offered as a module across several programmes, and if successful, new teaching aids could be rolled out to other biomedical modules and concepts. More widely among the community, raised awareness of our immune system has the potential to modify behaviour and improve public health, as the student groups chose to focus on allergies, vaccinations and transplantation.

As a developing field of pedagogic research, interdisciplinarity using co-design, playfulness and storytelling present challenges to established research traditions that are firmly entrenched in the Sciences. If more maverick and inquisitive researchers can support each other to look beyond the safety of their silos and borders, then new ways of thinking and working can be stimulated and celebrated. It is only through scientists and designers learning to work together that humanity will be able to meet the challenges of current complex problems, such as pandemics and climate change, as well as future ones unknown.

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APPENDIX

i) INTERVIEW QUESTIONS

1. How has working on this project changed your understanding of your immune system?

2. What were the challenges in communicating the immunology theme?

3. What were the challenges of working in a multi-disciplinary team?

4. Is there an optimum number in a collaborative group?

5. Is there anything more fundamental about lines of communication, language of communication?

6. What will you take away from this experience?

7. Was there some sort of level of experiential learning by having to work together and physically kind of talk things through and then create something that will help bed in your understanding of complex projects?

8. Will you approach group work or working with people from other fields in a different way now?

9. What's your favourite aspect of the project and why?

10. What did your studies help equip you for this project?

11. What about your skills that you brought yourself?

12. Were there any design thinking skills that you could've employed d'you think, knowing how a design process works? Any sort of design approaches and design skills that you employed in the making?

13. If you had your time all over again what would you do differently?

14. How would you use your teaching aid to enhance the curriculum on your programme?

15. Could you see that this experience, these skills are transferrable into career routes?

16. Is there anything else you'd like to share with the project team?

ii) Likert questionnaire results

Question	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. This project has improved my understanding of my immune system.	5		4		
2. The challenges in communicating the immunology theme were difficult to overcome.	1	1	3	4	
3. The challenges of working in a cross-disciplinary team were easier to overcome than expected.	3	3	1	1	
4. This was a rewarding experience.	6	3			
5. I enjoyed this project more than my course work.	6	2	1		
6. My studies helped to equip me for this project.	4	5			
7. I would recommend extra curricula and cross-disciplinary projects to my peers.	9				
8. I think this teaching aid will enhance the curriculum on my programme.	4	4	1		
9. There was not enough time to execute what I set out to achieve.	5	1	2	1	
10. This project was detrimental to my course work and exams.			1	5	3