
**O6 Report: Study of
project pedagogy and
impact, and strategic
partnership
effectiveness**

Project: SciCulture

**Edited by: Heather Wren, Kerry Chappell, Lindsay
Hetherington**

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Report of evaluations of courses 1,2, 4 and 3/5.

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EXECUTIVE SUMMARY

Introduction

The SciCulture project brings together the sciences, arts and entrepreneurship by incorporating transdisciplinary practice — combining specific disciplines to respond to common problems or goals — with design thinking. SciCulture courses are immersive one-week intensives which bring together 7 to 10 staff and up to 25 students from participating organisations and Universities to work in cross-disciplinary and cross-country home groups to respond to a ‘wicked’ problem. Project partners are University of Malta, University of Delft, University of Exeter, Science View and University of Bergen. The SciCulture team ran four one-week intensive courses between 2018 and 2021 with two courses face to face, one online and one hybrid. Each course combined the classic double-diamond design thinking process with a set of creative pedagogies that have been developed and researched within the Graduate School of Education at University of Exeter. The double diamond process takes participants through a process of Discovering (divergent thinking), Defining (convergent thinking), Developing (divergent thinking) and Delivering (convergent thinking) in order to find the essence of their response to the problem in hand and to develop it into a shared experience or presentation (for peers and SciCulture partners) by the end of the five day period. From the UoE research, the following creative pedagogies were woven within the double diamond experience: dialogue; transdisciplinarity; individual, collaborative and communal activities for change; balance and navigation; empowerment and agency; risk, immersion and play; possibilities: ethics and trusteeship. Within this combined framework, each SciCulture project was evaluated in turn to understand the impact of the course on participants, track the manifestation of the pedagogies within a transdisciplinary approach to design thinking and understand the effectiveness of the strategic partnership. In order to address these three foci, the following research questions were formulated:

- 1 Does SciCulture encourage [the LOs outlined in the bid] amongst course participants?
- 2 How do the pedagogic features contribute to this learning? For partners/trainers in designing and teaching the trans-disciplinary intensive? And, for the participants within their experience of the trans-disciplinary intensive?
- 3 How has the strategic partnership worked?

Methodology - A mixed methodology was used to address the evaluation research questions. The University of Exeter’s ethical procedures were followed throughout.

Methods - For each intensive course, the following methods were used: pre- and post- online questionnaires for participants; post-questionnaires for partners; pre- and post- participant focus groups (audio recorded and transcribed); semi-structured partner interviews (audio recorded and transcribed); observations, video and photographic documentation; and photologs were also sought in courses 4 and 3&5.

Analysis and Reporting - Qualitative and quantitative analysis were conducted separately for appropriate types of data.

Qualitative analysis for each course was conducted across a lower level and then a higher level. Once this was completed, the pre and post participants’ questionnaires were analysed alongside the data for questions 1a, 1b and 2b, beginning with the post questionnaire then adding the pre-questionnaire to reinforce the data at the end. A report containing summaries and recommendations was then prepared to accompany the next planning meetings. The partner/trainer questionnaire was also used to highlight key areas of agreement and disagreement with the participants’ perspectives, with open responses included in the qualitative coding. In the first instance, each intensive course was treated as a separate case for analysis, with results within course reports informing the design, implementation and evaluation of the next course. This final report is different to these and represents the outcomes of the

overarching analysis which integrates the key findings from the four courses to draw overall conclusions in response to the three evaluation questions above.

Findings

1 Does SciCulture encourage the LOs outlined in the bid amongst course participants?

Evidence from the first course showed little progress in relation to the learning outcomes surrounding disciplinary skills. Following the course this led to a staff team discussion as to how feasible it was within a one week intensive to develop understanding of transdisciplinary collaboration and process as well as knowledge and skills in science, arts and entrepreneurship. Staff agreed that the SciCulture priority should be its USP of transdisciplinary collaboration and design thinking so the focus on teaching knowledge and skills in the disciplines was much reduced in courses C2, C4 and C3/5. These elements were still tracked as part of the data analysis but without the anticipation that there would be substantial increase in the learning outcomes focused on disciplinary skills. They are therefore included in the main report but not this executive summary.

Importantly, participants' reported confidence showed a statistically significant increase between the pre and post questionnaires with respect to design thinking and transdisciplinarity, which fits with the decision taken above to reduce emphasis on discipline skills and re-emphasise transdisciplinary collaboration embedded within design thinking. There is then evidence that understanding of the key elements in the SciCulture courses increased across the courses with Transdisciplinarity causing the most excitement for participants in terms of their expectations as to what the courses would offer, and having the biggest increase in knowledge/understanding. There was also evidence in all four courses as to participants perceiving discipline interaction as more interdisciplinary (i.e. disciplines serving different purposes or indeed serving each other) rather than transdisciplinary (disciplines serving the problem in hand). The data shows partners in the courses working to address this to shift towards the latter, with participants experiencing this as simultaneously challenging, exciting and rewarding, tricky, good, bad, interesting and exhausting, demonstrating the complexity of the transdisciplinary learning experience.

The emerging outcomes provided an insight into what was important to participants; alongside evidence of two main new learning outcomes which emerged during the courses: working with others; and knowledge building and thinking (especially in relation to embodied thinking).

2a How do the key features of creative pedagogy manifest for partners/trainers in designing and teaching the trans-disciplinary intensive?

Evidence shows that there is a clear progression from partners/trainers beginning to think about the transdisciplinarity, dialogue, individual, collaborative and communal action for change (ICC) and empowerment features and trying to understand what they are and work out how to apply them in the earlier courses, evidence showing them emerging, then evidence showing that more critical thinking about how they can work better next time was taking place across the courses. In the final course, C3/5, the transdisciplinary feature was seen to have worked the best so far and partners thought that all of the other features were strongly encouraged, perhaps also demonstrating that partners had a clearer understanding about what they are. There was also evidence of more of the features emerging across all of the courses but in different ways. Ethics and Trusteeship was the least evidenced feature in early courses where it only appeared in courses 1 and 2. However, the online course in course 4 may have been instrumental in the lack of evidence due to it being difficult to capture. Nevertheless, in C3/5 there was more evidence of ethical thinking taking place both face to face and on the digital platform. Emergent themes illustrated diffraction through reflection in C1; the challenges of different spaces in C1, C4 and C3/5, as well as the importance of materiality to learning which was seen as better in a face-to-face learning environment in C1 and C4, the benefits of creativity and the digital

platform as a novelty and creating less conflict in C4 and challenges of delivering on the hybrid course in C3/5.

2b. How do the key features of creative pedagogy manifest for the participants within their experience of the trans-disciplinary intensive?

It is clear that partners/trainers had more awareness of what transdisciplinarity was across the courses as they noticed it emerging more than participants. Where it was mentioned in relation to thinking about how transdisciplinarity was understood as grounded in dialogue, difference and collaboration during sessions across the first 2 courses. Although there was not much evidence of it manifesting during courses 1 and 2, participants thought they were making links between disciplines and interestingly, more so where there was less evidence of its manifestation in course 2. This could mean that both participants and partners/trainers were still trying to understand the nature of transdisciplinary teaching and learning. By course 4 it became more apparent that transdisciplinarity was emerging for participants during sessions and it flowing more fluidly, demonstrating that there was a greater understanding of transdisciplinary delivery and learning. However, in C3/5 although there was evidence of participants working in a transdisciplinary way and seeing the benefits of it, some participants wanted clearer guidance about it. In all courses dialogue was seen mostly as discussion and embodiment. There was also some evidence in courses 1,2 and 4 that dialogue was used to understand difference and to navigate barriers. In C3/5 participants were seen to be communicating in different ways and being ethical, however, some participants thought the hybrid course limited communication (although one participant thought it was beneficial). Across all courses, participants thought that they engaged in continuous questioning of their ideas with more positive responses in C2 rather in comparison to C4 and C3/5. Across C1 and C2, most participants thought that ethical implication of their work was important but interestingly in C4 participants disagreed. In C3/5 participants seemed to think they were ethical if it was prioritised. In relation to empowerment and agency, although participants felt agency during all the courses, the amount of evidence for this feature fluctuated between agency and empowerment in each course. Risk taking and play came out strongest in the risk, immersion, play feature, with participants expressing that they took risks and saw play as important and both features being observed across all courses and linking it to transdisciplinarity in C3/5. Immersion was evidenced across courses but less so (although more so in C2). Where immersion was evidenced, it was mostly related to the material-dialogic space with some evidence of the digital space in course 4 disrupting immersion in participants. Possibility thinking increased across the courses with participants thinking that they asked 'what if' questions more than they thought they came up with new possibilities. The Balance and Navigation feature was evidenced more across courses 1,2 and 4 and related mostly to course structuring, but less so in C3/5.

Participants responses to whether they were given appropriate structure and freedom in their learning were more positive in C2 rather than C4, C3/5, raising questions into the effect of the digital nature of C4, and C3/5 on balance and navigation. Participants thought that they engaged in individual, collaborative and communal activity throughout all of the courses but with collaborative learning achieving the strongest levels of agreement. In C4 participants thought that they engaged less in wider activities which could relate to the lack of social time on the digital course. Co-creation was key to collaborative learning which was evidenced more as the courses evolved. Emerging outcomes in C1 related to participants wanting more depth to learning about disciplines; in C2 related to issues with time and conflict within collaborations but more material intra-actions were noticed in relation to C1; in C4 the digital tools, movement and rhythm were seen to shape learning but digital interruptions were highlighted; and in C3/5 challenges in the hybrid nature of the course were highlighted alongside the importance of embodied learning.

3 How has the strategic partnership worked?

Participants were positive across most courses about the way the strategic partnership operated but less so in C3/5. Strengths in C1 and C2 were related to the way the partners/trainers responded to each

other in terms of being adaptable and responding positively to feedback. The main reason for this was related to creative collaboration which led to partners/trainers being able to plan and organise the courses together easily. It was also noted that partners/trainers investment in the project meant that they put in effort to improve the courses. Strengths in C4 related mainly to the planning and delivery of the digital course as it was a new approach for this project. Thus, the main strength discussed was the affordance of the digital platform. In C3/5 strengths related to the professionalism of the partners and good communication which some partners felt was due to the partners working together for a long time and being on the same theoretical page. Timings relating mainly to planning but also the sessions schedules were the main challenges for the partnership in C1 and C4 but lack of flow of the sessions were highlighted in C2. Also, in C2 there were issues around space due to the location of the course, lack of communication between staff and the experience of partners/trainers with working within EU regulations with a small focus on the budget. In C4 minor challenges related to the nature of the digital course in relation to flow and fragmented process and loss of momentum due to having to plan for something completely new. In C3/5 the main challenges related to difficult participants and bureaucracy with some personal challenges within their own system highlighted. The main suggestions for changes going forward were related to adjusting timings across courses 1, 2 and 4, to allow more space for planning and deadlines, for participants to have time to breathe in between sessions, and for deadlines. In C1 and C2 it was highlighted that there needed to be more clarity on the framework in terms of embedding creative pedagogy and planning; and that the transdisciplinary sessions should be more co-led and embedded with embodiment. There were calls for greater partner presence in between sessions, better collaboration between staff and more focus on managing the expectations of the participants. With the absence of these suggestions in C4 it calls into question whether these had been improved by the time this course proceeded. Suggestions in C4 mainly related to the digital nature of the course with partners/trainers wanting more face-to-face time; more social events; clarity on photologs and continuity going forward. In C3/5 suggestions going forward related to the flexibility of the system to allow more freedom in course delivery, changing the scoring system to ensure the right participants are chosen for the course and participants needing clearer guidance. Other emergent themes from the strategic partnership included: understanding and creating balance between process, content and outcome, the benefits of learning new teaching processes and a focus on how the transdisciplinary element can work better, and be more clearly publicly defined. The nature of the digital course in C4 was also the focus of a few comments relating to the face-to-face vs digital experience for participants and the selection process for participants.

Discussion

The development of the transdisciplinary aspect of the course was evidenced as the strongest across the courses with clear links between partners/trainers developing their understanding about what it is and it emerging more, and more fluidly during sessions, and partners/trainers trying to find ways in which to develop this further. This resonates with the evidence that the ease of planning and organisation alongside adaptability to feedback were the main strengths of the strategic partnership, meaning the ability to plan and organise efficiently may have had a direct impact on the understanding of transdisciplinarity.

There was also evidence that the development of the understanding of dialogue with partners/trainers took place in a similar way with it not only emerging as discussion but also embodiment in later courses and with participants expressing that they were engaging in continuous questioning of their ideas across all courses.

However, the questioning of ideas between participants emerged more in C2 than C4, C3/5 which could be related to the nature of dialogue on the digital platform. There was also a similar trend with individual, collaborative and communal activity but with it more weighted towards collaborative learning, particularly co-creation. There were differences in C4 where participants thought they engaged less with wider activities such as socialising. This was picked up as a concern amongst the

strategic partnership as they felt the need for more social activities and breathing space for participants between sessions.

Partners/trainers were also thinking about possibilities across courses 1,2 and 4 which again could be linked to the strengths in the partnership in planning and adaptability. Participants were also asking 'what if' questions throughout the courses in different ways. Balance was evidenced across all of the courses in relation to the course planning and delivering by both partners/trainers and participants in C1, 2 and 4 but in relation to time and space in C3/5.

It is interesting also that there seems to be issues with balance in the strategic partnership where planning and delivery was seen as both a strength and a challenge in C1, C2 and C4 but not in C3/5. When observed in sessions balance and navigation was mainly related to relationships and difference in courses 1,2 and 4 and in relation to digital learning in C3/5. Again however, participants responses to whether they were given appropriate structure and freedom on their learning were more positive in C2 rather than C4 and C3/5 raising questions into the effect of the digital nature of C4 and C3/5 on balance and navigation.

Risk taking was related to planning and delivering in courses 1,2 and 4 which was seen as a challenge in places but also related to experimentation as was play and immersion. In C3/5 risk taking was briefly linked to transdisciplinary practice. Immersion was also related to embodiment and the material-dialogic space in later courses.

The main source of empowerment and agency was seen through the digital platform and related to the affordances of the digital tools for participants in C4. Partners/trainers thought they were also empowered in later courses but discussed it in relation to participant empowerment in C3/5. This could be linked to the evidence that partners/trainers were getting more comfortable with the understanding of many of the features as the courses evolved.

Across C1 and C2 partners/trainers were evidenced thinking about ethics a little in relation to spaces and relationships and in C3/5 in relation to inclusion, empathy and allowing space for learning.

Participants were observed being ethical across all courses. Interestingly however, most participants in C1 and C2 thought that the ethical implication of their work was important but in C4 participants disagreed raising questions to whether ethics can be captured easily on a digital platform. However, in C3/5 participants were seen as being ethical if it was prioritised showing that they are able to think about ethics within a digital environment. Trusteeship was evidenced a little between participants and as embodied in C1 and C4 and in relation to the transdisciplinary process in C3/5.

Recommendations

Overall the implementation of the creative pedagogies within the design thinking framework was evidenced to work well, with partner understanding of how to work in this way clearly developing over time. It is recommended that future projects continue with the same framework, educating new staff colleagues as appropriate in how to make this work, drawing on this report and the CourseKit planning tool. Alongside this, the following questions can be taken forward by future teams to continue to develop knowledge and understanding of this practice.

- How can partners/trainers promote embodied learning more both face-to-face and on the digital platform?
- How can learning spaces be better understood and improved?
- How can partners/trainers deal with conflict better?
- How can the understanding of transdisciplinarity continue to be improved and better articulated?
- How can partners/trainers ensure that participants understand the nature of the course and its relationship with process/end product and that the right participants engage with the course?
- How can timings be adjusted to allow for the balance between richer planning time, breathing space between sessions and meeting deadlines?
- How can the system be made more flexible to allow for better facilitation of transdisciplinary teaching and learning?

- How can the digital platform be understood better in relation to teaching and learning and the following features:

There seems to be a link between planning time and the understanding of some of the features which could be improved with more productive planning sessions. There is evidence, however that this improves in each course. As embodiment has arisen as key to the learning there may be a requirement for partners/trainers to learn how to teach this effectively, especially for those in disciplines where this is unusual, as well as understanding how to create successful learning spaces.

The implications for further research and practice are that more research needs conducting into transdisciplinarity and related training needs for partners/trainers, alongside further space for reflection around it. For digital or hybrid courses, it also seems necessary to conduct further research into the nature of the creative pedagogies features in relationship to the design thinking framework, and their emergence within this type of environment.

INTRODUCTION

The SciCulture project brings together the sciences, arts and entrepreneurship. We do this by incorporating transdisciplinary practice — combining specific disciplines to respond to common problems or goals — with design thinking. SciCulture courses are immersive one-week intensives which bring together staff and students from participating organisations and Universities to work in cross-disciplinary and cross-country home groups to respond to a ‘wicked’ problem. Project partners are University of Malta, University of Delft, University of Exeter, Science View and University of Bergen.

The SciCulture team ran four one-week intensive courses between 2018 and 2021 with teaching teams of between 7 and 10 staff, and participants numbers up to 25. The initial two courses were face to face in Greece and then Norway, the third entirely online, and the fourth in Malta as a hybrid course. Each course combined the classic double-diamond design thinking process with a set of creative pedagogies that have been developed and researched within the Graduate School of Education at University of Exeter. The double diamond process, as shown in the image below from our [CourseKit planning tool](#) takes participants through a process of Discovering (divergent thinking), Defining (convergent thinking), Developing (divergent thinking) and Delivering (convergent thinking) in order to find the essence of their response to the problem in hand and to develop it into a shared experience or presentation (for peers and SciCulture partners) by the end of the five day period. More information is available here showing examples of course programmes and flow: <https://sciculture.eu/programme/>



Figure 1 Double Diamond Process from Coursekit planning tool

From the UoE research, the following creative pedagogies were woven within the double diamond experience:

Dialogue: This is about pedagogically asking questions in a way which leads to new ideas and then/also leads to more questions. It means encouraging students to do this too, and to challenge and question some of what they encounter in everyday life.

Transdisciplinarity: SciCulture recognises the spreading practice of combining disciplines, and defines the relationship between disciplines within the project as serving the question or problem in hand, rather than disciplines serving each other.

Individual, collaborative and communal activities for change: Creativity is rarely a solo process. SciCulture prioritises encouraging individual contributions but also collaboration within a communally driven exploratory and experimental learning experience.

Balance and navigation: Within creative pedagogy there is a constant balance in control and freedom, structure and openness. This involves developing the practice of stepping in with expertise when students need it, but also stepping back and giving them space. Balance can also be about integrating existing knowledge with engaging or enlightening processes so that everyday questions about the world are brought to life. Navigation is about acknowledging some of the common tensions and dilemmas we all face as educators - testing and assessment, the marketisation of education, and resource/time pressures.

Empowerment and agency: This involves giving participants ownership of the learning in small ways that add together to help have agency over and within the learning process. This might be about modeling passion for independently asking questions. Giving them agency is also about creating space for participants to ask their own questions and make their own mistakes as well as owning their successes.

Risk, Immersion and play: Taking risks is very connected to students and Facilitators being able to make mistakes and have agency within their learning. To do all of these things students and teachers need to be motivated and excited. This might mean grounding the process in real life burning questions or using the arts as a starting point for provoking questions. For students this is a great opportunity to immerse themselves in cutting edge problems and take risks with their ensuing ideas supported by the facilitators.

Possibilities: This means allowing for multiple possibilities both in terms of thinking and spaces. In this kind of practice, it is important to know when it is appropriate to narrow or broaden thinking in the context of asking 'what if' questions, so that facilitators and participants can capture interesting new ideas.

Ethics and Trusteeship: This means that Facilitators and learners need to consider the implications and impacts on those around them of their creative processes and products. Thinking about ethics as part of any making and problem-solving process is complex. Here, the arts with their mastery of felt experience can be powerful ways of engaging in these questions. Trusteeship means thinking about who holds the values in question; and within education helping participants to understand that they are the trustees of their own community values, now and in the future.

Within this combined framework, each SciCulture project was evaluated in turn to understand the impact of the course on participants, track the manifestation of the pedagogies within a transdisciplinary approach to design thinking and understand the effectiveness of the strategic partnership. In order to address these three foci, the following research questions were formulated:

1. **Does SciCulture encourage the LOs outlined in the bid amongst course participants?**
 - 1a. What are participants' initial perspectives on, knowledge of, and understanding about interdisciplinary learning in science, entrepreneurship, the arts, and design thinking?
 - 1b. How do these change as a result of participating in the intensive?
2. **How do the pedagogic features contribute to this learning?**
 - 2a. How do the key features of creative pedagogy manifest for partners/trainers in designing and teaching the trans-disciplinary intensive?

2b. How do the key features of creative pedagogy manifest for the participants within their experience of the trans-disciplinary intensive?

3. How has the strategic partnership worked?

Methodology

A mixed methodology was used to address the evaluation research questions. The University of Exeter's ethical procedures were followed throughout. This included the submission of an Ethics Application which was peer-reviewed and developed over time in response to shifts in data collection related to COVID-19 lockdown procedures. Throughout, the team worked to the ethical principles of voluntary participation, informed consent, non-detrimental right to withdraw at any time, confidentiality, anonymity, and data protection. No data was collected from a participant until they had given their permission to be involved.

Methods

For each intensive course, reaching up to 10 partners and 25 participants, the following methods were used:

1. An online questionnaire consisting of multi-ranking and open questions was shared prior to participants' arrival at each course, to address RQ1a
2. An online questionnaire consisting of multi-ranking and open questions was shared with participants following each course, repeating the pre-questionnaire and with additional questions to address RQ1b
3. An online questionnaire consisting of multi-ranking and open questions was shared with partners following each course with questions to address all RQs.
4. Focus group interviews using a semi-structured interview schedule were conducted with course participants from different backgrounds at the start and end of the courses. (RQ 1 and 2). These took place both online and face to face.
5. Semi-structured interviews were conducted with partners/trainers in relation to RQ2 and 3. These took place both online and face to face.
6. Observations, video and photographic documentation of process and outcomes were conducted throughout the courses, using a semi-structured observation schedule, feeding in to all RQs.
7. Participants and Partners were asked to create a Photolog, taking at least 5 photographs per day in courses 4, 3&5 to reflectively document anecdotes and stories from the course.

Online questionnaires were conducted using Qualtrics in courses 2 and 4, and MS Forms on the University of Exeter secure server using the same question sets in course 3/5. Two questionnaires were used, one for participants, and one for partner/trainers. The participant questionnaire was piloted with a group of post-graduate students at the University of Exeter before use in Course 1. However, following C1 it was apparent that the length and complexity of the questions with respect to participants working in a second language meant that some questionnaires were incomplete. The question set with respect to creative pedagogies was also too complex to use in a pre-scale, so these questions were removed from subsequent courses and post-questionnaires only were used to explore the implementation of the creative pedagogies within the courses. The questionnaire was therefore redesigned and simplified somewhat for use in courses 2 onwards. Questions with respect to knowledge and understanding of key aspects of SciCulture were framed using a 5 point Likert scale asking participants to rate their confidence in knowledge and understanding of transdisciplinarity, science, arts, entrepreneurship and design thinking on a scale of 1-5, where 1 is 'not confident' and 5 is 'very confident'. The creative pedagogies scale also used a 5 point Likert scale rating the extent to which participants agree with statements regarding creative pedagogies, where 1 is 'strongly disagree

through to 5, strongly agree'. Questions with respect to the effectiveness of the SciCulture partnership were also framed using a 5 point Likert scale where 1 is 'not very effective' through to 5 'very effective'. Some inverted questions were included to ensure questions were being read carefully: these were adjusted in the final analysis for clarity. Partner/trainer questionnaires asked similar Likert-type questions regarding the effectiveness of the collaboration, using the same 5 point Likert scale as the participant questionnaire.

Observations of activities were carried out using a theory-driven observation structure to focus on participant response and participation related to the activities being undertaken. These took place early in the courses and towards the end.

Focus group interviews with participants took place during each data collection session at the beginning and end of the courses, and these were audio-recorded and transcribed.

Interviews were semistructured

and were conducted at two points during the research cycle to assess how perspectives have changed over time. Partners/Trainers were also interviewed individually using a semi-structured technique and notes were made of the comments which were also audio-recorded and transcribed.

Partners/Trainers were also asked to provide written answers and drawings. Photologs were used for data collection to add more depth to interviews and observations and to bring out materiality during sessions. Photologs are photographs taken of anecdotes of a moment which reveal the story of the learning spaces.

Analysis and Reporting

Qualitative and quantitative analysis were conducted separately for appropriate types of data. Qualitative analysis for each course was conducted across two levels, a lower level completed by Maltese and Greek colleagues and a higher level completed by the Exeter team. To help to conduct the evaluation, an analysis proforma was designed by the Exeter team and sent out to partners from Malta and Greece. Guidance was provided by the Exeter team when needed.

These teams then analysed the data from student focus groups, staff interviews and photographs of the sessions. To do this, themes were documented relating to each question and the weighting of themes and pedagogic features were documented alongside any further comments. The questions to be explored were analysed across the two teams as shown in the table below.

Data type	RQ responding to	Analysis Team
Pre-Questionnaires	1. Does SciCulture encourage the LOs outlined in the bid amongst course participants?	Malta Greece
Post-Questionnaires	1. What are participants' initial perspectives on, knowledge of, and understanding about interdisciplinary learning in science, entrepreneurship, the arts, and design thinking?	
Pre-Focus Groups and images		

Post Focus Groups and images Early Field Notes and images Later field Notes and images Staff Interviews and images	2. How do these change as a result of participating in the intensive? 3. How has the strategic partnership worked?	
Post Questionnaires Post Focus Groups and images Field Notes and images Staff Interviews and images (low level)	2. How do the pedagogic features contribute to this learning? 1. How do the key features of creative pedagogy manifest for partners/trainers in designing and teaching the trans-disciplinary intensive? 2. How do the key features of creative pedagogy manifest for the participants within their experience of the trans-disciplinary intensive? 3. How has the strategic partnership worked?	Malta Greece

Table 1 Data Collection methods with Research Questions

Once the higher level of qualitative analysis was complete, the pre and post participants' questionnaires were analysed alongside the data for questions 1a, 1b and 2b. Beginning with the post questionnaire then adding the pre-questionnaire to reinforce the data at the end. A report containing summaries and recommendations was then prepared to accompany the next planning meetings. The partner/trainer questionnaire was also used to highlight key areas of agreement and disagreement with the participants' perspectives, with open responses included in the qualitative coding. It should be noted that synthesis of the partner/trainer questionnaire across courses has not been included in this

report, as it is not suitable for substantive statistical analysis as the sample consists of <10 partner/trainers who are largely the same for each course.

Questionnaires were analysed in SPSS 26-28. Likert scale questions were analysed using descriptive statistics with ordinal data: central tendencies are reported using median and mode for preference, due to the ordinal nature of the data and recognising that Likert scales are not scales in the true sense, however, means are reported in comparisons across matched groups of participants since they are likely to have approached the scale in the same way in both pre and post. Range of responses are also reported. Significance testing was conducted using Wilcoxon signed ranks tests, as the data is non-parametric and ordinal, meaning that t-tests are not appropriate. Responses to the question sets from courses 2, 4 and 3/5 were tested using Cronbach's alpha to identify whether they constituted a reliable scale. Note that course 1 was not included in this analysis since the questionnaire was refined following its initial use in C1. The new post-questionnaire scale exploring the creative pedagogies used in the course was tested using Cronbach's alpha. Alpha = 0.861, suggesting the scale is indeed reliable as a measure of participants' perceptions of their experiences of creative pedagogies during the course. To check unidimensionality of the 'experiences of creative pedagogies' scale, an exploratory factor analysis was conducted. KMO=0.700, which is above the measure of adequacy of 0.6 typically accepted as a minimum, but suggests that the sample size is only just sufficient for PCA factor analysis. Bartlett's test of sphericity = <0.001, suggesting the data is suitable for reduction. Factor analysis initially yielded a 6 component scale. These components were inspected to explore whether there was a relationship between items relating to the 8 features of creative pedagogies that underpinned the design of the scale. However, due to correlations between items linked to different features of creative pedagogies across the components, this was not the case. Exploratory factor analysis therefore suggests that there are no distinctive differences between groups of specific components of participants' perceptions of their experience of creative pedagogies in this data, and therefore the scale could be treated as a single scale.

Once both types of data had been analysed, outcomes were combined analytically to respond to the three evaluation questions.

After each course, the outcomes of the analysis were used to adjust the pedagogical approaches and course design for the next intensive course. This sometimes required some associated adjustments to the evaluation tools for each new intensive. For example photologs were added after course 2, as a data collection method to better capture experience that was not available through words.

In the first instance, each intensive course was treated as a separate case for analysis, with results informing the design, implementation and evaluation of the next course. A separate evaluation report for each course therefore exists and was used internally by the project team. This final report is different to these and represents the outcomes of the overarching analysis which integrates the key findings from the four courses to draw overall conclusions in response to the three evaluation questions above.

FINDINGS

1. Does SciCulture encourage the LOs outlined in the bid amongst course participants?

Evidence from the first course showed little progress in relation to the learning outcomes surrounding disciplinary skills. Following the course this led to a staff team discussion as to how feasible it was within a one week intensive to develop understanding of transdisciplinary collaboration and process as well as knowledge and skills in science, arts and entrepreneurship. Staff agreed that the SciCulture priority should be its USP of transdisciplinary collaboration and design thinking so the focus on teaching knowledge and skills in the disciplines was much reduced in courses C2, C4 and C3/5. These elements were still tracked as part of the data analysis but without the anticipation that there would be substantial increase in the learning outcomes focused on disciplinary skills.

1.1 Entrepreneurship and innovation skills

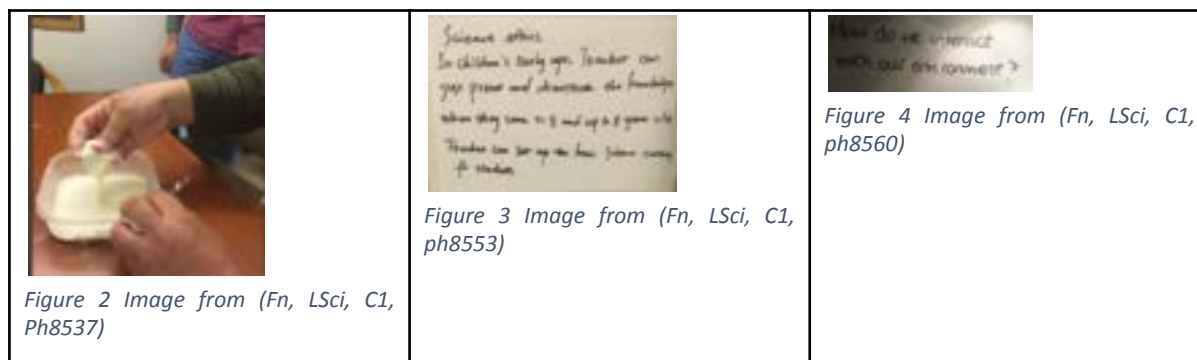
At the beginning of courses 1 and 4, participants expressed that they typically did not learn entrepreneurship or innovation as part of their undergraduate studies, but they did in postgraduate for example: *“My university, you could also have a degree plus course. This course is not something inclusive in the degree. We choose something, for example entrepreneurship, and it gives you the chance to establish new skills, try to learn them.”* (PreFG, C1, p. 2). *“I’d say I have. I think we’re all post-graduate or post-doctoral level. And I feel like, certainly from my perspective, there’s so much independence and creativity in that, that yes, I would say that I’ve been innovative and have had the opportunity to do so. ... I use walking interviews”.* (PreFG, VT C4p1). Course 3/5 showed a broader range of prior experience in entrepreneurship with some claiming no experience and others more specialist in the area.

There was little evidence in the observation fieldnotes of participants gaining entrepreneurship and innovation skills across all courses, although it was noticed by one partner in the first course: *“Some understanding of the essentials of entrepreneurship, but some much more than others. Some have worked on small business ideas, one publishes/sells books”* (Fn, EDuEnt, C1, p1). Questionnaire responses synthesising outcomes across all courses analysed showed no statistically significant change in participants knowledge and understanding of entrepreneurship (median = 3 for both pre and post questionnaires). In post focus groups there was only one mention of entrepreneurship and innovation skills in course 2 and this was to express disappointment: *“not too much for entrepreneurship ... I want to get more about this, more knowledge ... how to think like in a business ... So I miss that part in this”* (PostFG, C2,p2).

Overall participants had a little experience of entrepreneurship and innovation in their postgraduate courses and there was evidence of a slight increase in knowledge across courses 1, 2 and 4, but not 3/5. Differences in participants’ reported knowledge and understanding of Entrepreneurship between pre and post was significantly correlated with participants’ reported levels of prior experience in Science (Spearman’s $\rho=0.593$, $p=0.010$) and Entrepreneurship (Spearman’s $\rho=-0.114$, $p=0.011$), suggesting that, as expected, prior experience in entrepreneurship led to less impact of the course on understanding. Interestingly, prior experience in Science correlated with a greater impact of the course on understanding of entrepreneurship.

1.2 Enhancement of scientific knowledge through critical thinking

In courses 1 and 4 participants seemed to have a traditional view of science: *“I have studied a course called the New Technology of Education. I think it’s more a little connected with science because it’s told how to use the high technology in education in the model society.”* (PreFG, C1, p. 3) and *“I definitely have what, I suppose, you’d probably consider a traditional, maybe even outdated sort of attitude to science, that the natural sciences is science and then you have the social sciences”.* (PreFG, VT, C4p3). There was a small amount of evidence that the enhancement of scientific knowledge through critical thinking was occurring across courses 1, 2, and 4: through an embodied experience of science through touching, feeling, moving materials:



There were no statistically significant changes in participants’ confidence in their scientific knowledge and understanding across all courses. There were no significant correlations between difference in knowledge and understanding of Science and prior experience in any area.

From going through processes and activities: *“I think the only thing I learnt about science was more like the different; we did this game where we had this different spectra of like deductivism or inductivism...”* (PostFG, C2, p.4), and when talking about the construction of the course: *‘They embody science with critical thinking’* (PostQ). Across all courses, there was not a statistically significant change in knowledge and understanding of science.

Overall participants had a traditional view of science and although there was little evidence in enhancement of scientific knowledge through critical thinking across the courses, there was a small significant change in the self-reporting of an increase in the knowledge of science in three out of the four courses.

1.3 Use of design thinking to generate ideas and enhance creativity

At the beginning of all of the courses most participants did not really know what design thinking was or how it linked to creativity: *“The first time I heard of design thinking was yesterday”* (PreFG, C1, p. 5.); *“I’m not rich in the knowledge of [design thinking]”* (PreFG, C1, p. 5); *“I didn’t know anything about design thinking (PostFG,C2, p.3)and I haven’t really...I only had that one experience with design thinking. (PreFG1x2, P, C4p4).* This may have been because they saw them as separate processes for example: *“Like sometimes design is under arts as a category but it’s very different from each other, I think.”* (PreFG, C1, P. 4) and *“I think design thinking is very different from how art works. Because they have a strong focus and with different steps””* (PreFG, C1, p. 5); *I thought it was so confusing at the beginning but then I interpreted as design thinking is a title and you have many categories underneath it, methodologies are constructed by people that you can maybe use but to begin with I was very confused for quite a while”* (PostFG,C2, p.3). Although a small number of participants had rich prior design thinking experiences. Questionnaire responses across all courses show a statistically significant increase in participants’ self-reported knowledge and understanding of

Design Thinking (pre-median = 3; post-median = 4, $Z=-3.435$, $p<0.01$). Breaking this down by course, we find a significant change in Design Thinking in course 2 (Bergen) (median score increased from pre=3 to post=4; $Z=-3.051$, $p=0.02$), but no significant change in courses 4 and 3/5.

Participants' connection with design thinking seemed to improve across the courses where there was no evidence during observations of participants generating ideas and enhancing creativity in course 1; evidence from one participant in course 2 who saw it holistically: *"Design thinking I think is basically a practice[...] For me this is the way design; anything I've seen or I learned how to design your whole problem or idea and give how, give the whole process in a form of design"* (PostFG, C2, p.4); and where images show group design thinking clearly taking place in course 4:



Figure 5 Mural Reflection board from C4

The improvement of the development of design thinking during the courses was also backed up in the post focus group in course 4 where participants clearly recognised that they had learned this new skill for example: *I used to have just experimental thinking and science thinking. And now I can embody design thinking, critical thinking, arts thinking, and make more interesting things and interesting learning materials for my students.*" (postFG, SK, C4p10).

In course 3/5, Photolog data below, however, shows participants engaging with and understanding the design thinking double diamond at the heart of the course through embodied dialogue, object sculpture and self-initiated arrangement of the momigami paper with personal annotations.





Figure 6 Images from Photologs from C3/5

Overall, most participants began the course not knowing what design thinking was and saw it as a separate process. Difference in confidence in knowledge and understanding of Design Thinking was significantly correlated with participants' reported levels of prior experience in Transdisciplinary learning (Spearman's $\rho = -0.587$, $p = 0.010$) and Entrepreneurship (Spearman's $\rho = -0.767$, $p < 0.001$), suggesting participants with higher prior experience in these areas reported less of an impact on their confidence in design thinking as a result of the course. However, as noted above, there was a clear increase in knowledge about design thinking across the courses.

1.4 Open-ended transdisciplinary work

1.4.1 Expectations of course

Participants thought that trans-disciplinarity and diverse perspectives were important to them in all of the courses for a variety of reasons including working with different age groups and communities: *"I'm interested in learning new ways to integrate cross-disciplinary methods in teaching science to young adults and children."* (PreQ, C1, p.5)); for a new experience: *"I am excited for it. I'm generally excited for it. I'm ready to put in the work required of me and I hope to be open to this new experience and to gaining new skills, interdisciplinary thinking"* (PreFG1x2, PM, C4p8). This enthusiasm for the transdisciplinary part of the course also came out in the pre-questionnaires in course 4 *"I hope that this course can teach me more about effective forms of communication and give me a better insight into the transdisciplinary possibilities"* (PreQ, C4). Pre-focus group data for C3/5, showed that whilst some were inexperienced in this area, some students exemplified considerable trans-disciplinary experience: e.g. within *"...five additional courses, maybe six. And they were with architects, interior designers, engineers, and then we brought in public health students as well."* (PreFG, C3/C5, p1). One pre-focus group C3/5 student identified the open-ended and speculative nature of SciCulture: *"I find the course to verge more towards the speculative and imaginative, than the real - but that is also very exciting"*.

1.4.2 Participants understanding of Trans-disciplinarity

Participants self-reporting of their knowledge and understanding of transdisciplinarity increased following the courses (change in median from 3 to 4, $n = 62$, $p < 0.05$); alongside design thinking, the largest change in confidence in knowledge and understanding for any of the elements of SciCulture. Again, breaking this down by course we see a statistically significant change in confidence in knowledge and understanding of transdisciplinarity in course 2 (Bergen) Transdisciplinarity (median score increased on a 5 point Likert scale from pre=3 to post=4; $Z = -2.982$, $p = 0.03$), but no statistically significant changes in the other courses. It should be noted though that with smaller sample sizes in

individual courses, the statistical tests should be interpreted with caution. As one might expect, difference in knowledge and understanding of Transdisciplinary was significantly correlated with participants' reported levels of prior experience in transdisciplinary learning (Spearman's $\rho = -0.702$, $p = 0.001$).

In courses 1 and 4 participants' understanding of trans-disciplinarity tended to be more interdisciplinary, seeing disciplines as serving different purposes: *"For me, it [transdisciplinarity] is my love. It's what I do at school. I make them love it, not only do I love it, they love it too. They love science after that...I combine subjects [at school] for example it is biology this year, last year it was environment, this year it was astronomy."* (PreFG, C1, p. 10-11) and *"I am excited for it. I'm generally excited for it. I'm ready to put in the work required of me and I hope to be open to this new experience and to gaining new skills, interdisciplinary thinking"* (PreFG1x2, PM, C4p8). Or they saw science and art as separate. *"I don't usually use science [in my art]. I like newer science, for example, and use, like, neurons in patterns for the visuals."* (PreFG, C1, p. 6).

However, it was mostly seen as a very positive approach to teaching which promoted empowerment and agency.: *"The struggle to do it [school students learning science through theatre] so finally they get to have the strength to study more, I think"* (PreFG, C1, p. 11).

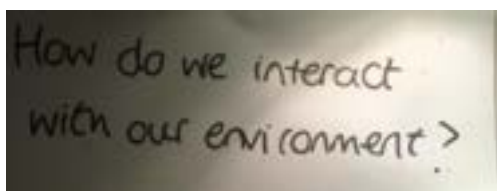


Figure 7 Image from (Fn, LSci, C1, ph8560)

The above quote might be seen as a way in to understanding a students' view of transdisciplinarity and empowerment and agency, with the important role of individual perspective and unique melding of ideas enabling distinctive agential cuts, to use one theoretical perspective.

Overall data showed that participants across the courses viewed transdisciplinarity in various ways including: building on previous experience of it; colleagues from different disciplines working towards a shared goal; thinking of it as networking; related to creativity; and to promote constant learning. Although one participant knew what is was in course 4: *"It gets people who are...people that studied in a certain field. Different people have studied in different fields, and it gets them together in order to work towards a goal. So it's bringing different people together in order to push forward the problem, to get a solution out of it"* (PreFG1x2, PM, C4p7).

Photolog data from C3/5 shows participants engaged in the combined sci/art pollution collecting/frottaging art task demonstrating transdisciplinary engagement in action. As well as frottaging outcomes on the windowsill of the science laboratory.



Figure 8 Images from Photologs C3/5

C3/5 post focus group data showed that students found the transdisciplinary development simultaneously challenging, exciting and rewarding, tricky, good, bad, interesting and exhausting, demonstrating the complexity of the transdisciplinary experience. This provides insight that the transdisciplinary learning journey is not always ‘fun’, and that moving forward there might be a need to acknowledge even more the intensity and emotional ups and downs inherent in this process.

1.4.3 Perceptions of possible issues with trans-disciplinary learning

Most students in course 1 thought the Arts and Entrepreneurship would be the most difficult to bring together because they were seen as having different goals, for example: *“I believe that the most difficult set of disciplines to combine will be art and entrepreneurship since it can be challenging to combine since art cannot always be confined to the limits of market needs”* (PreQ, C1 p. 7). The arts were related to emotions and openness, whereas entrepreneurship was related to specific endings for business. This raises the question for us as researchers/course designers of whether there be a meeting point between disciplines at some point.

Students’ experiences of transdisciplinarity are tracked below in the features section.

Overall participants were looking forward to learning about transdisciplinarity and the largest change in transdisciplinary knowledge was evidenced across all courses. However, observation and interview evidence showed that transdisciplinarity was understood in different ways by participants, at times more open, and at times more product focused.

1.5 Performance and other arts-related skills

Across all courses, there was no statistically significant change in participants’ confidence in their knowledge and understanding of the Arts. However, a statistically significant increase is reported in this element from course 2 (Bergen) (median score increased from pre=3 to post=4; $Z=-2.326$, $p<0.01$). As expected, the difference in participants’ confidence in knowledge and understanding of the Arts was significantly correlated with participants’ reported levels of prior experience in the Arts (Spearman’s $\rho=-0.616$, $n=62$, $p=0.007$). Participants across all courses had a wide range of prior knowledge and understanding of the Arts. The median response was 4 and mean response was 3.95 ($n=21$). No participants mentioned specific arts-related skills as an aim for their participation in the course. Across courses, some participants came with dominant arts expertise: mostly in Fine Arts, Dance and Drama.

In course 1, at the beginning, participants were thinking about what the arts were: *“Art is very broad, I think. Like sometimes design is under arts as a category but it’s very different from each other, I think. And all the different kinds of arts, like illustrative or abstract or video, it’s a lot of things, I think”* (PreFG, C1, p. 4), whereas in course 2 there was no qualitative evidence of participants talking about the arts. However, in course 4 participants voiced how they were looking forward to this part of the course: *“I expect an engaging program with a lot of doing: theatre workshops, active creative design sessions, searching or making visual images, discussions with people from other sectors (e.g. arts and entrepreneurship). I expect less thinking, like I am used to in university. However, I hope that the program helps me to make connections between (analytical) thinking and (creative) doing”* (PreQ, C4). They were also reflecting on what arts meant for them in their previous learning: *“My only sort of formal education in the arts was not really in the arts. I’m in Malta. We have a course which is systems of knowledge, and one of the parts of this course is learning a lot of art. But we learn a sort of...it’s a history kind of sense. So it’s look at it, appreciate it, understand its significance. But in terms of actual drawing, all I’ve done is a small few lessons.”* (PreFG1x2, PM, C4p3). So, participants saw art as a luxurious subject rather than for a career *“the arts would be my love. But I definitely see them as a luxury, as opposed to science which I see as essential”* (PreFG, VT, C4p4).

In course 1 there was quite a lot of evidence that participants were engaging in performance or the arts, for example: during early observations arts-related skills were shared in presentations by partners but not really engaged in: *“He talked about art works being appropriate for your audience. This ranged from not making artworks too childlike and also making art works that are appropriate for various mental health or conditions such as dementia”*. (Fn, ED, C1, p3). Interestingly, during sharing

some participants challenged arts and science integration: *“Not everyone communicates in the same way. An analytic person finds it harder to express their opinions. Communication in education as people are different – it’s going to be tough”*. (Fn, ACat, C1, p4). Also, the data showed a connection between the learning environment and materials being used and how students engaged and learned or did not early in the course: *“Students were initially engaged. One student was sketching till the lights were switched off.... The participants did ask questions, they asked for links and showed engagement”* (ED, Fn, C1, p3).

In course 2 there was no direct evidence in the collected data which showed the participants gaining skills in performance and the arts, however all groups created dramatic, movement-based performances for their final sharings which demonstrated these new skills in action, despite it not appearing concretely in the data. In course 4 there was evidence that these skills were improved in the post focus groups: *“It’s a painting. My students looked at...we have a physics course at 8am in Greece. And I told them for my experience in SciCulture course. And it was the global day yesterday. And he told me that they will send me a painting from his perspective. And I like it very much because it’s allegorical and it has parallels to thinking. And it’s connecting art, humans, the whole perspective for our future. [...] I inspire him to make this painting.”* (postFG, VK, C4p10.). Photologs also showed performing arts practice during the movement session, direct examples of which were then seen in the choreographed sharing of one of the groups in their final presentation on Friday:



Figure 9 Image from Photologs C4

And the momigami session introduced participants to arts skills related to paper art and production:



Figure 10 Image from Photologs C4

For C3/5, from the quantitative data, there was no change in participants' knowledge and understanding of the Arts at the end of the course. However, one participant commented in the open questions in the survey that the course "really challenged my perspective on using art as a means of communication". Alos, photolog data below showed participants drawing reflecting on bodies/embodiment within performing arts element of course, as well as working with dance/choreographic ideas in sessions:

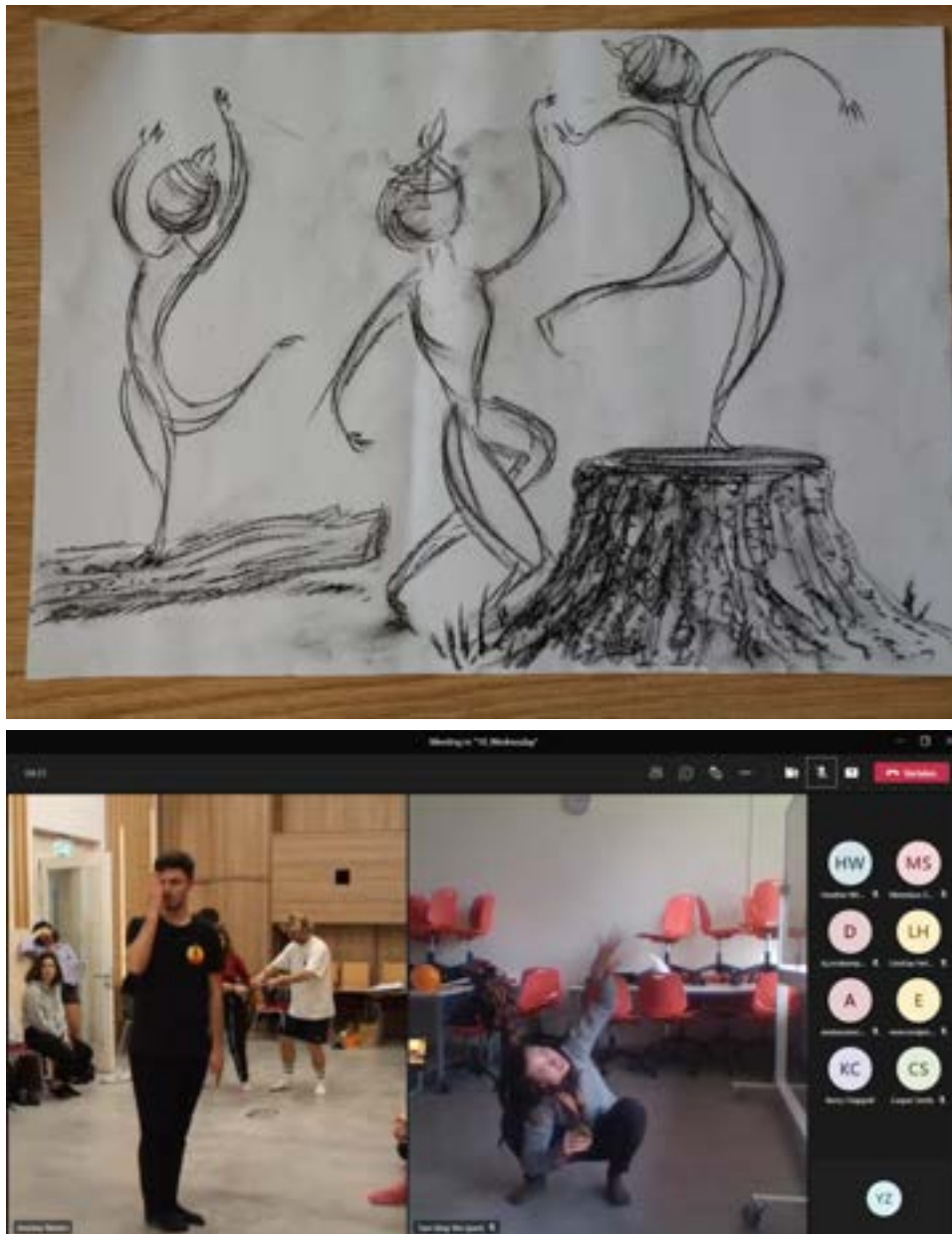


Figure 11 Images from Photologs C3/5

Overall, for participants there was an increase in interest in the perception and knowledge of the arts across the courses although course 2 showed the least amount of evidence of this. There are indications that this may have been related to the learning environment in places.

1.6 Other emergent learning outcomes

In the first course there were a few emergent outcomes but in the second course there was only one. However, in course four there was a lot more data relating to emergent outcomes. By C3/5, emerging outcomes focused around working with others and embodied thinking.

1.6.1 Anticipation of course content

In course 1 anticipation of the course emerged through the focus group interviews and pre questionnaires at the beginning of the course: of non-traditional teaching methods: *"I expect to get*

introductions to different topics from different points of view - scientific, cultural, artistic, economic etc.” (PreQ, C1, p. 6), of skills development: *“I think the course [will be] good for our communication skills. We’re divided into different groups and we come from different backgrounds, different cultural. But we can hold our own opinions, through each other we can exchange the information to others. So I think it’s very improving our skills and enriching our experience of communication”* (PreFG, C1, p. 8). And another saw difference as positive: *“It is really positive that everyone’s from different backgrounds”* (PreFG, C1, p. 8).

1.6.2 Working with others

In the C4 focus groups most of the participants thought that collaboration was beneficial to their learning: *“I learned a lot from the interaction with my group members from Malta and Greece (I am from The Netherlands) (PostQ, C4); “Also, I really enjoyed working in my home group. We bonded from the start and we had lot of thoughtful conversations about the topic/challenge” (PostQ). One student thought that this was because teamwork was an important part of the learning process “I am aware of the importance of working in teams, and I know how useful they are” (PreFG1x2, PM, C4p7). However, a couple of participants, perhaps those with more experience, were a little disappointed due to the different levels of knowledge and education: “I am a bit disappointed at the level of discussion we were able to reach. Not only because of different disciplines but also because of a language barrier” (PostQ, C4). This outcome also emerged as important in C3/5. As discussed above, collaboration and working with others became more of a focus for SciCulture facilitators than gaining expertise in disciplines. And this was recognised as a strength of this course in one of the staff interviews: “for the students because they are collaborating and they are co-creating actually something as we saw also from their presentations... All these things exist in collaborating with others without knowing them and so on. But still it was something productive that they came up with the ideas and presented them, and maybe they will continue doing this if they would like to continue working with these ideas” (Men, int, C3/5, p2).*

One point which arose in the mural for C3/5 which is worthy of note is that there were a number of calls to allow participants to introduce themselves and their expertise on day 1 – this seems vital feedback for the staff team to take forward.

1.6.3 Knowledge building and thinking

Thinking was mentioned briefly in course 2 in relation to communication: *“I want to use this experience as a learning curve for events and looking into event planning and thinking about your audience and communicating different ideas and then merge them together.” (P3, PreFG, C2, p1).* In course 4 this emerged in relation to embodiment more. Interestingly, one participant thought that the embodied sessions would contribute to stopping him thinking: *“I expect an engaging program with a lot of doing: theatre workshops, active creative design sessions, searching or making visual images, discussions with people from other sectors (e.g. arts and entrepreneurship). I expect less thinking, like I am used to in university” (PreQ, C4). However, A couple of participants in the focus group thought that the embodied sessions helped them to think better: “as soon as I started doing it I was just starting thinking, so the embodiment that Partner/Trainer I taught us, I could see it. It could make me think more” (postFG, VK, C4p3); “I felt very calmed and I have lost in my thoughts when I did momigami” (PostFG, KT, C4p6). C3/5 also strongly showed this engagement with embodied thinking, as shown in the two images below:*



Figure 12 Images from Photologs C3/5

When asked what participants will take from course 4 the main things were learning through connections with others and different disciplines and knowledge building:



Figure 13 Image of Mural Reflections from C3/5

1.7 Summary

Evidence from the first course showed little progress in relation to the learning outcomes surrounding disciplinary skills. Following the course this led to a staff team discussion as to how feasible it was within a one week intensive to develop understanding of transdisciplinary collaboration and process as well as knowledge and skills in science, arts and entrepreneurship. Staff agreed that the SciCulture priority should be its USP of transdisciplinary collaboration and design thinking so the focus on teaching knowledge and skills in the disciplines was much reduced in courses C2, C4 and C3/5. These elements were still tracked as part of the data analysis but without the anticipation that there would be substantial increase in the learning outcomes focused on disciplinary skills.

Overall, although the questionnaires show improvements in participants' confidence in knowledge and understanding of the key SciCulture disciplines (Science, the Arts and Entrepreneurship) using the mean as the central tendency, these are not statistically significant. Importantly though, alongside these, participants' reported confidence on a Likert scale of 1-5 showed a statistically significant increase between the pre and post questionnaires with respect to design thinking and transdisciplinarity, which fits with the decision taken above to reduce emphasis on discipline skills and re-emphasise transdisciplinary collaboration embedded within design thinking.

In the qualitative data, there is evidence of a full range of prior experiences in relation to the SciCulture disciplines, Transdisciplinarity and Design Thinking, with every course featuring students with no experience of one of the elements and some students studying these areas at M-level or Phd, or, indeed, a few times, participants working as professionals in one of the disciplines. There is evidence that understanding of the key elements in the SciCulture courses increased across the courses with Transdisciplinarity causing the most excitement for participants in terms of their expectations as to what the courses would offer, and having the biggest increase in knowledge/understanding. There was also evidence in all four courses as to participants perceiving discipline interaction as more interdisciplinary (i.e. disciplines serving different purposes or indeed serving each other) rather than transdisciplinary (disciplines serving the problem in hand). The data shows partners in the courses working to address this to shift towards the latter, with participants experiencing this as simultaneously challenging, exciting and rewarding, tricky, good, bad, interesting and exhausting, demonstrating the complexity of the transdisciplinary learning experience.

The emerging outcomes provided an insight into what was important to participants, including anticipation of learning with non-traditional learning methods and improving skills; alongside evidence of two main new learning outcomes which emerged during the courses: working with others; and knowledge building and thinking (especially in relation to embodied thinking).

2a. How do the key features of creative pedagogy manifest for partners/trainers in designing and teaching the trans-disciplinary intensive?

As noted above, the data from the questionnaires conducted with the partner/trainers has been incorporated into the qualitative analysis of each course to complement the richness of the qualitative data. Due to small sample sizes, statistical comparison between, and synthesis across the courses is not appropriate.

2a.1 Transdisciplinarity

In course 1 partners/trainers were thinking about what transdisciplinary was at the beginning and saw it positively related to difference by the end of the course. In course 2 issues were raised in relation to being able to understand how disciplines could come together. However, by course 4 partners/trainers were thinking about talking more about transdisciplinarity in terms of how it worked well and how it could be improved further. In courses 3&5 partners/trainers thought that the transdisciplinary aspect of the course had come together well and had worked the best so far.

Transdisciplinarity emerged as:

- Referencing distinct subjects: *“It was a transdisciplinary talk since it combined, science, arts and entrepreneurship” (Fn, EO, C1,p3)*
- Drawing together of different disciplines to respond to questions, for example: *“For transdisciplinarity to be effective it’s not about there not being any distinctions between disciplines. And it’s not about people all agreeing with each other. It’s about finding something rich and emergent and creative and developmental out of the bringing together of these things...” (SI, LH, p1).*
- Seeing the value of difference: *“students who were maybe coming from a science background would be taking in art from a particular way for the first time and vice versa” (SI, EO, C1p1),* but in course 4 there were sometimes conflicts between partners with language barriers *“Seems tired over a linguistic/comprehension barrier with another partner (slight sigh, tired voice).” (FN, Thpm, C4, p2).*
- As a success: *“I really think that these movements, these dances we have in us, art, the design thinking, these examples, architectural projects, bringing all of this together, that really makes me happy and satisfied as a science communicator” (SI, ED,C4, p6).*
- Fluid: *“there was a kind of fluidity that the students didn’t even notice that they were in the transdisciplinary process sometimes” (SI, EO, C3/C5 p1).*
- Risk Taking: *I think that’s been a big part of what we’ve learnt on the programme, how we can have the confidence to take the risk to collaborate together, to really teach in a way that is serving the problem, not getting across how to be an artist, how to be a scientist, how to be a something” (SI, KC, C3/C5 p1).*
- As a challenge: In all courses trainers foregrounded the challenge of work in transdisciplinary ways:
 - Working with colleagues from very different disciplines *“(I don’t often work with people from really hard-core science disciplines, so for me, trying to have those conversations, remain open to their way of thinking, try and think about how it works with my way of seeing the world, there was a definite learning curve there” (SI, KC, C1p7)*

- o Flow between activities perhaps because of the digital platform: *“Is it perhaps a jarring shift to go from a very interactive and energetic activity using art and animation, to a lecture on entrepreneurship? Doesn’t seem to be a proper flow from one activity to the next” (FN Learner Group, Tuesday).*
- o Student backgrounds far from transdisciplinary: *“He said that he did not understand [your session] to the point that he didn’t know what questions to ask to get access to what you were talking about. So he described it as sitting with visuals coming into his eyes but he couldn’t process it in relation to his own knowledge base” (SI, KC, C1p9).*
- o Leading to developing course practice after Course 1: *“It’s an interesting thing pedagogically as to how we address some of this next time and how we build it into sessions. There might even be something on the notion of trans-disciplinarity” (SI, AD, C1p12-13.)*
- o In relation to the C3&5 hybrid course: *“‘Challenging’, with the transdisciplinary part I think it’s harder to hold the transdisciplinary space when we’re in a hybrid environment, and I thought it would work more easily hybrid than the purely online one, but I’m not sure that’s worked. I think it’s been almost harder” (SI, LH, C3/C5 p1).*

2a. 1. 2 Improving Transdisciplinarity

In course 4 there were a couple of suggestions on how to improve the transdisciplinary aspect of the course

- By adding more materiality *“I sort of wish that what we’d done with the sessions that were kind of the science-y ones had got them to do something science-y. [...] But to look at some different building materials and, you know, explore them, or look at some different plants (SI, LH, C4p4.)*
- By thinking about the relationships between disciplines *“For the next course we need to think, as partners, about that relationship between science and technology, and how we want to sort of bring both of those aspects in. And I think maybe within the design thinking, you know, design and technology are also quite closely related”. (SI, LH, C4p5).*
- By exploring their own content within it *“So I think the course helped me explore my own content within the concept of sciculture, the creative pedagogies and so on, especially in terms of entrepreneurship and how it fits into the future of cities (SI, ED, C4p3)*
- By being outside of their comfort zone in order to achieve the transdisciplinary element *“I think that we need to get out of our comfort zones as well. So what would be blend of design thinking and dance and entrepreneurship?” (SI, MvdS, C4 p4)*

2a.2 Dialogue

In course 1 the focus was on how partners/trainers were thinking about how to use dialogue in the sessions and how to move away from traditional ideas about what dialogue is. In course 2 dialogue was observed more in sessions and thought of as working well. In course 4 the discussions around dialogue showed partners/trainers thinking deeper about what it was and how it manifested in the sessions. In courses 3/5 partners/trainers strongly thought that they had encouraged dialogue with more emphasis on embodied dialogue this time, however, there was less evidence of this in observational data.

Dialogue emerged as:

- Prompting dialogue: In course 1 and 4 partners/trainers were clearly planning for dialogue, for example:



Figure 14 Image from field notes C1

“When conversation stalls between participants, gives short input to try to spark conversation”. (FN, ?, C4, p2)

- Being ethical: *“They [participants] appear to be very good at having discussions in which everyone is able to speak their mind if they wish, rather than having one person become the dominating figure and have others who are constantly quiet and afraid to express themselves” (FN Learner Group – facilitated group time morning).*
- Embodied dialogue: In course 4 there was quite a lot of evidence that embodied dialogue was present during the sessions for example: *“I think there’s been a real variety of stuff that colleagues have given the students, the participants opportunities to try and engage, so that they are both embodied and in conversation, whether that’s through their body or through words”. (SI,KC,C4 p.1).* However, there were some issues with bringing embodied dialogue to life: *“And I think then trying to plan and anticipate and learning little tricks and things from teaching this year so that you can hold energy somehow, in an embodied way through the screen. I mean, I still feel very frustrated by it, but I think it’s there, it’s been there a little bit, I think, in what we’ve managed to pull off together” (SI,KC,C4 p.4).* There was also a small amount of evidence in courses 3&5 that embodied dialogue played a part in teaching: *“Crosses arms, leans on the table and listens to participant. Nods head in answer” (FN, AS, C3/5, p2).*
- Reflecting on dialogue: In all courses partners/trainers were reflecting on dialogue: *“This would be a great opportunity to make a deeper connection with theoretical ideas about dialogue, including embodied dialogue, and the notion of dialogic as per the features” (Fn, EDInt, analytic comment, C1, p1-2).*
- Communication: In courses 3&5 dialogue emerged in relation to communication between participants: *“lots of really interesting people there and really interesting comments and questions about different things.” (SI, EO, C3/C5, p6).*

2a.5 Risk, immersion and play

Despite partners’ experience in creative risk-taking and play in their own disciplinary practices, there were challenges in translating this to the pedagogical practices of course 1 with some partners linking play to experimentation. Immersion was apparent in course 1 but there was no indication that this was down to planning. In course 2 partners were thinking about how risk, and play manifested during session but still

linking play to experimentation. In course 4 risk taking was related to planning the course for a digital platform and explored in relation to participants whilst thinking about face to face or digital courses. Immersion and play were related to the embodied workshops. In course 3&5 partners/trainers thought they were encouraging risk, immersion and play but there was very little evidence in observational data. However, one partner/trainer thought that the programme had given participants a platform for risk taking and that participants were open to an immersive challenge.

Risk-taking was evidenced as:

- A challenge: *"I was a bit worried about trying to do some of those type of workshops in a hotel with limited resources available"* (SI, EO, C1p3). In course 4 the challenges of risk taking were related to planning an online course: *"I felt like there was going to be more risk in how the groups were going to set up and work in this space."* (SI, LH, C4p3), one partner was uncomfortable with this in places *"Because I think there is that risk that we experienced at the beginning of the week of losing students."* (Si, MS, C4p4). One partner was prepared though *"I tried to be prepared for any difficulties that we might face. Even from my connection or whatever, technical issues and so on."* (Si, MS, C4p4) so did not really see any issues *"Concerning my sessions, it went well. So I didn't experience any issues."* (Si, MS, C4p6). However, one partner thought that although the digital space had allowed some immersion and risk taking it was down to the human and not the digital space *"I think the quality still comes from the humans. So it doesn't give you any...everything in Teams can be replaced by humans, but not everything from humans can be replaced by Teams"* (SI, MvdS, C4 p3).
- Related to experimentation: *"I really see it as an experiment, a real sense of experiment with the students, with the partners and I think that effort is somewhat different but isn't that the idea of an experiment?"* (SI, MvdS, C2, p5-6). Due to the lack of explicit consideration of immersion, DQ suggested that perhaps a more appropriate theme could be 'emergent learning/adaptation/experimentation'.

Related to the digital platform in the form of cross-cultural immersion because of the online spaces *"I think that the cross-cultural kind of learning that has happened on previous courses has maybe been a bit more limited here"* (SI, LH, C4p10), but wasn't sure if it was more or less immersive than the previous courses *"I'm not sure if it was less immersive because they're in their own homes and you can't connect in the same way in Teams, or if it's more immersive because they're using the same murals and the same kind of digital space"* (SI, LH, C4p3).

Also, in course 4 one partner thought that the face-to-face courses allowed for more risk taking due to them being able to interact with materials: *"we were more limited in the aspect of immersion and play, in terms of an immersive experience, because in the previous courses I could see this element of risk immersion and play more present, for example. Because of also being all in a real face-to-face 3-dimensional space and getting to really also know the participants better and the ability that they could use many materials.."* (SI, DQ, C4 p1), and one partner had a suggestion on how to add it to the next course *"And I thought it would be nice for the next course to maybe beforehand ask participants to have different materials with them"* (SI, DQ2, C4 p2).

Play was evidenced as:



Figure 15 participants were invited to 'play' with materials to raise questions during 'scientific creativity' session (Fn, LSci, C1, Ph8537).

- Related to experimentation: *"This course itself is a giant experiment"* (SI, NL, C1p1)
- As open ended: *"Those quick words, right after asking questions are to fill that empty void in space and in security of leaving an open ended question rather than saying, 'OK we have these few provocations, tell me when we're going to have a discussion about it and reflections'"* (SI, ED, C2p6).
- As related to Transdisciplinarity: *"Even though the actual intro of it separated out science and the art so the session as a whole I thought it quite did an effective job of giving the students opportunity to try out and some tools to use to try out, that kind of transdisciplinary thinking..."* (SI, LH, C2, p1).

In relation to the digital platform: *"I've done Partner/Trainer 1's embodied workshops and I know they're really fantastic. But these show our playfulness and fun. And movement, different ways of doing things, which I really like"* (SI, ED, C4p4).



Figure 16 Choreographed session C4

- In relation to the digital space: *"that room with the movable walls, airbrushes, takes them away, brings in charcoal, clay, throw it around, take it away, cameras, animation, return to the dance theatre"* (SI, ED, C2p3).

- *As related to pushing boundaries: “hands reach out from Casper’s screen, grabbing gestures into the screen” (FN, LH 12.11, C3/5, p1).*

Immersion was related to planning: *“I think it was the structure of the course...the project time...but also I have to say also the social activities played a role because through them the participants managed to bond with each other and with the partners too” (SI, GT, C1, p2).*

2a.6 Possibilities

In course 1 partners/trainers were thinking about possibilities in relation to the course delivery and being open. In course 2 partners/trainers were thinking about their own possibilities in relation to planning and delivering. In course 2 partners/trainers were thinking about possibilities in relation to the digital platform and tools. In course 3&5 partners/trainers thought that they had given participants encouragement and space/time to think about possibilities but there was no evidence of this in observational data.

Possibilities manifested:

- Through working with others: For example, EO noted how *“I wouldn’t necessarily bring in a theme like the future of education or Anthropocene or social media into a hands-on course like that and in a way it made me question why not? The methodologies could actually be appropriate and interesting for people to think in a different way. And I was inspired by Partner/Trainer 1 and Partner/Trainer 2’s approach to that” (SI, EO, C1p12).*
- Through openness: *“the students were invited to consider things which weren’t traditional education”(Fn, ED, C1, p4). However, “[the course] could go further in terms of the things that the students produce, tangible materials that they produce as well as their ideas.” (SI, LH, C1p25).*
- Through reflections: *“I have a lot more I could have given to the students” and “next course I should come a bit more strongly on board to reintroduce that aspect” (SI, ED, C2p4).* Some of the partners/trainers were thinking about how they could think about possibilities: *“if they want to get into education or if they want to be involved in communication with other people how can we give them the tools to take that and move forward and make it their own and be the future of education.” (SI, EO, C2p3).* And one trainer connected her own possibilities to working with others: *“I think that the same is true for the partners so having the opportunity to work with people who or wouldn’t otherwise have chance to work with to try and create teaching experiences is really exciting and it makes me think about things in different ways and for me as a partner” (SI, LH, C2, p2).* In course 4 two partners recognised the usefulness of reflecting on the course to improve the possibilities of the next course, for example: *“. I think it will be helpful for us in gaining all this experience from face-to-face courses and virtual courses in the last course to try to realise it in the best possible way according to the experiences and the evaluation that we’ve got and the feedback that we’ve got from all the courses that we realised” (Si, MS, C4p7).*
- Through the recognition of options: *“More than once points positive aspects of presentations and makes parallels with concrete games/objects” (FN, Thpm, C4, p2); “Wow, in three days they did this. That’s amazing” (SI,ED,C4, p.5).*
- Through the digital platform: *“Obviously we’re using things like online tools and such, which are an explorative tool, trying to see how to use them, to make those work” (SI,ED, C4, p.3), and that digital tools can be used to improve possibilities “But I think that also there are opportunities, even in this virtual course, that could shape also in the in-person courses.”(Si, MS, C4p4); however, one was unsure about this “Possibilities I think it’s almost always there. I know that was lower down on our list of priorities when we were using them. Compared to with online and real worlds? Were there more or less?” (SI,KC,C4 p.3) and thought that maybe they were just*

different *“I think they’re just different, aren’t they? You know, the physical face-to-face possibilities are entirely...well they’re not constrained but they become different” (SI,KC,C4 p.3).*

- Through materiality: *“I think that it would have been maybe nice if we’d built more opportunities for them to work with materials during the sessions” (SI,LH,C4p1). “But I just wonder whether or not we could have done more to think about their material and bodily space that feeds into the computer” (SI,LH,C4p1).*

2a.7 Individual, Collaborative and Communal Action for Change (ICC)

In course 1 partners/trainers were clearly planning for Individual, Collaborative and Communal Action for Change, in course 2 they were reflecting on how Individual, Collaborative and Communal Action for Change manifested between partners/trainers and participants and in course 4 there was a small amount of evidence that partners/trainers were thinking about how participants were practicing ICC but also thought that the collaboration between partners could be improved. In courses 3&5 partners/trainers thought that they had encouraged collaboration more than individual learning and one partner thought there was more collaboration than in other courses.

Individual, Collaborative and Communal Action for Change manifested as:

- Planning for co-creation: In course 1 the theme of co-creation (and collaboration) was explicitly discussed in some sessions, for example when EO talked about collaborative work on climate change in classrooms in Norway and Bangladesh (Fn, ED, C1, p4). Co-creation manifested in the creation of the course between partners, though it was felt that this should be enhanced in the planning of future courses: *“I think one of the next steps will be to have a meeting on the concepts that we want to get across. And what our concept for a framework is...And now we know from each other so we can talk about it and see how things fit together... And actually play with it” (SI, MS, C1, p11).*
- Working with others: Partners recognised the importance of participants in ICC, which was particularly apparent in project time: *“Instead of achieving something in an individual way, ‘I achieved this,’ it was more a collective effort” (SI, DQ, C1p1).*
- Challenges with ICC: In course 1 partners found a particular challenge in the manifestation of ICC resulted from the range of disciplinary backgrounds and levels of expertise of the participants, and two partners reflected on challenges in the facilitation of participant ICC with participants working *“collaboratively”, at times ‘deathly’, and at times ‘hearingly’”(SI, KC, C1p3).* In course 4 one partner recognised the need for partners to be better at collaborating *“I think it went well, but we can do better. For example, I didn’t work with anyone on my part. I worked with myself..... But I think it would have been more rewarding if we explicitly said during the organisation process, ‘Edward is going to work with this other person within the team’” (SI,ED,C4,p.2).*
- Creating new ideas and ways of thinking: *“...also because myself and Maarten were sort of forced into the situation of coming up with something when that slot became available and I think that’s been really productive, really good because I, it also kind of changed my perception on some things and will change my approaches to teaching in tiny steps I guess but it’s still really good” (SI, EO, C2p2).* Perception seems to be that this gets better when they know each other more. One partner/trainer recognised how ICC was also used to solve conflict between the participants: *“...some of the minor tensions between the participant groups were solved like smoothly without any significant effort from our part.” (SI, GT, C2, p3).*
- Through the digital platform: There was a small amount of evidence that the partners thought the collaboration worked well amongst participants using digital tools: *“I really like seeing*

how groups of people collaborate together, also. That relates to the mural one. It gives me a lot of joy to see people hardly knowing each other; you put them in this framework and all of a sudden they're working together gives me hope for the world.” (SI,ED,C4, p.6).

2a.8 Balance and Navigation

In course 1 partners/trainers related balance and navigation to challenges in delivering and spaces and in course 2 partners/trainers were mainly concerned about balance in relation to planning, delivering and difference. In courses 4 and 3&5 partners/trainers also talked about the challenges of getting balance and navigating but this time in relation to the digital platform. However, in courses 3&5 one partner also thought that they allowed enough space and time for structure and freedom of learning.

Balance and navigation was evidenced:

- As relating to traditional teaching approaches vs transdisciplinary pedagogy: *“amount of talk...and the pedagogy of SciCulture” (Fn, EO, C1, p4).* In course 2 this also arose when many partners/trainers were concerned about getting the balance between traditional and non-traditional ways of teaching and learning *“My question is like how do you get the anti-education or anti-environment concepts within a five day intensive course that's really structured and has to be structured” (SI, ED, C2p6).* Also balancing an outcomes vs a process-oriented teaching approach was deemed necessary in course 1: *“I felt like there was some resistance and then the kind of releasing of pressure of results, conclusions was very relieving. And I think this workshop should not be so much in the result” (SI, AD, C1p11).* Balancing results and process is required not only on the part of the partners but for the participants themselves.
- In relation to the rhythm, time, pace and space of the course, for example: *“And then there's a cut and you go to the next scene, the next room, the next everything. And maybe it's interrupted in a way that it doesn't leave them space for incorporating it into whatever they're doing.” (SI,AD,C1p3).* In course 2 this was related to presentations and discussion timings: *“the whole time got taken up with the presentation and there was no time to talk and that's been a bit of a pattern” (SI, KC, C2wordsquestions.p2).* In course 1 the need to navigate a way responsively through the course space, in response to participants' direct or indirect feedback was also raised by two partners, for example, *“I changed my whole PowerPoint presentation for the second one [...] in order to get a bit more space” (SI, EO, C1p8).* In course 4 One partner highlighted that the limitation of time effected results: *“And of course this is also due to time limitation, because I have experienced other, let's say, things that are not from this specific course but other things, even as I told you at the beginning from schools or from other participants, that when they have much more time it is much more, let's say, the result, it is much better.” (Si, MS, C4p6).*
- In relation to partner reflections about space: *“Hard marble tiled floor; dark space, a large pillar obscuring the view of the 2 members of staff on their laptops.... The ceiling is low, the lights are dim [feels slightly oppressive for me] [and later] Leaning on tables, hard, dull light, marble floor, feet through shoes touching; wire hanging still, leaning back supported by chairs; looking at floor [our eye can't travel far down here – does this make us more reflective/internalized]?” (Fn, ACat, C1, p2; p4-5).* The field note description of a session in the conference room that was rapidly nicknamed ‘the dungeon’ gives a strong sense of the potential influence of space on the manifestation of creative pedagogies. Partners wrestled with the challenges of the physical space and the spatial organisation of the course for example: *“We ended up sort of trying to break out of the [“dungeon”] space a little bit...The sessions were organised into spaces and the space makes a difference to the feel of the session. The dungeon felt like a box, in the same way that it felt to me like we were boxing in*

the subjects rather than breaking them out into a trans-disciplinary way of working.” (SI, LH, C1p19).

- In relation to difference – of expertise: *“Do we want artists to get skills in social innovation so that they can go beyond their artistic expression ideas into something more tangible? Or do we want scientists instead to go the other way around...I think that we should find a balance between the two... It’s challenging to just bring them together” (SI, DQ, C1p9).* In course 2 there was also concern about the participation of participants due to differing backgrounds: *“...one group in particular that had some problems collaborating because one participant -- they have different backgrounds okay -- So one of them is a PhD student and the others were post- ah, undergraduates actually, their Bachelor's -- and he thought that he should step back” (SI, GT, C2, p2).*
- Through the digital platform: *“Partner often shares screen to make their points across. To talk, participants usually raise hands on the platform” (FN, Thpm, C4, p3).* However, a few partners recognised that balance and navigation was difficult to maintain on the digital platform where it was easy to get lost *“it feels more fragmented than in Bergen. We seemed to have...because we were all together and we were in these rooms together, you could kind of have an overview of both the schedule and then talk to people and so on, whereas when you get lost, you get really lost this week” (SI, EO, C4p2);* difficult to navigate: *“So you had very easy to see their reactions or their discussions or to hear their discussions, while now it was a bit isolated when you left the virtual room and go to the other. So for me it was not so easy to guide them in the proper way” (Si, MS, C4p3);* and hard to engage *“Cause it’s quite hard for the participants to engage creatively with those sessions where they’re just listening.” (SI,LH,C4p4).* However, some partners found that the digital platform allowed them to maintain balance and navigation for example: *“Balance and navigation I think for us as a staff team is there enormously ‘cause we’re constantly trying to kind of figure out what’s going on, respond, perhaps even more than we would be if we were face-to-face. (SI,KC,C4 p.2),* although one partner said that they couldn’t really understand it because of things they can’t see on the digital platform *“There’s this whole peripheral space that they were in and working with that we didn’t see and we don’t know. It’s like a...we don’t know what they were doing or what was happening in that space” (SI,LH,C4p2).*

In courses 3&5 partners were discussing how to adjust the course to allow for more balance: “we need to have a design-thinking colleague on the ground at the heart of the programme [...] the design thinking approach was muddled [...], it’s no harm for us to put a lot of examples of this kind of practice around if people want that on top, not necessarily in replacement of, the course” (SI, KC, C3/C5, p4).

2a.9 Other emergent outcomes

Other emergent outcomes from how the key features of creative pedagogy manifest for partners/trainers are:

- Reflection/Diffraction/Emergence: In course 1 all the partners interviews included reflections on their ways of working on the course and how they had learned from the experience, raising many questions for future courses. This is a very good example of where the term ‘diffraction’ is perhaps more appropriate than ‘reflection’ since, like dropping a pebble in a pond and seeing the ripples and changes as a result, the partners’ pedagogical approaches changed both during this course and in planning the next: *“I think it was a combination between reflecting on the content and on what the students were coming up with, but then*

being self-critical and developing my teaching methodologies that I hadn't really expected before. But that could be the nature of the subject and the nature of getting so many different people together, both staff and students." (SI, EO, C1p10). Interestingly, the depth of comment on this was largely from the partners coming from 'artistic' disciplines. The interview image Adria drew highlighted his reflective thinking about hierarchical knowledge, reflecting place (the Parthenon), dialogue and the creation of something from the SciCulture experience.

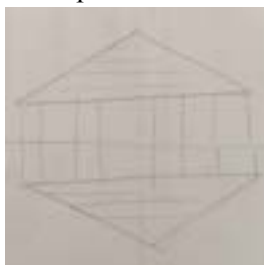


Figure 17 SI, AD, image.

A dynamic sensibility was apparent in three other partners' images of the course, that fits with the development of reflection into diffraction, tying with the open-ended and emergent nature of the course planning, teaching and aims.

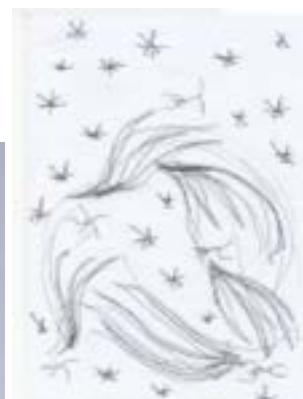


Figure 18 (SI, ED, C1, image; SI, KC, C1, image; SI, NL, C1, image)

- Space: The notion of space was associated in partner reflections in relation to several of the features in course 1 and as observations in course 4 for example in course one partners talked about the space nicknamed the dungeon: *"Hard marble tiled floor, dark space, a large pillar obscuring the view of the 2 members of staff on their laptops....The ceiling is low, the lights are dim [feels slightly oppressive for me] [and later] Leaning on tables, hard, dull light, marble floor, feet through shoes touching; wire hanging still, leaning back supported by chairs; looking at floor [our eye can't travel far down here – does this make us more reflective/internalized]?"* (Fn, ACat, C1, p2; p4-5). Partners wrestled with the challenges of the physical space and the spatial organisation of the course: *"there were certain challenges around both the venue and the things available. [...] on the actual doing, the hands-on, it didn't feel that it was possible to be so experimental, just because of the venue."* (SI,EO,C1p4). In course 4 it was the digital space that was observed: *"six squares fill the screen, all the same size. A small circle appears on the right bottom corner. One less square on the screen. Four small squares and one bigger rectangle on the right side. The screen goes back to six squares."* (FN, ?, C4, p3) and also the space of home: *"Partner/Trainer 1*

disappears whilst doing the movements, this leaves a room with different dimensions showing. Objects around the room, stuff on the walls, a basket of clothes in the corner, a dining table in the distance. Light shines through from the back windows into the back room, the middle room remains dark then the room in the forefront becomes light again” (FN, Ker, p3).

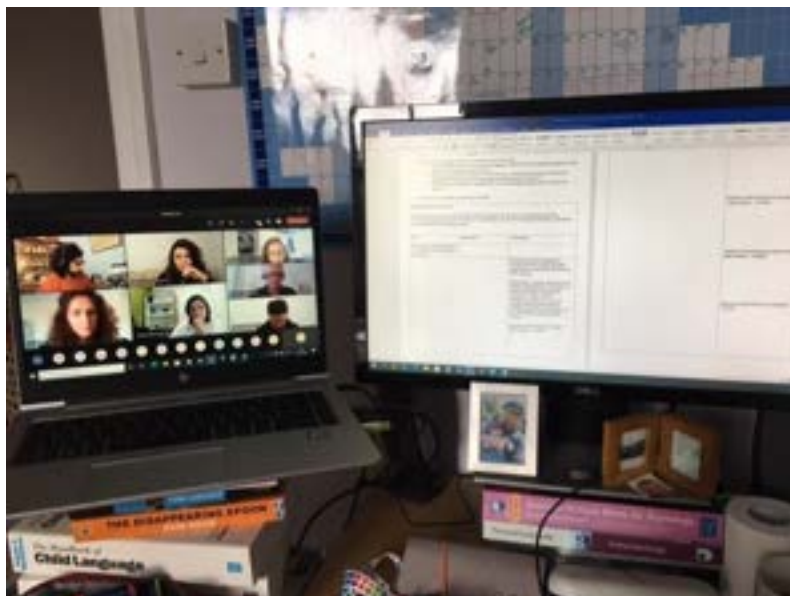


Figure 19 LH, Image 3

- The digital platform: Also in course 4 one partner expressed many issues with using the digital platform, for example: *“As a teacher, that being able to assess learning as you go matters a lot, and evaluating it as you go[...] And I didn’t get a strong sense from them of how they found it”* (SI,LH,C4p9) Another partner felt it took time to learn the digital platforms: *“it took me a little while to get my head around this idea of the pre-recorded direct inputs, and I’m not fully...I mean, it functioned and it actually worked really well the way it happened but I’m not fully used to sort of working in that format”* (SI, EO, C4p2). One partner thought that the digital technology created barriers: *“The technology is a barrier. We had many dropouts on Monday. People I think weren’t as committed to this course so we had a lot of dropouts on the first day. That wouldn’t have happened if we’d had a real-world course. They’re actually there, they can’t drop out”* (SI,ED,C4, p.2); with energies: *“I think the collaboration is made easier by Mural and Teams. But I find that there are Certain things missing. For me, my energy levels were lower working in an online space”* (SI,ED,C4, p.2). In courses 3&5 these barriers were seen in relation to the hybrid nature of the course: *“it’s a contrast between it being the best yet in terms of the design and the thinking behind the trans-disciplinarity but the experience being sort of frustrated by the hybridity of it, I think.”* (SI, KC, C3/C5, p1). Also in courses 3&5 the digital platform was seen as a barrier to group harmony: *“So it’s probably meant that their group hasn’t come together as quickly as it did maybe on the first two courses that we ran. But I think that they’re getting there now. I just think it takes a bit of a longer time, maybe. I don’t know.”* (SI, LH, C3/C5 p6). However, one partner in course 4 saw the use of digital technologies as creative pedagogy and as a good tool to promote it that worked well: *“I think that using Mural worked well.[...] Some of them weren’t able to get into it or use it so easily. But I think as a whole I think it worked as a sort of sensible system for doing it”*(SI,LH,C4p8), *“Mentimeter worked well as a whole group collaboration. [...] And in our session I thought that, you know, we had some interesting ideas that came out from them”* (SI,LH,C4p8).

- The benefits of creativity: *“I think that they needed, according to how it worked with students placed in my session, we needed to be a bit creative in order to cope with the assignment...[...] That’s why this connected with their creative aspect” (Si, MS, C4p3).*
- Importance of materiality: *“These intra actions with materials are constant. It seems as if they all need to be constantly touching something whilst talking, standing, thinking, planning and doing” (FN Learner Group Thursday, C4) and “Materials are used to add more intra actions to the activity as if materials are used as a prop to prompt the next action or shift it into something new” (FN Learner Group Thursday, C4).* In-betweenness relating to materiality: *“But really I enjoyed the things that actually happened in between. I think that’s one of the virtues of sci-culture is that it is physical. That’s what we do in our design class as well, through the logbook and that kind of stuff. But if I would make a picture for sci-culture, I would picture this chaos, so to speak. Or in the midst of having all these different insights collected and bring them together at the very end.” (SI, MaaS, C3/C5 p5)*
- Novelty: *“And seeing how we’re using Teams to help people collaborate and stuff, yeah, that’s all new, really. So this course has helped me learn new things that I wouldn’t have. Because we have to solve certain problems” (SI, ED, C4, p.4).*
- Less conflict/less investment: *“But when it comes to collaboration, there is actually less conflict now. People can’t get asupset with each other over Microsoft Teams or Mural as they can in real life. But that might mean they’re a bit less invested “ (SI,ED,C4,P.3).*
- Challenges with time: *“we were working right up to the last minute to have the show ready. (SI, EO, C3/C5, p5), “I had to come up with a complete workshop during a really hectic week that I hadn’t planned for, and then also be part of a round table discussion at the end as well. And it all worked out absolutely fine.” (SI, EO, C3/C5, p6).*
- With some participants not understanding what the course was offering: *“I think working with people on the course this time has been problematic. There have been two participants in particular who have, I think, come with misconceptions about what the course was going to offer them, and that’s been really quite problematic” (SI, KC, C3/C5 p2).*

2a.10 Summary

Evidence shows that there is a clear progression from partners/trainers beginning to think about the transdisciplinarity, dialogue, individual, collaborative and communal action for change (ICC) and empowerment features and trying to understand what they are and work out how to apply them in the earlier courses, evidence showing them emerging, then evidence showing that more critical thinking about how they can work better next time was taking place across the courses. In the final courses of C3/5 the transdisciplinary feature was seen to have worked the best so far and partners thought that all of the other features were strongly encouraged demonstrating that partners had a clearer understanding about what they are. The feature of possibilities was also evidenced across the earlier courses in relation to planning and delivering but in C3/5 it related to participants learning which partners thought they had encouraged. There was also evidence of more of the features emerging across all of the courses but in different ways. For example, in courses 1 and 4 balance and navigation emerged in relation to navigating learning spaces whereas in course 2 it emerged in relation to how to approach planning, delivering and difference and in C3/5 was related to the frustrations of trying to get the balance between time and space right. In the risk, immersion, play feature the main aspects emerged as planning and delivering, whereas play and immersion related to experimentation early on embodiment later and through play in the final courses. Ethics and Trusteeship was the least evidenced feature in early courses where it only appeared in courses 1 and 2. However, the online course in course 4 may have been instrumental in the lack of evidence due to it being difficult to capture. Nevertheless, in C3/5 there was more evidence of ethical thinking taking place both face to

face and on the digital platform. Emergent themes illustrated diffraction through reflection in C1; the challenges of different spaces in C1, C4 and C3/5, as well as the importance of materiality to learning which was seen as better in a face-to-face learning environment in C1 and C4, the benefits of creativity and the digital platform as a novelty and creating less conflict in C4 and challenges of delivering on the hybrid course in C3/5.

2b. How do the key features of creative pedagogy manifest for the participants within their experience of the trans-disciplinary intensive?

2b.1 Transdisciplinarity

Across all courses, participants were more likely to respond that they made links between disciplines during the course than prioritising learning within separate disciplines (median = 4 compared with median = 3, n=62, range =4). In course 1 there was a lot of evidence that both partners/trainers and participants were thinking about how transdisciplinarity manifested for the participants and how it was understood as grounded in dialogue, difference and collaboration and as thinking differently. In course 2 there was less evidence of transdisciplinarity emerging from sessions and where it arose it was mainly mentioned by partners/trainers and one instance in the field notes and post focus group, however, this course showed the highest rating for ‘making links between disciplines’ compared with other courses (median = 4.5, n=18). Where it was mentioned by participants it was linked to difference and partners/trainers thought it had been successful. In course 4 partners/trainers thought transdisciplinarity was evident during sessions even though participants were doubtful in places. This doubt is also found in the lower mean response to the question ‘I made links between disciplines’ in C4 (median = 3, n=15). There was evidence of it manifesting during sessions however and being more fluid meaning the teaching and learning flowed smoothly between disciplines. In course 3/5, participants’ median response to the question ‘I made links between disciplines’ was 4 (n=20).

Transdisciplinarity manifested as:

- Relating to dialogue, understanding of difference and collaboration: Participants did not directly refer to dialogue when discussing transdisciplinarity but they did understand it in terms of difference and collaboration (which can be seen as related to dialogue) for example: *“People from different backgrounds were observed discussing a lot of ideas”*. (Fn, ED, C1, p4), this was also apparent in course 2 where participants had in common an interest in what happens when these disciplines come together: *“In the feedback, one of the groups...outlined their take on/interests in transdisciplinarity and education rather than simply things they have in common, [and] in three of the groups’ feedback an interest in the intersections between science and art [appeared]”*. (Fn, MonIceb, C2, p2). Also, towards the end of course 2, a participant identified the interesting way a group consisting of different disciplinary backgrounds worked, suggesting that *“The most thing I learnt from working with the diverse [disciplinary group] is think and try to explore the competency and try to [find the] best way to work together.”* (PostFG, C2, p.2).
- Relating to agency and moving forward: The drawings the participants were asked to do as part of the post focus group interviews mostly demonstrated the tensions, which could be emotionally driven, relating to individual agency which arose through transdisciplinary learning but were also seen as positive in places to move forward with ideas. Their discussions reinforced this point too: *“Sometimes I felt that I could explain my opinion and that other people could listen to me, that I could listen to them, we could collaborate well, so I was happy. Sometimes I felt that only one person’s voice was heard and I felt a bit angry or sad about it”*. (P4, PostFG, C1p19)

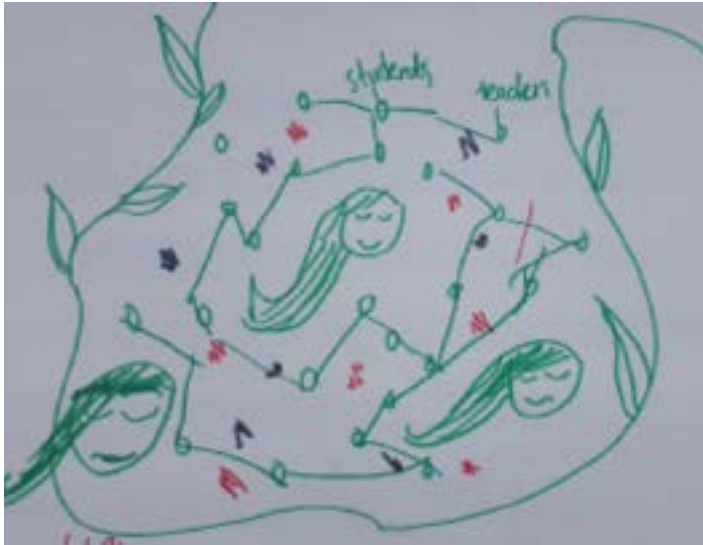


Figure 20 Drawing in relation to comment (P4,PostFG,C1p19)

- An embodied dialogic learning process: For example, figure 22 captures participants' movement, representing their process of design thinking which is also captured on their group board behind the dancers.



Figure 21 Dancing design thinking

There was some recognition of transdisciplinarity happening during sessions in course 4 too:



Figure 22 Photolog reflections from C4

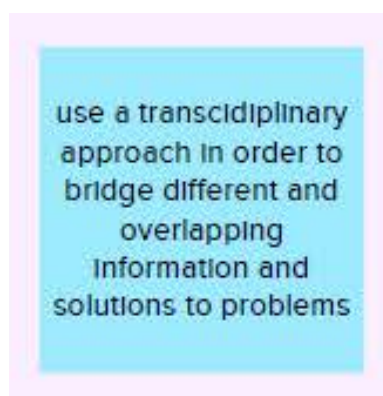


Figure 23 Mural Comment from C4

And, where “groups seemed invested on the activity, embracing the role play dimension and having a transdisciplinary approach to the challenge presented”. (FN, Thpm, C4, p2); “Joran, holding keys, which jangle as he moves them around ‘I like to keep doors open to different disciplines’. Hands moving from side to side as he talks about interdisciplinary to transdisciplinary” (FN, LH, C4, P3).

- As a meld of embodiment alongside digital technology, design thinking and dialogue to engage viewers: “OK, I’m going to ask you to close your eyes and really listen to what’s going to happen”. Pause. Silence. There is discussion of the process. A narrative plays, participants stand silently, eyes closed. Eyes open, Ylke’s voice guides us to look around and notice, image on screen like a moon (from the microscope)” (FN, LH 12.11, C3/5, p2).

2b.1.2 Participants’ understanding of Transdisciplinary learning

Participants thought they were being asked to think in a different way alongside developing specific knowledge because of the combination of science, arts and business: “So then if we think this way then I think yes, our scientific knowledge – at least for me – has improved”. (P2, PostFG, C1p4). Reflecting on their learning through course 2, participants from different disciplinary backgrounds highlighted how their own processes had changed as a result of engaging with transdisciplinary learning, with design students’ “seeing [the art student’s] process” (Post FG, C2, p. 5), or the art student’s description that “But now this very interesting for me to now come up with on a paper or in a proper procedure when I work with different scientists and different science students so this was

very interesting to me...” (PostFG, C2, p.3). The space as a manifestation of transdisciplinarity was also noted: *“I really got inspired even from the place being an art space and the activities that we built, I got inspired to realise that art can be a source of entrepreneurship and product and the way of making a life out of it.”* (PostFG, C2, p.2). In course 4 although at the beginning, transdisciplinarity was highlighted as an important aspect of the course by the focus group participants, there was less mention of it at the end of the course. One participant who did mention it thought that it didn’t work well: *“I thought it was really interesting seeing all the transdisciplinary perspectives and really thought-provoking seeing them. But...and I don’t know how to do this. I felt they didn’t quite mesh, they didn’t come together. I still felt that they, particularly in the presentations, they were still isolated disciplines.”* (postFG, VT, C4p12). In course 3&5 participants were thinking about how to use transdisciplinarity and saw it as a benefit:

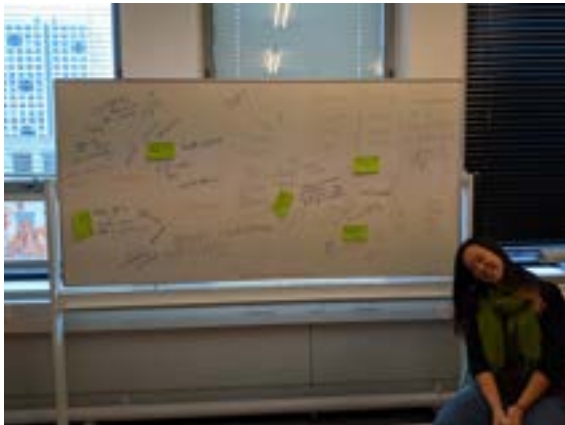


Figure 24 Photolog photo from C3/5 1

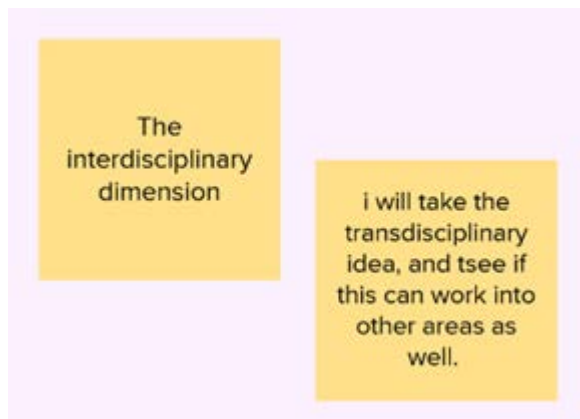


Figure 25 Mural Reflection Comments from C3/5

However, also in C3/5 some participants thought that the connections between subjects could have been clearer:



Figure 26 Mural Reflections from C3/5

One participant questioned the understanding of transdisciplinary:

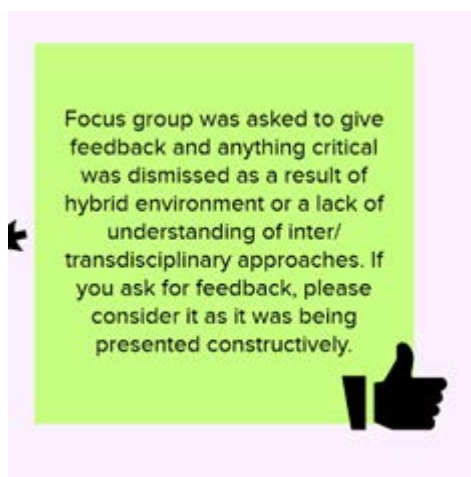


Figure 27 Mural Reflection from C3/5

And one thought the lectures needed to be designed in a transdisciplinary way:

the lectures - they felt
very "standard
academic" and didn't
fit with the
transdisciplinary
educational nature of
the rest of the week

Figure 28 Mural Reflection from C3/5

In the post focus group some participants thought that the transdisciplinary approach was too open: *"It is because it feels like the topic, like the future of this city, is too, like...too open. It feels like if the topic could narrow down in one point or in kind of like a specific area would be really nice because it feels like everything is floating on the surface but is not, like, too deep"* (FG2, C3/5, P2).

However, other participants found it both challenging and rewarding: *"Yeah. I found it challenging. Whether that was because of the transdisciplinary so much as the hybrid, I did find it quite challenging, like, at times – different expectations, different backgrounds, different approaches. At the same time I did find it really rewarding when we did, like, come together in something and we perhaps shared or found an insight or built something. And I still think it's really exciting to be working with people from different knowledge fields"* (FG2, C3/5, P2).

2b.1.3 Teachers perceptions of participant experiences of transdisciplinary learning

In course 1 staff data showed mixed perceptions of participants' experiences as both interesting and challenging. For example: *"I watched the trans-disciplinary element of the course be extremely challenging for different sets of students at different times"* (SI, KC, C1p1). In course 2, however, partners thought participants were more willing to take on a transdisciplinary approach: *"the willingness with which students are taking on and mixing things together so they're willing to put some drama techniques with the science knowledge"* (SI, KC, C2.p1). Described as *'immersive, challenging and creative'* (SI, DQ, C2p1), and *'Fun, learning and stretching'* (SI, KC, C2) by course partners, transdisciplinarity manifested in the course in the diversity of the participants, including partners, their processes and their outcomes. However, it is interesting that one of the partners noted the experimental nature of transdisciplinarity: *"Time of alchemy, time of experimentation and these different times which I think we need to embrace again"* (SI, EO, C2p6). Despite this, partners also commented that both the outcomes and the processes of the course felt stronger in transdisciplinary terms than course 1: *"[the] transdisciplinary element also feels stronger within the student work, I don't know whether that's because of the co-leading by the partners but it definitely feels more connected this time"* (SI, KC, C2.p1). In course 4 partners felt that the transdisciplinarity aspect was more fluid: *"science and art and entrepreneurship, they are all kind of coming into play when relevant but there's not like a hierarchy with them. And that's why I'm describing it as fluid."* (SI, EO, C4p1). One partner thought that transdisciplinarity did not occur in certain groups however *"It definitely with the Group B guys this morning felt more connected. But the experiences I had with the other group were perhaps more separate disciplines, but I think that's more indicative of where we were in the week than those groups being less transdisciplinary."* (Si, KC, C4p2).

2b.2 Dialogue

In all courses dialogue was seen mostly as discussion and embodiment. There was also some evidence in all courses that dialogue was used to understand difference and to navigate barriers. In course 2 there was evidence of people connecting with ‘other’ through dialogue but also some uncomfortableness with engaging in dialogue. Issues with dialogue were only raised in course 4 where the digital platform prevented or interrupted dialogue in places. Given the theoretical perspective on dialogic learning within creative pedagogies drawn on in SciCulture, we asked participants the extent to which they engaged in continuous questioning of their ideas, which occurs through dialogue. Most participants agreed or strongly agreed that this was the case (34/53, median = 4, n=53), with C2 participants more likely to respond positively that this was the case (mean = 4.33, median = 4, n=18) compared with C4 (mean = 2.87, median =3, n=15) and C3/5 (mean = 3.7, median = 4, n=20).

Dialogue manifested as:

- Looking forward to gaining communication skills: *“But I’m hoping for some really interesting ideas and insights into interdisciplinary collaboration and also for some really creative ideas about communicating and engaging with publics” (PreQ).*
- Discussion: In all courses, participants responded positively to the statement ‘talking over ideas with others helped me to learn’, demonstrating the importance of dialogue in these intensive courses (overall mean = 4.08, median = 4, n=53). In course 1 participants engaged in dialogue through traditional discussions between each other.



Figure 29 (Fn, ED, C1, IA, ph8596)

The image above and fieldnotes demonstrate that students were engaging in dialogue on the course: *“from a group of 4, 3 students talked. In another group all 5 students talked and in other group all 5 students talked as well [this was a great measure of success]. The students actively listened to each other and also communicated their ideas. They shared personal experiences. Despite the traditional nature of the talk it worked well”.* (Fn, ED, C1, p4). Teachers also saw dialogue between staff and students: *“I think the main thing was this dialogue between the participants and the staff”* (SI, EO, C1p12).



Figure 30 C1 Dialogue in Action

- The exchange of information and ideas:



Figure 31 (Fn, MonIceB, C2, ph026)

- Questions leading to questions: For example, *“the dialogue starts off each time with a question, “do we all use twitter?”, followed by agreement, or not. ‘Are we all...’. Sometimes the question is phrased differently, ‘do you like photography?...Conversations are focused around who they are, their institution and background and the sorts of things they are interested in. (Fn, MonIceB, C2, p2-3).*
- Mutual learning: *“exchange has to do also with this aspect of really exchanging knowledge so I liked the fact that I could learn from them and they actually learned from me” (SI, DQ, C2p2).*
- Working things out: *“Brainstorming: they produced words like balance, colonize....but now they’re talking about plant next to one participant; asking why plant is purple but in reality, is green” (FN, Pav, C4, p2).*
- Embodied: Participants in all courses identified bodily interaction and interaction with the material world as important to their learning in the course, with this being much more strongly rated in C2 and C3/5 compared with C4 (bodily interaction overall mean = 3.37, median = 4; C2 mean = 4.00, median = 4; C4 mean = 2.6, median = 2; C3/5 mean = 4.11, median = 4. Material interaction overall mean = 3.69, median = 4; C2 mean = 4.06, median = 4; C4 mean = 2.73, median = 3; C3/5 mean = 4.11, median = 4). Comparing these results between courses, the difference between C2 and the other courses for bodily interaction is statistically significant (Chi-square = 12.556, $p < 0.005$). However, the difference for material interaction between C2 and the other courses is not statistically significant.



Figure 32 (Fn, Iceb, C1, p8513)



Figure 33 Participants hands covered in goo – experiencing through touching, feeling, moving materials (Partner/Trainer 1) (Fn, LSci, C1, Ph8537).

In course 1 the images above show participants engaging in materiality and embodied dialogue. Where embodied dialogue was present this also raised questions for analysts around how space was encouraging and discouraging dialogue and how materials might be influential in dialogue too. In course 2 participants recognised the importance of embodied learning during the course. One participant even expressed how embodied learning had been the highlight of the course for him:

“I had no expectations, but it absolutely blew my mind (and body)” (Questionnaire). This aspect of dialogue developed over time, beginning with a ‘warming up’ for embodied dialogue:

“Participants have been asked not to talk while moving. They formed a circle and started warming up their body after Partner/Trainer 1’s directions (Fn, Weds Perf/DI, C2, p2), which then becomes more evident: “Repetitions made participants bolder in their attempt to try more sophisticated body postures and use more directly the objects and space surrounding them” (Fn, Weds Perf/DI, C2, p3). The two images (Figure 35) exemplify the embodied dialogue developed through the course, with the participants’ needing to be closely ‘tuned in’ to each other as part of their moving together.



Figure 34 Embodied dialogue.



In course 4, however, only one Participant evidenced resonance with embodied dialogue discussion:

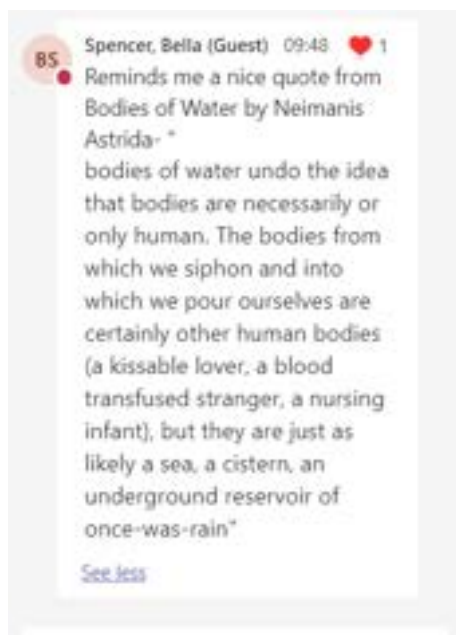


Figure 35 Embodied Dialogue discussion

In courses 3&5 there was quite a bit of evidence that body language and movement demonstrated engagement/disengagement in participants: *"When participant next to him speaks, he changes is position. Switches crossed leg and leans torso towards the participant speaking"* (FN, AS, C3/5, p1) and there was one instance where absences of verbal dialogue refocused attention to bodies: *"There is an oddly dreamlike quality to being unable to hear all the words in the performance, it forces focus and attention on the bodies and objects intra-acting, lending a sense of bodies in dialogue in the space. I can't see the tablet and the online participant in the performance"*. (FN, LH 12.11, C3/5, p1).

- Understanding difference: In all course participants saw dialogue as a positive tool for communication amongst diverse backgrounds and for the understanding of different cultures. For example: *"In my groups, because we're from about three different countries, so sometimes we think things from different perspectives but I think throughout those days, the activity, we can combine our opinions about one topic and we can make good communication with each other"* (P3, PostFG,C1p1) and some participants in course 4

thought that discussions between different people and partners were key to the learning *“stimulating because my spirit, my knowledge was stimulated through every workshop and discussed with the partners and the people in my group, rather than learning according to read new things, search for art stuff, for landscape architecture.”* (postFG, VK, C4p11). However, in courses 1 and 4 some issues with dialogue and difference were recognised: *“I had a great time with my teammates, but would have liked to learn more from all the different backgrounds and disciplines”* (PostQ).



Figure 36 Reflective Mural quote from C3/5

Navigating barriers: In course 1 one student expressed that dialogue sometimes created barriers between participants: *“So I saw communication both as a medium and as a barrier. If used well, ‘cause it’s a tool”.* (P1, PostFG, c1p10-11). This was also seen in course 4 where there were a few barriers to the discussions. Language was one barrier *“Some language barriers. Most members discuss and talk, but language barrier with one of the elements makes the person less engaged with the activity”* (FN, ?, C4, p2), this was expressed by one participant at the end of the course *“I am a bit disappointed at the level of discussion we were able to reach. Not only because of different disciplinairies but also because of a language barrier”* (PostQ), but mainly the barriers seemed to be through the digital platform: *“And in this case it was not so easy to guide them, and in some cases it was, let’s say, not very...it was not so easy for them, I think, to be in a room and start discussing. Because many times while I was visiting a room it was somehow silence”* (SI, MS, C4p4). However, in course 1 the learning process was described by others as a way to overcome these barriers, even though the process itself could be challenging: *“but I watched them [two participants from different backgrounds] literally bash up against each other verbally on four, five, six occasions, where they were sometimes using similar language but meaning different things but not knowing that they meant different things, and that’s why they were just bashing up against each other”.* (SI, KC, C1p1,2)

- Being ethical: *The rest of the group seems comprehensive and patient with these situations. Some frustration at times. Healthy discussion, constructive criticism and exposition of diverging opinions”* (FN, Thpm, C4, p2).
- Connecting with other: *“Several participants are writing things down as another participant is discussing his experience and maintaining eye contact”* (Fn, Tues FGT, C2, p1), *“Some discussion about splitting the performance in two, so that the online are in zoom.”* (FN, LH 12.11, C3/5, p1).
- Uncomforting: *“Quiet participant at one point has her arms crossed and leans back in her chair, when asked a yes/no question, nods her head. She appears a bit shy and uncomfortable with the activity and discussion”* (Fn, Tues FGT, C2, p1). Another participant expressed discomfort with the embodied dialogic approach introduced in the movement session (LH reflective notes, Tues FGT, C2). Partners noted some of these discomforts and attempted to draw participants together: *“Some of them have appeared separate and I’m trying to bring them in”* (SI, ED, C2p7).

- Digital issues affecting dialogue: *“Internet connection was cut a couple of times on a student’s side that impeded her being well-understood. In addition, the sitting position of another student stopped her from being clearly audible”* (FN, Mah 16th, C4, P5), and created interruptions in the dialogue: *“Another technical problem with google meets”* (FN, Pav, C4, P2), *“After the presentation there is space for an open discussion. Participants are not asking questions so Edward is the first to open the discussion by asking a question”* (FN, E&M, p1). Notes show this continues with staff verbal discussion with participants contributing in the chat in stulted dialogue *“There are many moments of long silences where participants are staring at their screen rather than engaging with each other. They are all staring at their laptop in a focused way”* (FN, ?grpwork, p2), Ker, p2). Sometimes there was empty dialogue: *“I look across at the chat and see some partner questions and comments there, but they have not been responded to”* (FN, LH, C4, P2).
- A challenge: *“Communication and giving space to all ideas being represented and accepted. And it is a challenge how to present all ideas together; how all ideas are going to work at the end”* (FG2, C3/5, p2), Some participants thought that the hybrid course created communicative challenges:

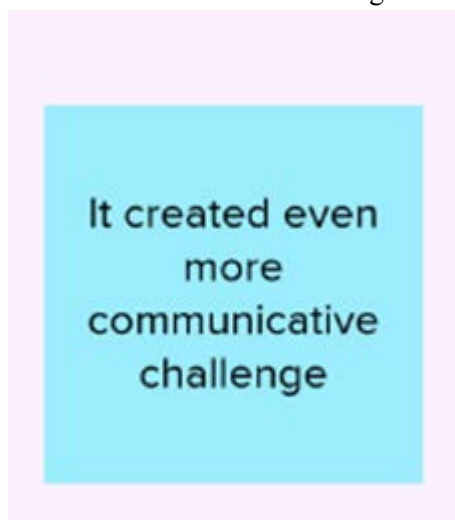


Figure 37 Reflective Mural quote from C3/5

- Finding different ways to communicate: *“One group: two of the four are discussing. One writing. Some silence from time to time. They are mostly asking the Maltese person about the things. One person doesn’t talk a lot”* (FN, A n.d., C3/5, p2). *“In the online space, participants talk about how to organize their materials in a zoom, videos, for their performance next, then let us know to move to the zoom. ‘I’ll see you there’”* (FN, LH 12.11, C3/5, p2).

2b.3 Ethics and Trusteeship

There was some evidence that participants were thinking about ethics in courses 1 and 4 but they were observed being ethical across courses 1,2 and 4. Questionnaire responses suggest that most participants felt it was important to think about ethical implications of their work and learning (overall mean = 3.40, median = 4, n=53) and that they took responsibility for ethics on behalf of their community (overall mean = 3.56, median = 3.56, n=53). Interestingly, in C4 the mean response to the statement ‘it was important to think about ethical implications’ was to disagree (mean = 1.87, median = 2, n=15). Further exploration would be required to understand what factors made a difference here, though this was not apparent in C1, C2 or C3/5. Furthermore, in courses 1 and 2 partners were

thinking ethically about participants experiences of the courses. In course 2 there was some evidence of trust coming out in embodied ways between participants and in course 4 there was a very small amount of evidence that there was mixed feelings about trust between participants.

Participants were:

- Thinking about ethics: *"It fulfilled an important need to create a network of people who care about the world and want to innovate together. I had been longing for such a nourishing environment. I have met several people who I believe will become my colleagues in various capacities in the future."* [student] (PostQ p. 9), in terms of place: *"I guess it would be nice to focus on maltese culture, maltese space"* (FN, LH 12.11, C3/5, p1).
- Being ethical: *"It makes it difficult for people to respect their career if they are not valued in society"* (Fn, ED, C1,p2).

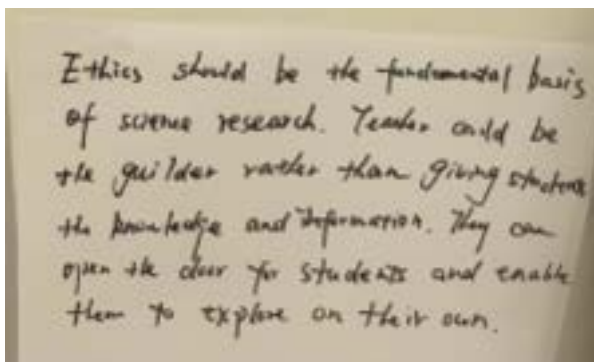


Figure 38 (Fn, LSci, C1, ph8553)

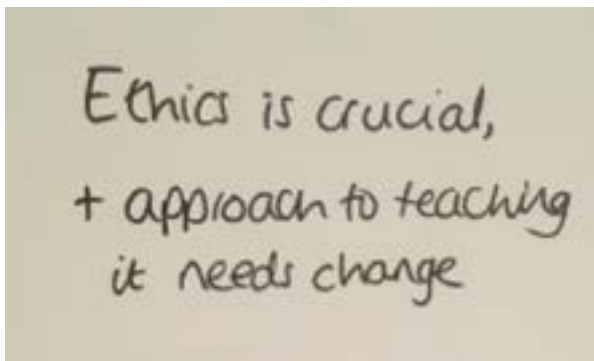


Figure 39 (Fn, LSci, C1, ph8555)

About Place:

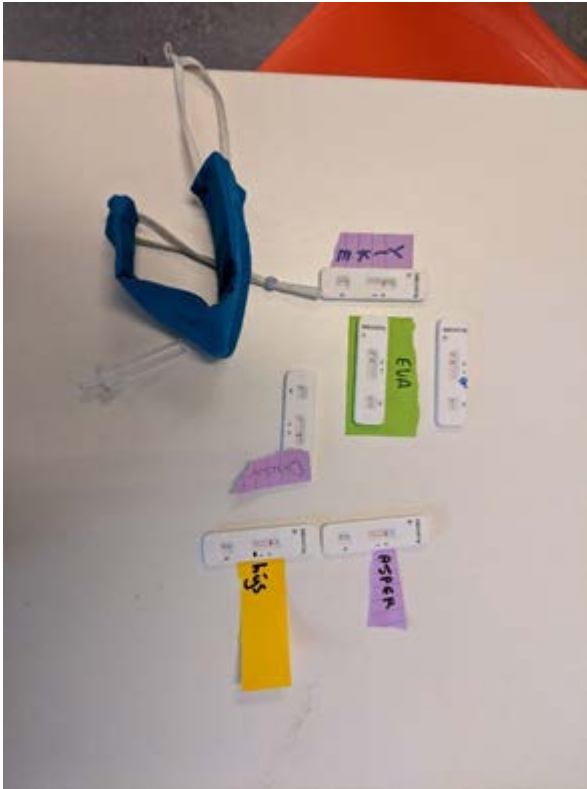


Figure 40 Photolog from C3/5

And a participant in course 2 was “sharing his feelings about how pessimistic he feels about the future and the other participant who was quiet the whole time said ‘I think humans need to be wiped out’ with a smile, agreeing that the future is bleak.” (Fn, Tues FGT, C2, p2). In course 4 participants were observed thinking about ethical considerations during planning “. V raises her hand ‘from the safety point of view we have to make it safe for bikes’, ‘a place for dogs’, C raises hand and puts it down” (FN, KC, C4, P2).). Also in course 4 one partner noticed a possible sign of valuing ideas and being affected by them: “conflicted, hand on face. Seems frustrated” (FN, Thpm, C4, p1), and in courses 3&5 the importance of light to wellbeing emerged: “They reply that it’s about natural light. A debate develops about natural and fake lighting that creates the ‘wrong’ or ‘right’ atmosphere” (FN, KC 9.11, C3/5, p2).

Trust and trusteeship manifested as:

- Embodied and Material:



Figure 41 (Fn, WedsPerfDI, C2, ph076)

- Between participants: Where some said they got on well: *“I had a great time with my teammates, but would have liked to learn more from all the different backgrounds and disciplines” (PostQ)* and others feeling the different levels of knowledge between participants affected the whole experience *“Too wide a mix of participants meaning that the course was aimed at the lowest common denominator and was far too low a level” (PostQ)*.

And in courses 3&5 one participant liked being told to trust the process:

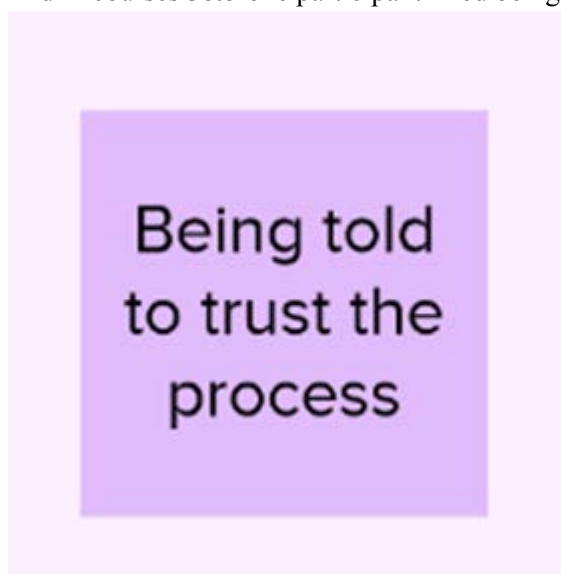


Figure 42 Reflective Mural Quote C3/5

2b.4 Empowerment and Agency

Course 1 saw more evidence of empowerment than agency through fieldnotes, whereas course 2 saw more evidence from fieldnotes and partner interviews, of agency than empowerment occurring in sessions. In course 4 there was more data to suggest empowerment in participants than agency, where lack of agency was also highlighted, however, empowerment was recognised by participants themselves whereas agency was highlighted by observers. In C3/5 there was less data demonstrating empowerment or agency. The majority of participants in all courses felt able to make choices (overall

mean = 3.48, median = 4, n=53) and had the opportunity to enact their choices (mean = 3.45, median = 4, n=53). Results between the different courses are similar, with no statistically significant differences in participant's perspective of their empowerment and agency across courses.

Empowerment manifested:

- Through sessions: *"the level of engagement between them showed that once Partner/Trainer 3 stopped his talk they were empowered"* (Fn, ED, C1, p4). Data from the end of the course demonstrated that through their presentations they showed that they had been empowered to generate their own ideas: *"The students had to present their work as a group, and they communicated things like: schools with a kitchen and garden to teach life skills and subjects like maths and biology. This showed that they had learnt the concepts of the session"* (Fn, ED, C1, p4). Interestingly, however, there was some evidence of disempowerment too: *"Not everyone communicates in the same way. An analytic person finds it harder to express their opinions. Communication in education as people are different – it's going to be tough"*. (Fn, ACat, C1, p5.)
- As being thoughtful: *"The discussion pauses a little (10.26) while notes are made and the group appear to be thinking, looking up"* (Fn, MonIceb, C2, p2), which perhaps suggests empowerment though not yet agency (Partner/Trainer 1).
- Through experience: *"stimulating because my spirit, my knowledge was stimulated through every workshop and discussed with the partners and the people in my group, rather than learning according to read new things, search for art stuff, for landscape architecture"* (postFG, VK, C4p11).
- As knowledge: *"The new knowledge that they allow us to expand our thinking and get our ideas a step forward."* (P2, PostFG, C1, p1). In course 2 participants' showed values and beliefs about the importance of the topic: *"I think that the depth, the level of critical reflection and the ability for the students I mean to reach a deeper level, like less superficial [than course 1] for sure. They were immersed; I think because the theme was climate change and Anthropocene..."* (SI, DQ, C2.p1).
- Through the action of others: *"They do not engage directly at first. One element asks a question and the rest of the group gets more engaged. They quickly get back to focus on their own screens"* (FN, AS, C3/5, p2).

Agency manifested as

- Views and opinions: *"Different participants throughout the talk have been voicing their opinions and views"* (Fn, Tues DI, C2, p3).
- As Gender difference: *"I noticed the men tended to lead the discussions around the table in this session. I am not sure if it is because the men are dominant, or the women were missing from yesterday's session therefore needed to catch up"* (Fn, Mon FGT, C2, p. 1).
- Embodied Dialogue: Agency was also seen as manifested through movement and embodied dialogue (see Figure 44), where the whole group were seen sharing their ideas to make a representation of their groups' ideas in action. *"They also used the floor while balancing on their hands. At first the rest of participants looked at them with a sense of confusion, but they instantly became more motivated and looser, as they also tried more challenging body postures including having physical contact with each other"* (Fn, Weds Perf/DI, C2, p3), *"Two groups in the back are more vocal and move more than the ones in the front"* (FN, AS, C3/5, p2).



Figure 43 (Fn, Weds Perf/DI, C2, ph079)

- Taking control: *“Drew on the white bord behind him to add depth to the activity.”* (FN, Thpm, C4, p2). This may be why there was also a small bit of evidence to suggest a lack of agency *“Participant sits to the side of the camera and explains what they need to do. She complains about information overload and that she is overwhelmed”* (FN, LDgrps, p1), *“The participants are leading the partners for where to be and what to do in this case”* (FN, LH 12.11, C3/5, p2).

2b.5 Risk, Immersion and Play

On average, participants felt that they took risks during the courses (mean = 3.63, median = 4, n=52); that play was important to them in their learning (mean =3.75, median = 4, n=53); but were less likely to state that they ‘often got lost in their learning’ (immersion) (mean =2.87, median = 3, n=53). This pattern was found in all courses, though the difference is greater in C2, where the difference in average score for ‘risk’ and ‘play’ compared with ‘immersion’ is greater. A course 1 a small amount of risk taking mixed with play was observed during sessions, in course 2 risk and immersion came out more strongly and in course 4 no evidence was highlighted. In courses 2 and 4 immersion was related to the material-dialogic embodied space mostly with some evidence of the digital space in course 4 disrupting immersion in participants.

Risk and Play manifested:

- In sessions in the different groups, for example *“one group included roleplaying and storytelling for Immigrant groups—they had to roleplay each other’s story”*. (Fn, ED, C1, p4). There were also some observations of play and some discussions around risk taking and play: *“Once the students were performing the task they started sharing stories. One student talked about how museums are not places for play, but when they are used in such a way it opened up the concept of possibilities [they used this specific word] and was very effective”*. (Fn, ED, C1, p2), Participants were being playful through their presentations which were creating curiosity: *“Footsteps, whispers, paper folded over a banister with ideas written on”*. (FN, LH 12.11, C3/5, p1).
- The facets of this feature ‘risk’ and ‘immersion’ came to the fore more strongly in the course 2 data than was apparent in course 1; playfulness is less immediately apparent in the textual data but can be seen within the photographs and students’ work (Figure 45).

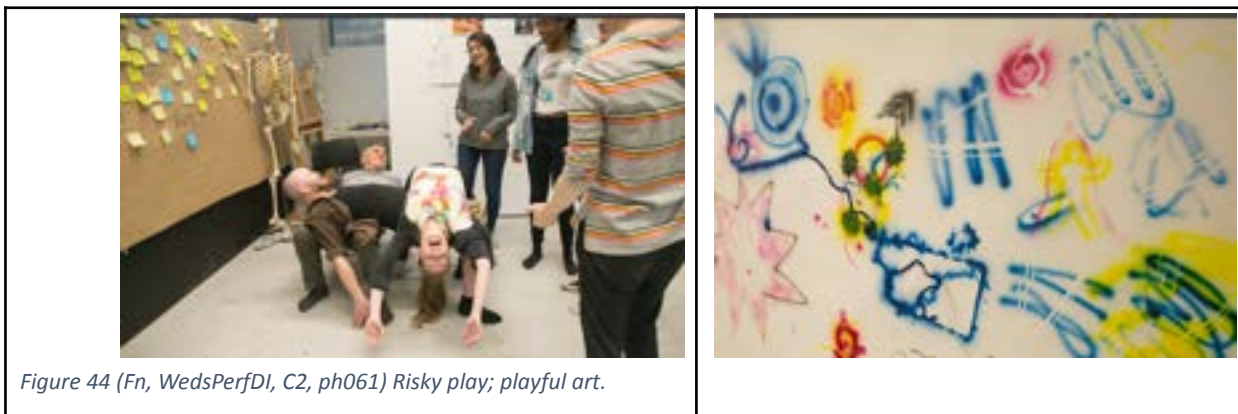


Figure 44 (Fn, WedsPerfDI, C2, ph061) Risky play; playful art.

- Through questioning: *“Laughter and smiles. [Participant] “What is our political orientation?” “Ooooo!” “Are you a socialist, perhaps, or do you...” Body language is more serious, fewer smiles, more nods/leaning in to listen” (Fn, MonIceb, C2, p2).*
- Through embodiment: *“first the rest of participants looked at them with a sense of confusion, but they instantly became more motivated and looser, as they also tried more challenging body postures including having physical contact with each other” (Fn, Weds Perf/DI, C2, p3), “Learner is getting ready for the momement session – standing with feet apart, rolling up her sleeves, bending and touching her toes, moving her hips, doing some yoga poses and stretches on her own on the floor. She stands up again and attempts a headstand, people laugh” (FN, HW 10.11, C3/5, p1).*

In C3/5, some participants wanted more risk taking:



Figure 45 Mural Reflection comment C3/5

Immersion manifested:

- In sessions: *“Everyone is focused and involved. I haven’t seen a single person during observations that appeared disengaged, bored, removed in some capacity from the activity. :)” (Fn, Tues FGT, C2, p3).*
- As a material-dialogic space: *“I felt that this space was more immersive for the experience and less fragmented than we were in Athens so it gave me really the feeling that you were totally immersed in a very creative environment and full of inspiration” (SI, DQ, C2p1).* The intra-action between shape, space and depth of ideas was also important: *“Tension in between abstract shapes which I found really powerful, and that tension and feeling [is] important for the creative process and to really go deeper into ideas” (SI, ED, C2 p.7).* Fieldnotes show detailed insight into embodied engagement: *“Looks at corner of camera while other participant speaks, potentially to where the participant image pops up. Looks outside while thinking. Gesticulates while speaking. Constantly puts her hands in her face either on hair, ear or forehead” (FN, ?, C4, p1).*

- Lacking in the digital space: *“Through the whole sessions, rarely turns camera on, hardly speaks. Doesn’t seem comfortable with sharing her image. Another participant has some language barriers.” (FN, Thpm, C4, p2).*

2b.6 Possibilities

Our questionnaire framed questions to participants with respect to the notion of ‘possibility thinking’, asking to what extent participants thought about ‘what if’ questions (mean = 3.4, median = 4 n=52); or generated new possibilities (mean = 2.96, median = 3, n=53). In each course, we see a similar pattern of a stronger agreement in asking ‘what if’ questions, (which can be connected to our dialogic and creative pedagogical approach) with fewer participants feeling they actually came up with new possibilities. C4 is again rather different from the other courses, with more participants disagreeing, or giving a neutral response to these questions compared with C1, C2, or C3/5 (C4 ‘what if questions’ mean = 2.71, median = 3, n=14; C4 ‘coming up with new possibilities’ mean = 1.87, median = 2, n=15). Whilst the quantitative data does not tell us reasons for this finding, the major difference in C4 was its fully online nature. However, the hybrid C3/5 course showed higher responses than C2 to both questions. Other evidence of participants engaged in possibility thinking was mainly related to creative tools and tensions in course 2 and a small amount in course 4.

Possibilities manifested:

- Through critical thinking: *“Once the students were performing the task they started sharing stories. One student talked about how museums are not places for play, but when they are used in such a way it opened up the concept of possibilities [they used this specific word] and was very effective”. (Fn, ED, C1, p2).* Some students did express that they saw the possibilities of the sessions helping them to move forward with ideas. For example: *“The new knowledge that they allow us to expand our thinking and get our ideas a step forward”. (P2, PostFG,C1,p1).* In course 2, the use of material space lent a stronger sense of tracing participants’ thinking about possibilities through the ideas, notes and scattered patterns: *“The wall holding their ideas is right behind them, post-it notes sticking out, scattered and perhaps patterned tracking the process from earlier process” (Fn, Weds FGT, C2, p2).* There is also a sense in which the physical space prompted dynamic response to possibilities from partners and participants alike: *“we can be responsive to those surrounding contexts as well as planning [ahead] and I think there were aspects where it just worked” (SI, EO, C2p1).* In course 4 many of participants were thinking about possibilities at the beginning of the course for example: *“I hope that this course can teach me more about effective forms of communication and give me a better insight into the transdisciplinary possibilities. This is not only of great value for my graduation, but also for my further career” (PreQ)* and at the end of the course some participants were thinking about the possibility of improving the course through a more careful participant selection process: *“The course organizers might either adapt the assignment accordingly, or adapt the selection of participants” (PostQ).*
- Through creative tools and tensions: *“I think for me using the creative tools to sort of tell the story differently than what I would normally do...in a way it requires creativity so it's nice to have tools that also sort of emphasise on the line of creative aspects to help those cognitive processes go easier or go long I would say...” (PostFG,C2,p.1).* The contrast, even tension, in the course aims opens out a range of possibilities for the participants: *“We want the students to really go deep, to the deep layers and to the essence and having that critical mind-set but on the other side there is the element of entrepreneurship, design thinking which are developed mainly in a world a bit high speed time in everything” (SI, DQ, C2p1).* Tension within group dynamics was also seen as having potential and a sense of possibility: *“[a group showing tensions] being the group that seems to have the least likelihood of producing something but also the greatest potential of really delving deep” (SI, ED, C2p1).* In course

4 there was one example of role play playing a part in acting ‘as if’: “*A member of the group seems particularly engaged in the role play*” (FN, Thpm, C4, p2).

- As thinking about the possibility of ideas: “*Another participant makes a point about who is invited into conversations about city wellbeing and how invested or not they might be in the ideas and whether they realise what the benefits of certain projects/approaches might be*” (FN, KC 9.11, C3/5, p2).



Figure 46 Photolog C3/5

2b.7 Balance and Navigation

Balance and navigation was evidenced mostly in relation to course structure where there was a small amount of data in participant discussions in course 1, a little more evidence in participant interviews and questionnaires on course 2, evidence through observations and interviews of both participants and partners in course 4 and less evidence in C3/5. The mean average response from participants to the question ‘I was given appropriate structure and freedom in my learning’ was 3.38, and median response of 4 (n=53). The below discussion explores a range of facets of the ‘balance and navigation’ feature of creative pedagogies, but with respect to balancing structure and freedom in the participants’ learning experiences, there are some differences between courses. The majority of participants in C2 felt that they were given appropriate structure and freedom in their learning through the course (17 out of 18 responses), whereas in C4, only 3 participants agreed that this was the case, with 8 neutral responses and 4 participants disagreeing or strongly disagreeing, and in C3/5 the response was spread across the full range (see figure 48).

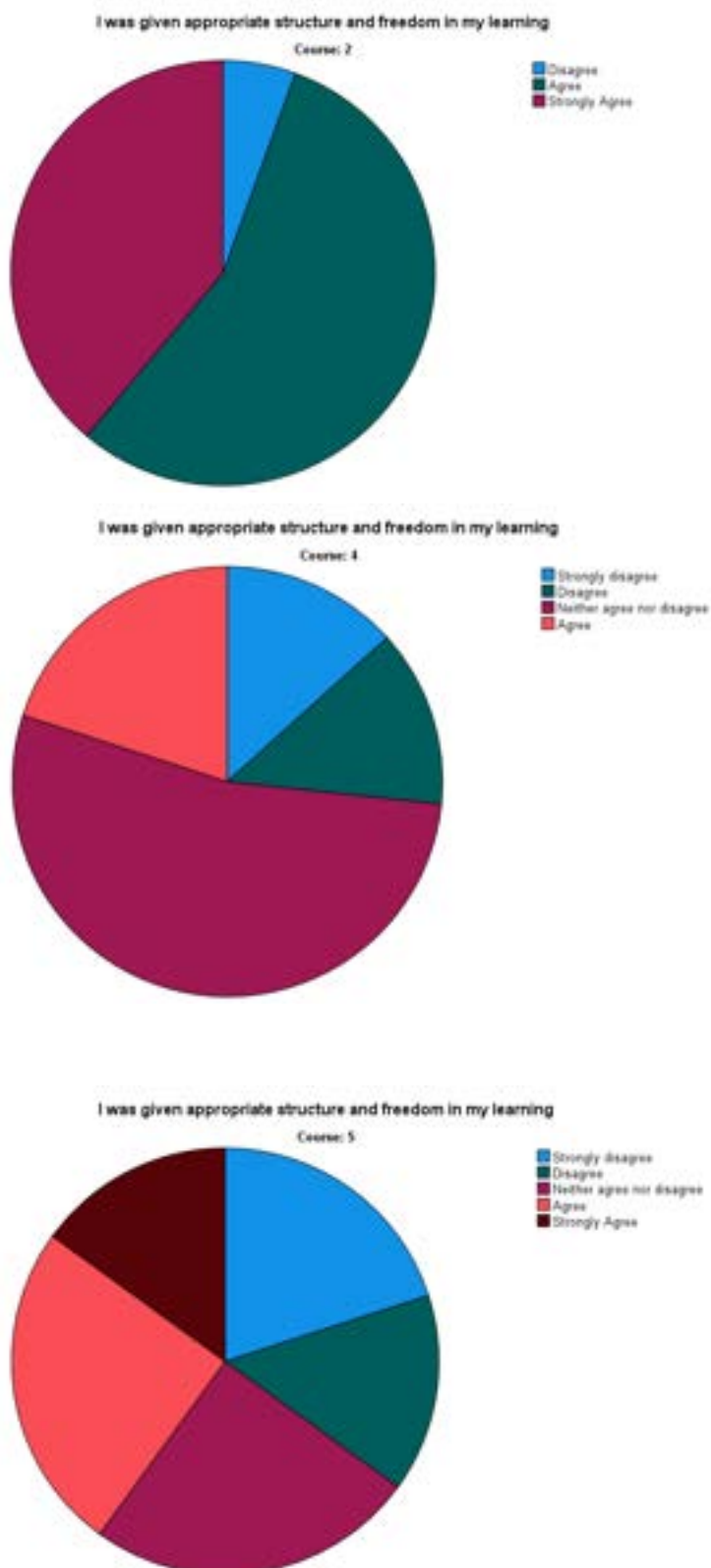


Figure 47 Questionnaire data from all courses in answer to question: I was given appropriate structure and freedom in my learning.

Balance and Navigation was evidenced:

- Through discussion: *“I didn't know anything about design thinking so I really liked [that] element [...] I definitely learnt, I thought it was so confusing at the beginning but then I interpreted as design thinking is a title and you have many categories underneath it, methodologies are constructed by people that you can maybe use but to begin with I was very confused for quite a while. (PostFG, C2, p.4).*
- In relation to the course structure: *“However, I hope that the program helps me to make connections between (analytical) thinking and (creative) doing. I would like to learn to balance these in my daily activities” (PreQ); “Also, expanding my viewpoint while learning from others and being able to comfortably navigate between science, art and design for understanding complex problems and finding innovative solutions” (PreQ).*
- In relation to the digital platform: *“Group E takes longer to start (about a minute) because one participant had more some connection issues. This didn't seem to affect their presentation or performance. After a day and a half, one of the participants is finally able to show more than his forehead” (FN, Thpm, C4, p3),* where some were deciding to give more away about themselves than others:

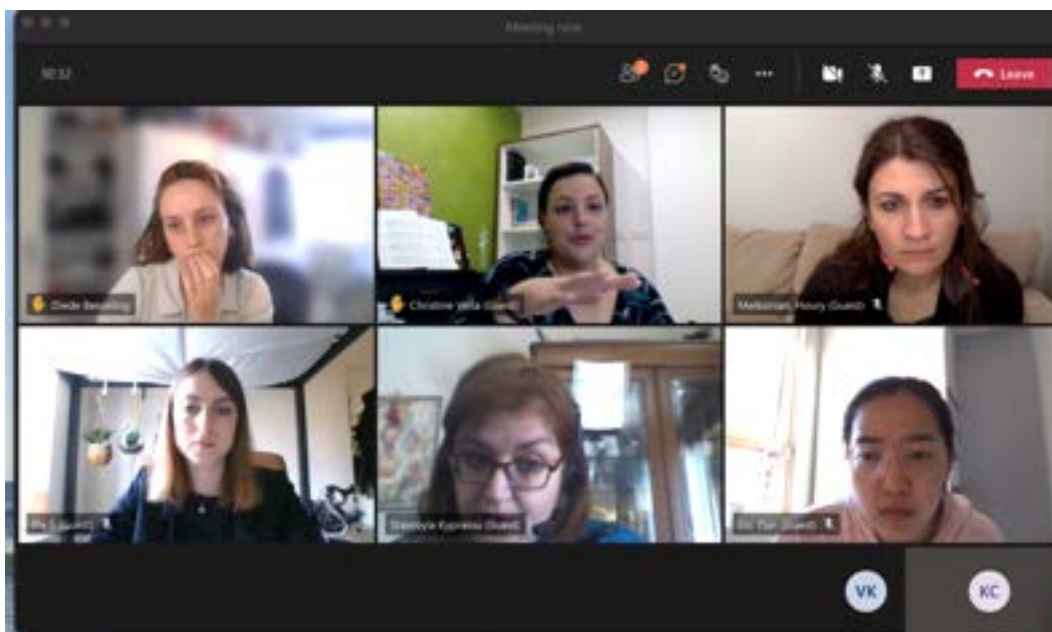


Figure 48 KC images

One participant felt that she needed clearer navigation *“I almost think because there's so much expertise in the room in the partners, that it's quite hard as a participant to see a clear line through. So I think for me the sort of direction has been a little bit lacking at some points” (postFG, VT, C4p2).* At the end of the course many of the participants commented on getting the balance right between presentation techniques, subjects and levels of participants: *“No. I would have love to go into more depth for most topics. I also expected more hands on workshops instead of presentations. I also thought that the participants would be students, artists or entrepreneurs.. which they weren't.. I am a bit disappointed at the level of discussion we were able to reach. Not only because of different disciplinairies but also because of a language barrier. I think the participants really make the course, therefore selection of these participants might be an important step of making the course better” (PostQ).*

- Relating to diversity: *“the thing that personally for me is SciCulture is to find balance between diverse worlds” (SI, DQ, C2p1).* One view of balance is linked to a *“dynamic of understanding and questioning”* for students who are from diverse backgrounds but *“on an equal footing” (SI, EO, C2p3).*

- In relation to ethics: In course 2 students made regular reference to the need for balance in relation to action for the future with respect to climate change and environmental responsibility, as shown in the dialogue example and photographs in figures 50&51.

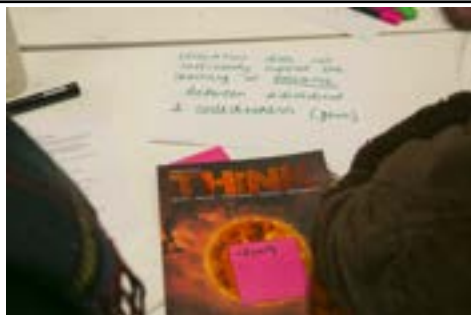


Figure 49 "Education does not sufficiently support the learning of balance between individual and collectiveness (Gaia)", in green writing on paper laid on the table.



Figure 50 A bread human and burned book, left after first attempt at filming a stop-motion animation. The bread human has fallen over from its previously balanced position.

K – could be about sharing – could be a few scenes, vignettes showing things
 B – we already know stuff about wind turbines, maybe starting off where people have to start all over again
 H – make breakfast, you need to find wood, make fire,
 C – there could be no words
 B having actors not speaking and then there's a narrator.
 H – sets the world up.
 J/H – connecting this to our stop motion animation – we stopped that part way through, talking to a skeleton, kind of Mad Max feeling
 C – there could be other survivors
 H – it becomes more and more stressful to share the resource – that's the problem with balance
 (Fn, Tues FGT, C2 p. 1)

- Between the virtual and the real world: *And I could see that the idea was to, you know, 'Let's sort of try and go beyond the digital space into the real world, where we should have been.' [...] It was like, 'Great, well I'm not there. I'm stuck in front of my computer having a kind of Blair Witch experience with handheld shaky cameras.' So yeah, it was quite trick" (postFG, VT, C4p2), "She says she still cant see the camera and Ed says he is aware of that, she apologises" (FN, HW 10.11, C3/5, p1).*
-

2b.8 Individual, Collaborative and Communal Action for Change

With respect to the feature of creative pedagogies regarding creativity as individual, collaborative and communal activity, we asked participants about the extent to which they engaged in learning individually, as a group, and collaboratively. Overall, most participants agreed that they engaged in learning in all of these ways, with collaborative learning achieving the strongest overall levels of agreement that they learned in this way during the courses (Collaborative learning mean = 4.45, median = 4, n=53; group learning mean = 3.96, median = 4, n=53; individual learning mean = 3.47, median = 4, n=53). Interestingly, although differences are not significant, the digital course, C4, also achieved high ratings for collaborative learning (mean = 4.53, median = 3 n=15) albeit slightly less

than C2 (mean = 4.67, median = 5, n=18). It is interesting that this result was higher for C4 than the hybrid course C3/5 (mean = 4.2, median = 4, n=20). In contrast, fewer participants in C4 agreed or strongly agreed that they engaged in wider group learning (C4 mean =3.13, median = 3, C2 mean =4.44, median = 5, C3/5 mean = 4.16, median = 4). The reasons for this are not clear. In course 1 there was a small amount of evidence that the nature of co-creation was foregrounded in the data which emphasised co-creation as a result of group diversity, whereas it was noticed by partners in course 2 that focus was placed on a flat hierarchy in contrast, as well as in relation to objects. In course 4 there was more evidence selected which demonstrated co-creation

Individual, collaborative and communal action for change manifested:

- Between participants and partners: *“In the task section the team from Exeter and Malta helped Partner/Trainer 3 either in taking pictures or bringing items for the students or discussion the topic with them” (Fn, ED, C1, p5).*
- Through the design process: *“We were introduced to the science theme and social design, and instead of just having all of your ideas in your head you could organise them into different ways so that everyone could collaborate and pitch in as well”. (P1, PostFG, C1, p1).*
- As hindered by more didactic teaching approaches: *“Some lectures were too long without a lot of time for teamwork” (PostQ, C1, p8).*
- Through co-creation: *“MD shares his notebook, moving it across to be in front of the others so they can see it and they take a look and see what else they have. (Fn, MonIceb, C2, p2).* There was a small amount of insight into how ideas developed co-creatively ie stops and starts, highs and lows: *“Element speaks out and no one answers. Another element joins the meeting half through and tries to start a group dynamic/icebreaker. All the group is open to her suggestions and seems immediately more excited with the online dynamic. One of the elements wants to make a video, the rest of the group doesn’t seem excited with the idea. Everyone gets up for the dynamic suggested and starts dancing. At the end, although everyone seems happier, the discussion around the challenge is still staled” (FN, ?, C4, p2).*
- As anticipation of the course: *“From the SciCulture I expect to practice and acquire communication skills and enhance teamwork in a transdisciplinary collaboration setting” (PostQ).*
- As collaboration: *“And to do so, I think that they were very good even if the assignment, it was one of the first, let’s say, assignments, as it was on the second day. I think that they collaborated very well in order to produce this result” (Si, MS, C4p3).*

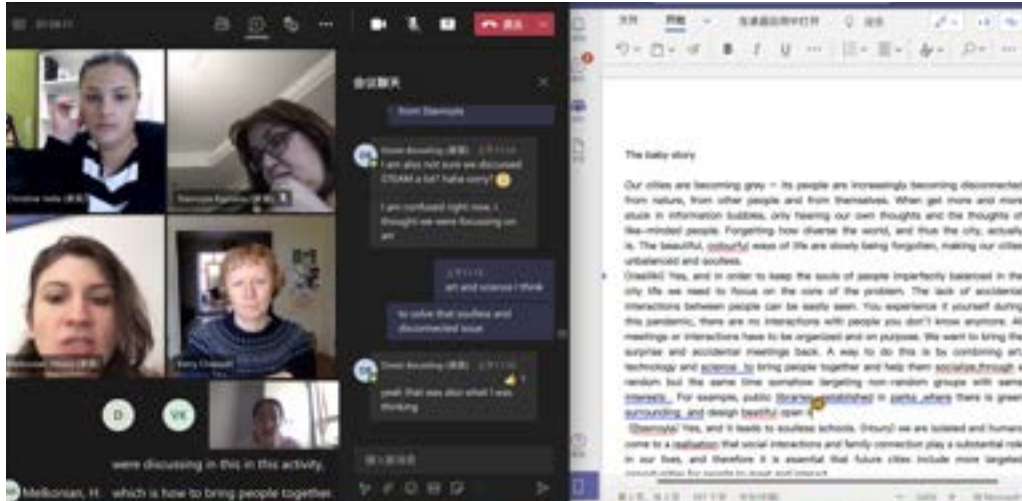


Figure 51 Collaboration images C4

- As diversity: *"I have met many people from different backgrounds and I feel I have learned a lot from them" (PostQ, C1, p8).* At the end of the course some participants thought that co-creation with the other participants helped them to learn about different cultures for example: *"I had the chance to collaborate with people from different backgrounds and exchange views while working on the project. At the same time, I learnt a lot of new things and skills that will definitely be very useful for me in the future" (PostQ).*
- As co-creation with objects: Non-human agency was manifested in this course with objects as co-creators: The skeleton stands out in the photographs and in the data as a co-creator with the participants (Figure 53). Its presence in the room at the outset and adoption by one of the groups seemed to make it part of that group: *"A stack of connected bones, a skeleton is suspended in the hands of one person, he kneels and puts the skeleton tumbly on the floor... Another puts skeleton on his back, gesticulating, walking, stepping... Skeleton is nudged with feet and propped up against a chair... Two bodies, pushing and pulling each other through their arms – fingers interlocked over the top of the skeleton. They pull apart and start to talk, pacing in small steps around the floor" (Fn Weds FGT, C2, p. 2).*



Figure 52 (Fn, Tues FGT, C2, ph024, Fn Tues Ref C2, ph151)

- As individual work: *“participants start sharing how partners entering the group might perceive them as silent and not talking to each other; they laugh and say how they are focusing individually on the mural logbook.” (FN, ?grpwork, p2), “participants are using the mouse to move post its notes around and there is more an individual (FN, ?grpwork, p2).*
- On the digital platform: *“Whole group interactions happen mainly through the chat during the session. A lot of interaction on the chat when other groups are presenting” (FN, Thpm, C4, p3), “It’s like the film is a connection that all are intra-acting with, intra-acting silently with each other, through the film” (FN, LH 12.11, C3/5, p3).*
- As embodied:

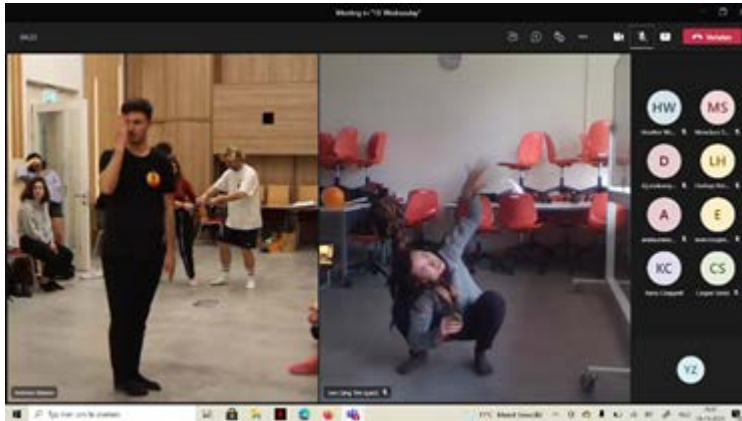


Figure 53 Photolog C3/5

- As beneficial to learning: *“So then that required creatively ‘cause...connecting all these disciplines together by itself is quite creative. You have to find a creative way to bring science and art and everything together; and actually I think we...my group was quite creative doing that and I really enjoyed the process of it. That was very stimulating” (FG2, C3/5, p2).*

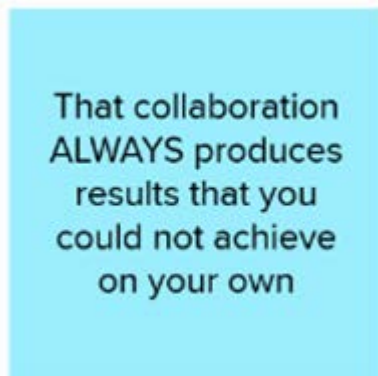


Figure 54 Reflective Mural Quote C3/5

2b.9 Other emergent features of pedagogy and learning?

Some further questions emerged from observations and conversations in relation to the pedagogy and learning:

- Pedagogy related to disciplines: In course 1 there were a number of emergent points related to different disciplines and their pedagogy. Some students asked for more entrepreneurship information and time for application: *“I think we just have some basic knowledge of*

entrepreneurship but we don't have enough time to practice this...application".

(P3,PostFG,C1p4). Although the performing arts session actively involved taking part in performing arts practice, this was not the case for the other art form sessions, and students requested this more practical experience of the fine art sessions too: *"I mean, an art installation could have been set and then we could intervene and the partner could tell us more information about the project that he did"* (P4,PostFG,C1p.7).

- Time: Pressure and Constraint: *"I felt sometimes the lecturers were really constrained with time, I could really see it on their faces...I felt [Partner/Trainer 2] was being rushed into it so we can move on to the next stop and that I felt like that had a pressure on me"* (PostFG, P0, C2, p.5).
- Space/Materiality: *"Participants were actively using the environment and surrounding materials while practicing their movements. Two of them used the note boards to find balance in order to exercise some challenging movements and body postures. They also used the floor while balancing on their hands"* (Fn, Weds Perf/DI, C2, p3).



Figure 55 (Fn, ThursEa, C2, ph025)



Figure 56 (Fn, ThursEa, C2, ph042)

Also final art work as material manifestation of intra-active process?



Figure 57 (Fn, ThursEa, C2, ph061)

- Working in different spaces refocusing or shifting thinking: *“Participants are quite active, working with cameras, post-its, the moveable walls. Physical positioning of participants is indicative of being highly engaged. Groups are all facing each other and/or facing the wall they’re working on. i.e., there are no “stray” individuals on the outside of this group time session”.* (Fn, TuesFGT, C2, p3).

It was extremely surprising that I discovered new corners and items in the house during Kerry's session ☺

#observation_skills_enhanced



Figure 58 (Fn, ThursEa, C2, ph061)

- Collaboration and conflict resolution: In course 2 participants noted the challenges inherent in intensive collaboration in diverse groups not of their choosing: *“I think a lot of groups were struggling with collaboration, us included and I feel that in the beginning after we, there was this thing about this profiles like different personalities...”* (Post FG, P0, C2, p.6). Suggestions from these participants were to include more reflection time, as well as an initial workshop to aid participants in fostering effective collaboration and resolving conflict. They also raised questions about the effectiveness of partners’ approaches to conflict resolution, *“there was a big conflict but when staff members came over they didn't know how to deal with it and the way they dealt with it for an example in a room yesterday, they said leave, come back later and I said that is the worst approach you could have and that's why I stopped and told them you should just put away the differences quickly and work but the staff members where agitated”* (PostFG,P1,C2, p.6). In C4 though, participants developed strategies for overcoming conflict through collaboration, for example: *“I find it much easier to work with facts and when it comes to things like dealing with specific individuals, I think art definitely helps, personally helping to sort of direct my input in a way that was helpful. I think art helped him in that regard. So I think it was important that we had this transdisciplinary aspect to it”* (PostFG, PM, C4p12).

Shaped by tech (is limited verbal a bad thing though or just different?): In course 4 the technology helped to shape the learning in various ways: *“The use of the Mural online platform would focus the attention of participants on the screen staring at MURAL rather than looking at each other. This would limit the free flow of conversation and exchange between them (FN, ?grpwork, p2).*

Conversation shaped by tech:



Figure 59 (Im, Grps)

Shaped by tech combined with movement



Figure 60 (Im, Ker)

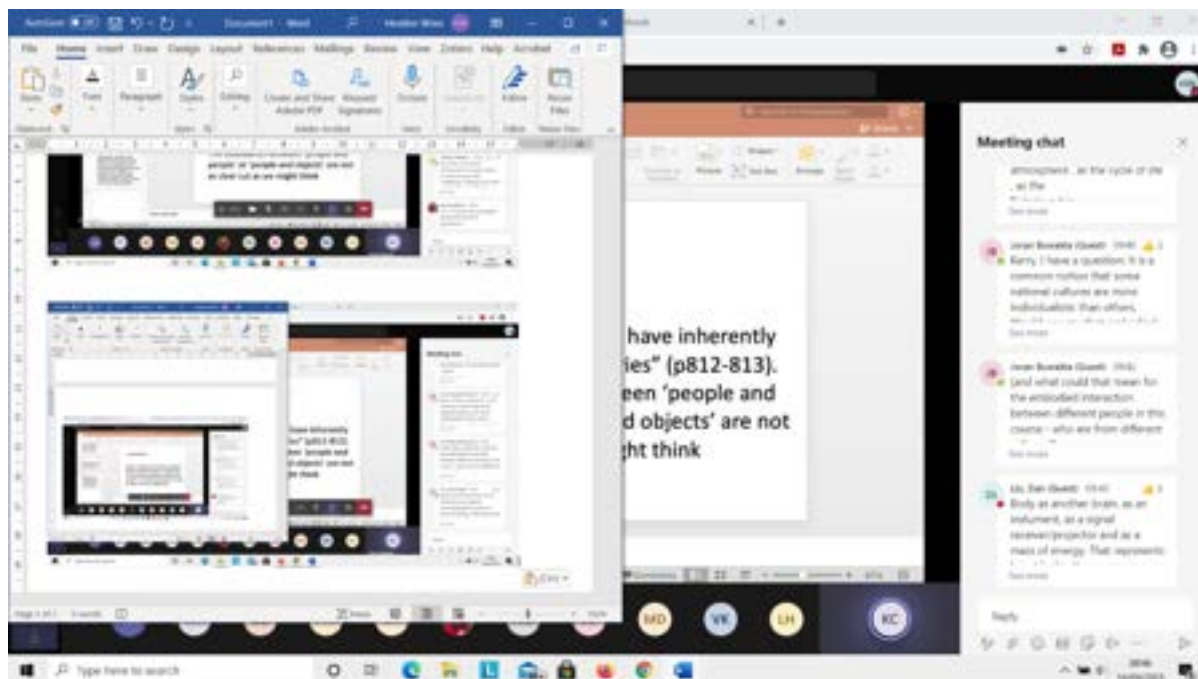


Figure 61 (Im, Ker)

Shaped by tech with lines and shapes: “Deep perspective of the room is in view...Squares in backgrounds....circles at top flashing on and off. Rectangles at bottom of each screen. Mic symbol with line through. Large boxes, small boxes” (FN, HW 11.11, C3/5, p2).

- Maintaining motivation: In course 4 one piece of evidence showed that a participant was observed trying to maintain motivation: “She looks fed up but is trying to move things forward. Students discuss how cities are both old and new in design” (FN, LDgrp, p1).
- Movement and rhythms Important to learning: “ She has her finger on her cheek and the rest of her hand curled around her lips. She looks up moving her eyes around the screen in front of her (she could be looking at both M and the ppt slide). She tilts her head to the side as she writes (I assume)..(FN, KC, C4, P1). There was also a small amount of recognition of the rhythms occurring during learning: “Part of the audio backdrop is also the sound of these words being typed into another white box on the lit screen” (FN, KC, C4, P3) and “Another voice takes up the audio backdrop it is more grating but rhythmic than the other backdrop voice”. (FN, KC, C4, P3), “Lots of movement of bodies, chairs haphazardly stacked on tables, the colour of them dominates the picture, arms moving around, different shapes of different people, standing facing different directions, tables placed at different angles” (FN, HW 10.11, C3/5, p2)



Figure 62 (FN, HW 10.11, C3/5, p2)

- Digital interruptions:

There was a small amount of recognition of how digital interruptions played a part in the learning:

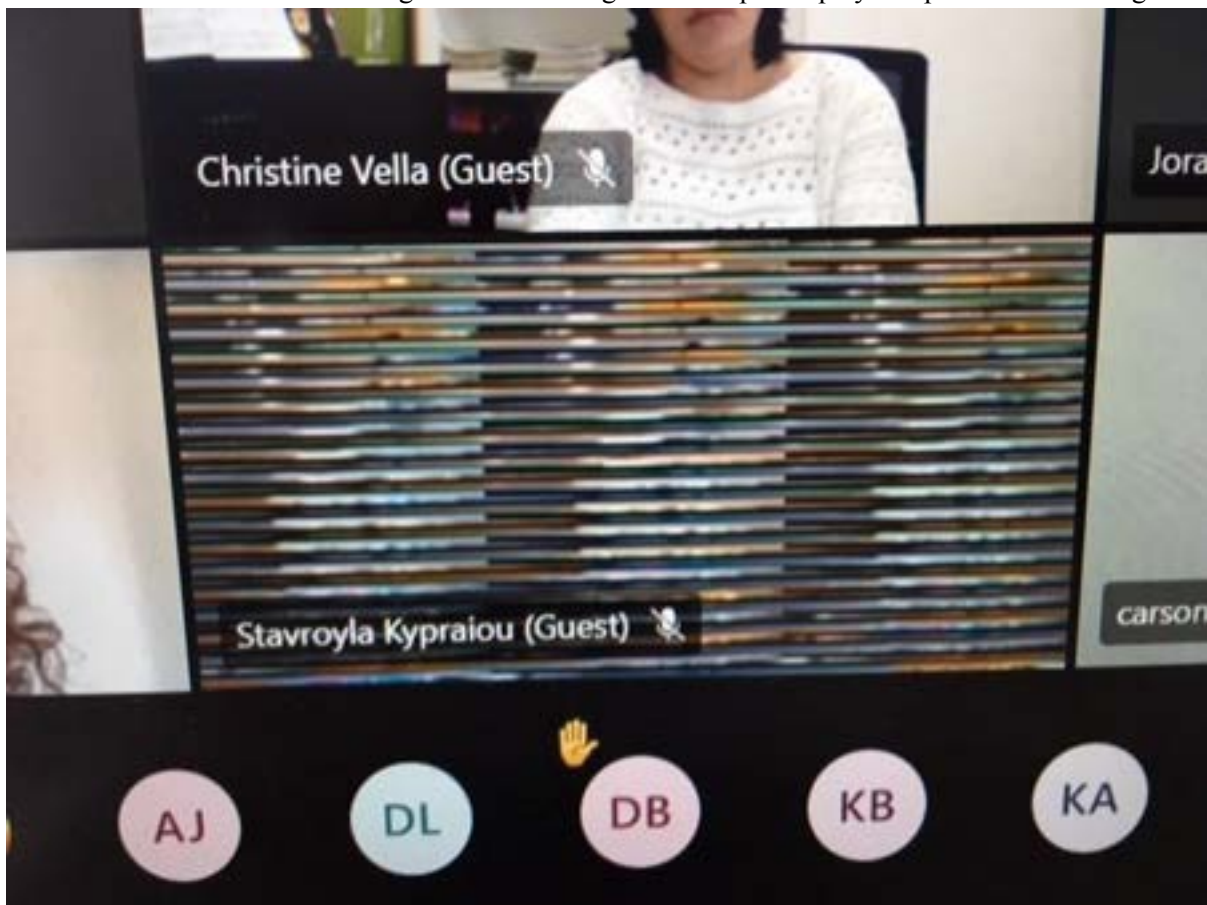


Figure 63 (FN, LH, C4, Image 1)



Figure 64 PM (Photolog)

- Invisibility on the digital platform: *“I cannot view the whole class but I can see 8 squares with one person in each square” (FN, HW 11.11, C3/5, p2).*
- There was some evidence that multisensory intra-actions with hands and mouths were key to learning: *“Pencil in mouth. Pen in hand with pink paper attached...Stroking of beard. Flicking of hair” (FN, HW 11.11, C3/5, p2).*
- Digital interruptions were creating new experience of performance: *“Patterned floor; sound jerk. We are going to start, art, art, art...” (FN, LH 12.11, C3/5, p1).*
- Learning spaces were highlighted as containing/not containing objects: *“ In some spaces there are bags on tables; others there are abstract prints on the walls; in the design space there are large metal poles with round knobs on the end leant against the wall; in others there are digital photo prints on the wall” (FN, KC 9.11, C3/5, p3)*
- Issues with time: *“I think we don’t have time to do this because, like, it’s pretty intense. Yeah. We don’t have enough time to sleep so...” (FG2, C3/5, p3).*
- Embodied learning important to participants: *“So I think it’s pretty interesting because, like, everybody’s, like, using their body to express their thinking”. (FG2, C3/5, p1)*
- Not seeing the point of embodied learning: *“Like why we’re going to use our body to express the thinking. So, like, what is the outcome of the whole process?” (FG2, C3/5, p1).*

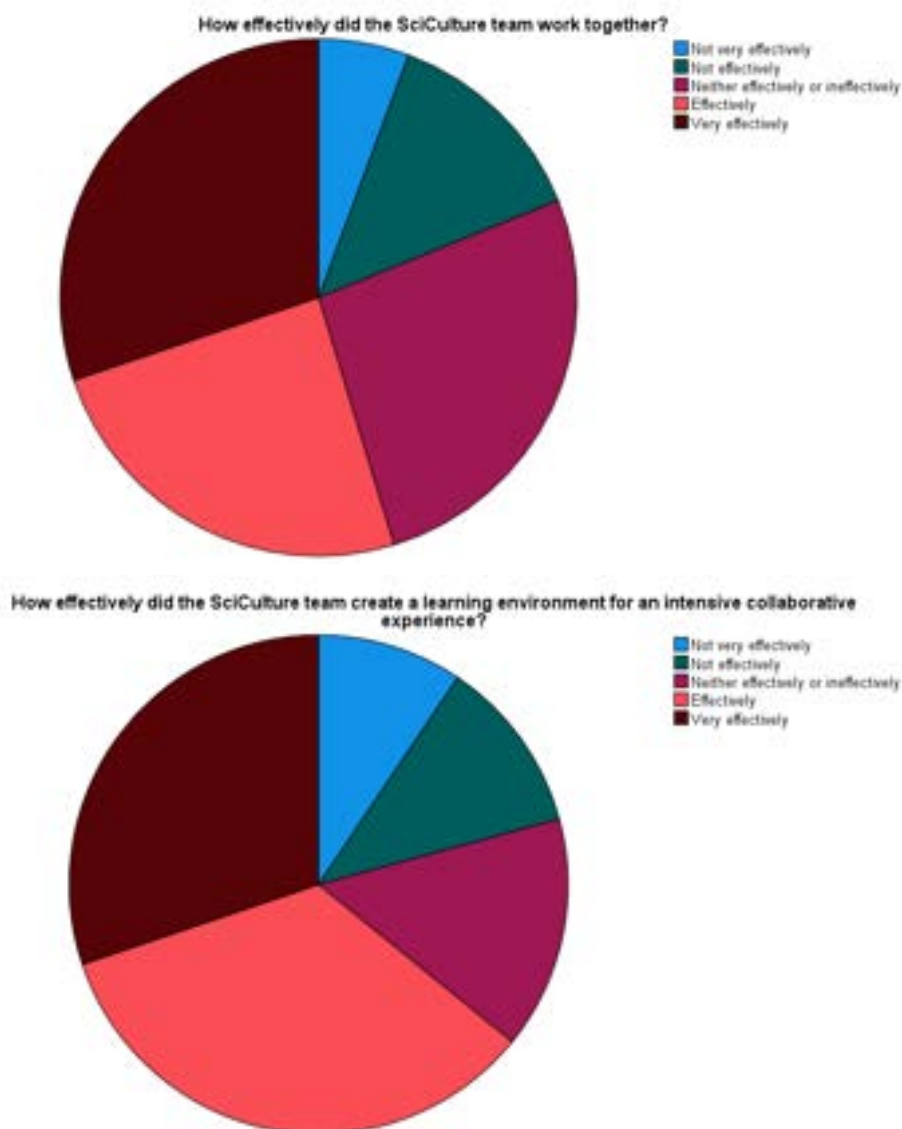
2b.10 Summary

It is clear that partners/trainers had more awareness of what transdisciplinarity was across the courses as they noticed it emerging more than participants. Where it was mentioned in relation to thinking about how transdisciplinarity was understood as grounded in dialogue, difference and collaboration during sessions across the first 2 courses. Although there was not much evidence of it manifesting during courses 1 and 2, participants thought they were making links between disciplines and interestingly, more so where there was less evidence of its manifestation in course 2. This could mean that both participants and partners/trainers were still trying to understand the nature of transdisciplinary teaching and learning. By course 4 it became more apparent that transdisciplinarity was emerging during sessions and it flowing more fluidly, demonstrating that there was a greater understanding of transdisciplinary delivery and learning. However, in C3/5 although there was evidence of participants working in a transdisciplinary way and seeing the benefits of it, some

participants wanted clearer guidance about it. In all courses dialogue was seen mostly as discussion and embodiment. There was also some evidence in courses 1,2 and 4 that dialogue was used to understand difference and to navigate barriers. In C3/5 participants were seen to be communicating in different ways and being ethical, however, some participants thought the hybrid course limited communication (although one participant thought it was beneficial). Across all courses participants thought that they engaged in continuous questioning of their ideas with more positive responses in C2 rather in comparison to C4 and C3/5. Across C1 and C2, most participants thought that ethical implication of their work was important but interestingly in C4 participants disagreed. In C3/5 participants seemed to think they were ethical if it was prioritised. There are questions here to whether this was related to the course content or something else. However, there were observations of participants being ethical across all of the courses which may suggest that being ethical is embedded in the participants ways of being. In relation to empowerment and agency, although participants felt agency during all the courses, the amount of evidence of emergence of these features fluctuated between agency and empowerment in each course. Risk taking and play came out strongest in the risk, immersion, play feature, with participants expressing that they took risks and saw play as important and both features being observed across all courses and linking it to transdisciplinarity in C3/5. Immersion was evidenced across courses but less so (although more so in C2). Where immersion was evidenced, it was mostly related to the material-dialogic space with some evidence of the digital space in course 4 disrupting immersion in participants. Possibility thinking increased across the courses with participants thinking that they asked ‘what if’ questions more than they thought they came up with new possibilities. Evidence of participants engaged in possibility thinking was mainly related to creative tools and tensions in course 2, a small amount in course 4 and lots of observational evidence in C3/5. The Balance and Navigation features were evidenced more across courses 1,2 and 4 and related mostly to course structuring, but less so in C3/5. Participants responses to whether they were given appropriate structure and freedom on their learning were more positive in C2 rather than C4, C3/5, raising questions into the effect of the digital nature of C4, C3/5 on balance and navigation. Participants thought that they engaged in individual, collaborative and communal activity throughout all of the courses but with collaborative learning achieving the strongest levels of agreement. In C4 participants thought that they engaged less in wider activities which could relate to the lack of social time on the digital course. Co-creation was key to collaborative learning which was evidenced more as the courses evolved. Emerging outcomes in C1 related to participants wanting more depth to learning about disciplines; in C2 related to issues with time and conflict within collaborations but more material intra-actions were noticed in relation to C1; in C4 the digital tools, movement and rhythm were seen to shape learning but digital interruptions were highlighted; and in C3/5 challenges in the hybrid nature of the course were highlighted alongside the importance of embodied learning.

3. How has the strategic partnership worked?

The strategic partnership and its relationship to the course was evidenced in a number of ways across the data sources. In most courses, participants responded positively to the work of the strategic partnership: Looking across all courses, more participants agreed or strongly agreed that the SciCulture team worked effectively together, created a learning environment for intensive collaboration, planned for the interaction between different disciplines and encouraged co-creation towards a common objects (see Figures 66). However, there were differences in participants' perspectives on these elements within different courses (see Table 2 for a breakdown between courses; note that C1 is not reported here due to the change in questionnaire between C1 and C2). As sample sizes are low, the views of one participant can have a large impact on the overall ratings. It is apparent that the challenges of working online in C4, and in a very difficult hybrid environment in C3/5 may have had an impact on participants' perspectives.



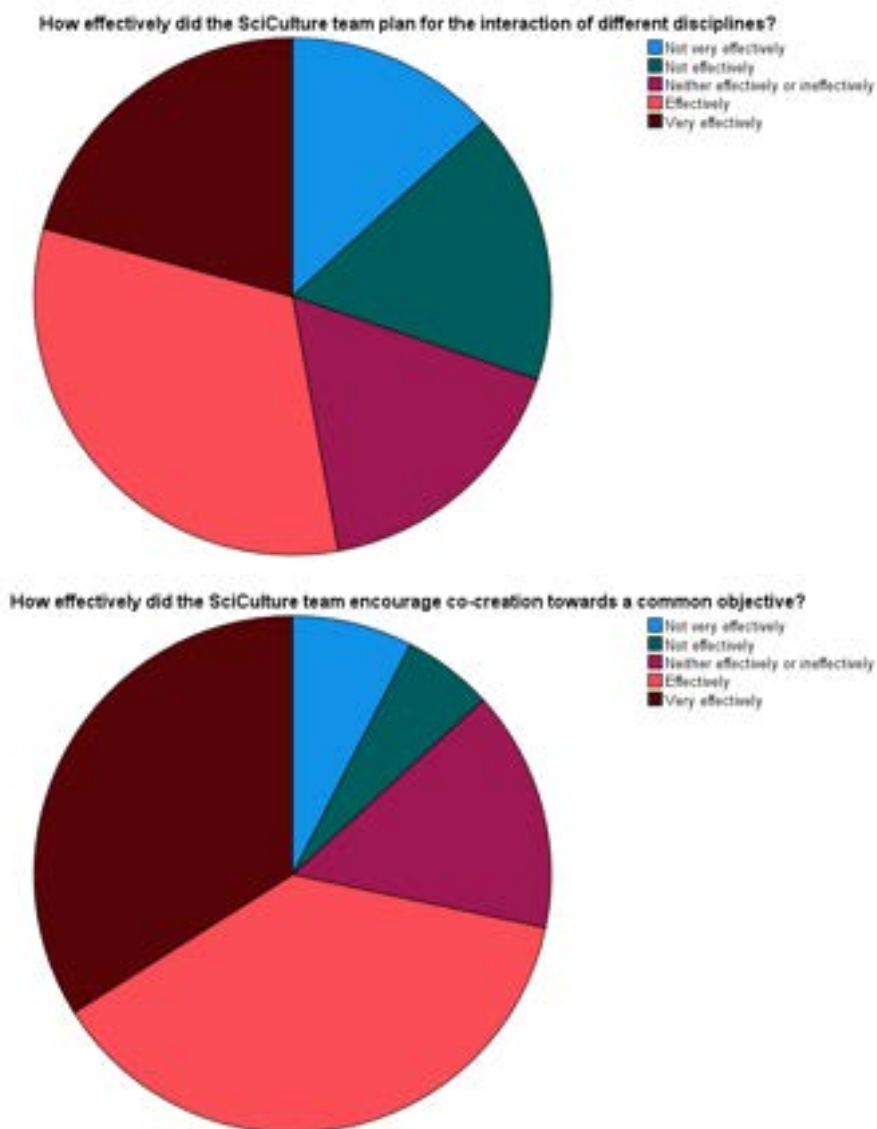


Figure 65 Data from Questionnaires across all courses

			Statistics			
Course			How effectively did the SciCulture team work together?	How effectively did the SciCulture team create a learning environment for an intensive collaborative experience?	How effectively did the SciCulture team plan for the interaction of different disciplines?	How effectively did the SciCulture team encourage co-creation towards a common objective?
2	N	Valid	18	18	18	18
		Missing	2	2	2	2
	Mean		4.17	4.06	3.83	4.17
	Median		4.00	4.00	4.00	4.00
	Mode		4	4	4	4
	Range		3	3	3	4
4	N	Valid	15	15	15	15
		Missing	6	6	6	6
	Mean		4.00	3.80	3.27	3.73
	Median		4.00	4.00	3.00	4.00
	Mode		5	5	3 ^a	5
	Range		4	4	4	4
5	N	Valid	20	20	20	20
		Missing	1	1	1	1
	Mean		2.80	3.15	2.85	3.65
	Median		3.00	3.50	2.50	4.00
	Mode		3	4	4	4
	Range		4	4	4	4

a. Multiple modes exist. The smallest value is shown

Table 2 Breakdown between courses

Partner/trainer questionnaire responses show a high degree of agreement that these same elements were fostered within the courses, and this was a particular contrast with participants' perspectives in C3/5.

Strengths emerged as did areas for change, alongside a number of more unexpected themes detailed at the end.

3.1 Strengths

The strengths of the strategic partnership across all courses are as follows:

- **Adaptability and feedback:** In courses 1 and 2 project team staff commented on the team being able to be adaptable and responsive to feedback. In course 1 they recognised this both in the wider team and personally in themselves: *"we were quite good again, the adaptability and receiving feedback"* (SI, NL, C1p15); *"Oh actually I've never looked at this from this perspective, and having this type of learning and this reflection."* (SI, DQ, C1p5-6). They also saw the potential for and positives of improvising with structure during the course itself: *"Improvised in a good way, that we were responsive to that, rather than continuing following the structure...you can just make a structure that you can go throughout the days and know that the first day is divergent, second day is convergent, then divergent again."* (SI, DQ, C1p10-11). In course 2 it is also noted that as partners got to know each other better in the course of the project, constructive criticism and feedback towards improving the course becomes more prominent and possible. *"we can criticise in a constructive way ... learn from*

each other: ...we need to take a step further and every single course and work with that and that's what I really like, we should be critical.” (SI, MvdS, C2, p6)

- **Team Investment:** In course 1 five staff members commented on a strength of the strategic partnership being people's interest in bettering the project: *“we are interested, we are invested in this, and we do as a team want to make this course better....so there's great exchange of ideas” (SI, NL, C1p15).* Sometimes interactions with students were the source of this motivation: *“but one of the students came up to me and she was really moved by the whole thing and that was really nice. ... So it's giving a lot of food for thought about how to approach it in Bergen and then also Malta.” (SI, EO, C1p10).* Sometimes comment was simply made on staff enthusiasm: *“everybody worked extremely hard and gave 100%+ in order to make things work, and did that with good humour.” (SI, KC, C1p6).* There was a shared feeling that the first course had laid a good foundation for future experimentation: *“But now I really think that a seed. I foresee that the other four sessions...yeah, I look forward to it as an experiment.” (SI, MS, C1, p15).* Overall the researcher felt that the data showed that something really promising had begun which needed clear direction in the next courses going forward. This showed in course 2 when the team (taking into consideration each partner's different context) is regarded as solid and invested in bettering the course, especially by the project lead: *“we have a solid team, I just see my role as making sure it keeps solid and making sure that the strugglers get brought in.” (SI, ED, C2p10).* In course 4 one partner also thought that the course enabled insight into what could be done to improve future sessions by what was learned on the course: *“Some comments might be, let's say, I think that it can be improved, especially we had the time to test or to, let's say, rehearse the whole course or the main parts of the course before presented to the participants.” (Si, MS, C4p7).*
- **Ease of Teamworking:** Teamwork within the partnership was felt to flow well in terms of planning in all courses. In course 1 five of the involved staff members seemed to appreciate the professionalism and overall flow of the teamwork leading to the organisation of the course, for example. *“I think that the collaboration and the delivery in the end in such a short time of the course, the design and the delivery went really well in general.” (SI, GT, C1, p12 – 13).* Also it seems that even though many of the persons involved had never worked physically together before (as was explicitly mentioned by one staff member), they seem to intuitively pick up on what was needed to support the participants: *“Easy to communicate with other partners in terms of needs and expectations....I was only communicating with people virtually, having not met them before.” (SI, NL, C1p15).* In course 2 working together meant working in an equal way: *“the way we have a more flattened hierarchy of leadership, I really appreciate that” (SI, KC, C2stratpart.p2).* In course 4 one partner thought that the teaching team had risen to the challenge of changing the course to online: *“And you know, I think generally, not just from my point of view but other people's sessions that I've been in, I think the whole team, the teaching team, has really risen to the challenge and just gone for it” (SI, KC, C4 p.4).* Another partner thought that the partnership was working well due to common ground they have found: *“I think that we've got a really good thing going now with the strategic partnership, with the group of people that we've got together and the common ground that we've found” (SI, LH, C4p11).* In C3/5 One partner thought it worked well due to the amount of time the partners had worked together: *“these four years of working together with everybody as a team, and the planning and everything somehow prepared us for an eventuality like this.” (SI, EO, C3/C5, p9).*
- **Effective course organisation:** In course 1 the continuous presence of the travel agency and organisers for taking care of the practicalities and needs of the participants and staff was also positively highlighted: *“because I think it was very professionally run, everything and also having the travel agency there, it was super good to have a point of contact for everybody”*

(SI, EO, C1p4). Also, in course 2 one participant commented on how effective the course was organised: *"It was extremely organised and co-operation between individuals worked very flowingly. It was a very inspirational and motivating experience as a young growing artist and student"* (no ref). In courses 3&5 the professionalism of the handling of the course despite lots of setbacks was highlighted by many partners: *"I think the staff team have been incredibly professional in how they've dealt with that, but I think for us to have that on top of a hybrid experience with staff ill, staff on compassionate leave etc., it's challenged everybody."* (SI, KC, C3/C5, p2).

- Creative Collaboration: Creative collaboration is regarded among teachers/partners as very efficient and as one of the main strengths of the course. This is outlined by both questionnaires (80% high and 20% very high ratings on the creative collaborative environment and high or very high on how effectively the Sci Culture team encouraged co-creation towards a common objective) and interviews. *"I think that building in the idea of this co-planning has helped bend those creative pedagogical ideas and features in a little bit more."* (SI, LH, C2, p6). Moreover, staff interviews showed recognition of better collaboration compared to the previous course and also suggest bringing also to the students the kinds of staff conversations based in tension *"how we could bring this to the students and how they could learn from it. That could be awkward and you have to think about it and see what you can do and what you can prove for yourself to make such a move towards the students as well and yeah that's learning as well for us."* (SI, MvdS, C2, p3-4).
- Other strengths from course 4 and 3&5:
 - Affordances of the digital platform for example: *"the pre-recorded direct inputs really worked, both on a logistical level but also maybe on a kind of formal level within the course..."* (SI, EO, C4p5).
 - Participants seen as a key part of team/supporting during workshops: *"Yeah. It felt very engaged, as much as you could feel engaged on the screen with people, in whatever way that is that that happens. Because we were kind of all doing the same thing but in our own way"* (SI, KC, C4 p.8).
 - Social Events: *"I liked the social evening that we had the other week. [...] I think because we didn't have a focus or really that many expectations out of it, it suddenly turned into something which was quite fun and interesting"* (SI, EO, C4p5).
 - Communication worked well: *"all of that I think the communication worked very well, especially towards the end where obviously people are starting to focus more on the course than on the other projects."* (SI, AS, C3/C5 p5).
 - Structure worked better due to being on the same theoretical page: *"I think, because of the way we had structured it, and also because we were all on the same kind of theoretical foundation and page in relation to new materials and post-humanism and so on."* (SI, EO, C3/C5, p1)
 - Empathy was present between partners: *"because I felt that there was a lot of empathy between, you know, me, Partner/Trainer 5 and Partner/Trainer 4 and all the interns running the course,"* (SI, EO, C3/C5, p4)
 - Ability to overcome challenges: *"We pulled together, like I said, as a team, as a family. And we made it happen. And, you know, there is no...I mean, you can have differences of opinion maybe, in terms of some of the discussions and things like that"* (SI, EO, C3/C5 p5).
 - The Hybrid course worked well: *"And hybrid speaking, I don't know how it was for the online participants that weren't hearing the speakers in person, that were here in person, but at least from the online ones that were speaking with us in person, I think it worked well"* (SI, AS, C3/C5 p6).

3.2 Challenges

The challenges for the strategic partnership across all courses are as follows:

- **Space:** In course 1 specific rooms at the venues were negatively criticised for limiting the interactivity and other spaces were positively commented upon staff members: *"The upstairs and the activities out and about and around the hotel and by the swimming pool and so on were good."* (SI, EO, C1p2). One of those members of staff also discussed how dialogue with the environment and local culture might contribute to the course and partnership in different ways *"But I've been thinking in Bergen that maybe we should go for a few walks up the mountain maybe in twos where people can get to know each other and talk to each other and then have an activity up on the mountain together"* (SI,EO,C1p13) On the same note, the distance of the hotel venue from Athens cultural centre was highlighted: *"I think some of the students' attendance was a bit slack because of that [not having more of Athens itself in the course]."* (SI,EO,C1p2). The same member of staff as above expressed concern at how the provided spaces also perhaps did not lend themselves to more workshop based activities *"but I was a bit worried about trying to do some of those type of workshops in a hotel with limited resources available."* (SI, EO, C1p4) The same criticism as above is evident: some of the venue spaces and their provided resources seemed limiting in terms of introducing alternative ways of teaching.
- **Timings:** Were an issue across course 1 and 4: In course 1 time was an issue for staff members for planning sessions and activities. Staff from across the team commented on time in relation to some timings being inappropriate *"We ended up having that [transnational meeting] around eleven... I'm like trying to take minutes and I can't even remember what was said. ...So the fact that the only time we could meet was a really inappropriate time."* (SI, NL, C1p16) some timings needing to be changed responsively *"There was some...a workshop that we planned that we had to retract, which was annoying, but I think for the project it was better that way."* (SI, ED, C1p9). The tight and packed schedule was also highlighted, that did not allow enough free time to the participants between the sessions: *"there's a lot of activities packed into a very short space of time"* (SI, EO, C1p1) or allow for reflectivity and listening for participants and for staff trying to share practice *"because it's so jam packed it doesn't really allow that much time for reflection or even critical reflection in between the different things."* (SI, EO, C1p3). In course 4 discussions around timings were related to planning the digital course: *"So there might be not enough time for me to work with Partner/Trainer 1 or Partner/Trainer 2 or Partner/Trainer 6, to bring in what they know into what I do, and learn from each other and truly work in a transdisciplinary way. I think that's been a bit of a limitation at times"* (SI, ED, C4, p.11). Participants also stressed issues with time in terms of it being too intense and not having enough time to breathe in course 4 – this related to the online aspect of the course. Time for personal space was also raised as an issue by participants in C3/5.
- **Frustration around EU regulation interpretation and understanding:** One main emergent theme according to staff interviews was both frustration with EU regulation interpretation and institutional lack of experience/understanding of EU projects: *"empathising with your situation in Exeter and also Partner/Trainer 6's in Delft and so on I think there is a bit of a frustration around maybe how Malta is interpreting the EU regulations and that is challenging"* (SI, EO, C2p5). Those regulations come with some administrative burden: *"In the run up to the course I think there's been a few tricky organisational things like how the timesheets worked... that can be frustrating sometimes because the project shouldn't be about*

the timesheets “ (SI, KC, C2stratpart.p1). And it seems that for partners/institutions with limited or no experience in EU funded projects, this can be challenging: “I think the other challenge for me and this is not necessarily with the management of the whole course and so on is that because of my predicament and my institution and being new to the whole thing and so one that I am learning while doing” (SI, EO, C2p5). In course 4 one partner also found the lack of flexibility from EU funders frustrating: “but I just wish that the EU were a little bit more flexible. It’s like, ‘We’re having a global pandemic here. You cannot just stick to the rules. It’s not going to work!’ Just things like, a really good example is losing some of the participants because it’s much easier for them to step back and then the EU going, ‘No, that’s all the money gone for that person.’ It’s like, ‘It’s not that simple. It’s not the same as normally,’ you know. And all the other funders I’ve worked with have somehow managed to be flexible”. (SI,KC,C4 p.12). “I think there are clearly lots of things that haven’t worked – the bureaucracy with getting students around, the bureaucracy that the multi-team have had to engage in to run a hybrid course at very short notice. I think we’ve been really stymied with our design-thinking colleagues” (SI, KC, C3/C5, p6).

- Loss of momentum due to pandemic: In course 4 one partner thought that the pandemic was instrumental in the loss of momentum in SciCulture as a whole: *“So we would have had the five courses. The momentum of just doing the courses fairly quickly after each other; I think, would have kept us going. But there was that real dip with the pandemic, you know, middle to end of last year...” (SI,KC,C4 p.11).*
- Fragmented process: In course 4 one partner thought that the process worked in stages but was fragmented: *“fragmented nature of the planning has been a little bit challenging. But it’s mainly due to the digital platform, you know, for us not to, you know, for us to meet up in person and to kind of have an intensive workshop period or something like that, and just reconnect.” (SI, EO, C4p5). One partner was also frustrated by not being able to create sequences during the course: “I knew what the titles of the different sessions were, but I didn’t really know what they were going to have in them. So it was hard to try and make your session have a sort of sequence. [...] in a course like this it’s hard to sequence because partly it emerges, it’s driven by the participants themselves. But at the same time we need to be able to make it seem like it’s a whole, that things connect” (SI,LH,C4p11).*
- Sometimes overwhelming: In course 4 one partner thought using the digital platform was initially overwhelming at times: *“But I think Tuesday morning was particularly intense because of trying to juggle between observing, and then somebody spotted I was there and started asking me questions. I was like, ‘Argh!’” (SI,KC,C4 p.9).*
- Lack of flow: In course 2 lack of flow was evidenced across questionnaires, observations and interviews, for example: *“Thought it was a bit clunky as no clear overall leader providing signposting through the course. I wasn’t sure why some lecturers and activities were happening as there wasn’t a link provided as to which part of the design process it related to” (ref unknown).*
- Lack of staff communication: In course 2 staff interviews suggested that communication both internally between staff and between SciCulture and the participants prior to the course could be better for example: *“The one thing that should be improved in my opinion would be the communication to the participants which is of course directly related to the input from all partners. Regarding the reading materials for example...” (SI, GT, C2, p4).*
- Financial concerns: Staff interviews show concerns regarding long term budget issues: *“hopefully will start attracting more paid participants that is worrying me. As a coordinator I’m worried about budget, we are over spending especially the Malta team to be able to do it to this level” (SI, ED, C2p9).*

- Partners felt out of their comfort zone in places: *“But then suddenly when you get there and, you know, they’re not there and you have to do it, then that was maybe throwing me outside of my comfort zone in different ways[...]*” (SI, EO, C3/C5, p4).
- Dealing with participant issues: *“And I think how we’ve had to plan for...yeah, how you resolve group issues has come up more than once, not in this course but in previous courses also.”* (SI, LH, C3/C5 p11).
- Personal challenges within own system: *“I mean, personally I think one of the things that’s most challenging for me is that, you know, I’m the only one here that is connected to this. I mean, I have a tiny bit of support from administrative staff, but even that was, you know, drawing blood from a stone kind of thing”* (SI, EO, C3/C5 p10).
-

3.3 Suggested changes

Suggested changes for the strategic partnership across all courses are as follows:

- Adjusting Timings: Suggestions to deal with timing issues in course 1 with time were given through the use of dialogue *“so in the project time if we could have some conversations about sharing ideas, sharing practice of how we work in the facilitation space.* (SI, KC, C1p14). Face to face dialogue was highlighted as particularly important to be able to discuss timings *“contact on Skype is good, but it doesn’t make up for being together with people and discussing things.”* (SI,EO,C1p14). There was the recurrent theme in the interviews to provide with more “open” space to participants. Giving participant more free time between activities becomes part of the learning experience, as well as more time for reflection that could foster creativity even more. Timings were still an issue in course 2 to an extent, both when it comes to keeping the sessions’ timing or proceeding with consideration and negotiation with timing changes: *“we could keep timing better on the course but I think that might be a cultural thing”* (SI, KC, C2stratpart.p2) and when it comes to allocating additional time/space for students to re-charge and step back: *“So I think it would be very nice, as a student to have for each other kind of space within the program that you can recharge and write down the things that you like to do and take a step back for yourself as well.”* (SI, MvdS, C2, p5). In course 4 a suggestion was made to not use up valuable time changing the course if it stays online or blended next time: *“ ‘Okay, we’ve developed the content for one course. We should just keep it exactly the same,’ just so that we can actually give all the course content enough advanced time for the participants, and not inform them super-late and all this kind of stuff. Rather than keep changing, changing, changing”* (SI, ED, C4, p.12). However, one partner thought that more time was needed to plan next time: *“so that we can have just a little bit more time to work together, to do that collaborative planning...”*(SI,LH,C4p12). Furthermore, one partner thought that deadlines needed to be shifted to allow for other commitments: *“we just need to push the deadlines back a bit. And it’s really hard ‘cause everybody’s got so many other commitments”* (SI,LH,C4p11). Related to this, participants thought that clearer timings and the course material to be sent earlier were all ways to improve the course.
- Clarity of Framework: In course 1 the clarity of the framework for all staff members was highlighted by one member of staff *“I think one of the next steps will be to have a meeting on the concepts that we want to get across. And what our concept for a framework is”* (SI, MS, C1, p11). In course 2 the clarity of framework especially when it comes to the embedding of creative pedagogies in the design of workshops was also highlighted by staff: *“... I would like to see all of the partners fully engaged or trying to draw those pedagogies into their*

planning...” (SI, LH, C2, p6). Nevertheless, it should be noted that non-Exeter staff are starting to note shifts in their pedagogy: *“It was different in the sense that I got direct inspiration from Partner/Trainer 1 and Partner/Trainer 2 so I used what the participants were already familiar with the notion of embodied learning”* (SI, GT, C2, p5) Staff interviews also showed a desire for more clarity in terms of overall planning: *“I think it should be more clearer ideas about what we are going to do next, this shifting between places and whether it's going to be Malta or Delft, or have a transnational meeting just before or after”* (SI, MvdS, C2, p6-7).

- Co-led Transdisciplinary workshops: In course 1 three staff members commented that transdisciplinary co-led workshops would model the transdisciplinarity the course in a more effective way for example: *“If I'd known more about what he does and he'd known more about where at Exeter we come from with the creative pedagogical approaches and the kind of science I think about and sort of work with quite a lot, we could probably have built a collaborative session that could have brought things together a little bit more, or been a bit more explicit with the students”*. (SI, LH, C1p8-10). Techniques such as embodied learning were suggested as an alternative *“Yeah, so out of all of the sessions that I saw, Partner/Trainer 1's was the most different because they were physically moving in the space and the way that she used some images rather than slides to sort of like pin up, and music, and bodies and space in a different way, that was probably the most different to a normal kind of sort of higher education delivery.”* (SI, LH, C1p15 - 16). By the time course 2 arrived staff thought that the co-led transdisciplinary workshops were improved from course 1: *“a major improvement when it comes to collaborative efforts in comparing the two courses”* (SI, LH, C2, p3) which suggests some suggestions from the 1st course were implemented and successful, however, at the same time many teachers/partners and participants feel that there is still room for improvement.
- Greater partner presence: In course 1 one of the Exeter team recognised the challenging nature of the course and its commitments: *“I think in a positive way we've set ourselves an extreme challenge there with what we're expecting of ourselves in the course. So I think we just need to keep a wary eye on that.”* (SI, KC, C1p5). In this context, the Maltese team felt that more even partner presence and attentiveness was needed across the course per se and within project time *“So I think for a course like this all partners need to be present the whole time... Like you have one person there in the beginning, they leave, and then a different person comes in in the middle and can't stay there until the end.”* (SI, NL, C1p16) *“Some of the partners weren't engaging in the project time”* (SI, ED, C1p16). Moreover, one staff member of the project lead admitted to feeling out of depth in project time: *“So on project time, project time was difficult, I think. I don't know how to convey this in one word but how do you say I felt I didn't have the tools that I needed to help them? ‘Ill-prepared’ or... ‘out of my depth at times’?”* (SI, ED, C1p10). In course 2 some partners also felt that not everyone contributes with as much motivation as others, and that not everyone works to deadlines: *“some partners are not sticking to deadlines”* (SI, ED, C2p11). On the other hand, fieldnotes do show partner engagement in general which means it improved from course 1: *“Partners are going around the groups and providing input and feedback, which appears to be well received by the participants”* (Fn, Tues FGT, C2, p3)
- Better collaboration: In course 1 contrasting with one of the perceived strengths of the course and partnership being that there was an ease of teamwork, other data showed that, the Maltese team especially would have liked stronger collaboration in the run up to the course, especially when it comes to filling the planning documents they prepared. *“Collaboration wasn't really there going into the course. So not everyone filled out the planning document...it was a really great template...and they were supposed to act as living documents so that everyone reads them and provides feedback, and so we all have input”* (SI, NL, C1p16). In course 2 staff

interviews show partners still pushing for better collaboration to really integrate approaches: *"I think maybe we need to burden the collaboration a bit more..."* (SI, LH, C2, p7) and identifying the need to find a way to communicate better to maintain the collaboration and allow for staff as well as participant agency *"I think that we need to find a better system to communicate for collaborating together and I don't have right now immediately an answer but I think it's something we should really discuss"* (SI, DQ, C2 strategic partn.p1)

- Managing Expectations: In course 1 managing expectations through balance and difference was highlighted as important to improve future courses by one member of staff. They thought that the balance between theoretical and workshop-based teaching should be considered *"we tended to have more theoretical presentations and workshops. So I mean maybe that's something to take into consideration for the autumn is to integrate some of that a bit more."* (SI,EO,C1p3). They also thought about how it was important to manage expectations of student levels going forward *"So I think I had to be open in terms of my expectations of the different levels of the students and the different backgrounds of the students"* (SI,EO,C1p5) and how different students own expectations of arts/science/business might need to be managed *"and I think lots of the students came with expectations of what art was and they had that a bit confounded and then others came with expectations of what science was and business was and so on."* (SI, EO, C1p5-6). Despite these suggestions, In course 2 there was evidence that expectations were still not met for participants: *"No, I had the wrong expectations about the course. I was expecting more or less clear directions on how to develop my communication skills on important aspects of natural sciences. A very fuzzy outline was provided instead of it"* (Ref unknown).
- Other minor suggestions from individual courses:
 - Allowing for face to face learning if possible: Following course 4 one partner would rather have a face to face element to the course: *"And even if we have to have a digital SciCulture next time, I would really like at least part of it to be face-to-face. 'Cause you know, then you get the best of both worlds, I think. So we can learn a lot from this experience this time round, but I really wouldn't want to be online for the whole thing again next time if it's possible"* (SI,KC,C4 p.5).
 - Evaluation suggestions: *"I think if we reflect, if we get all this evaluation that you are doing, if we keep up the momentum with the participants, use those reflections and stuff to improve the next course, then it's going to be an amazing thing that we do."* (SI, ED, C1p17). Another staff member recognised that this would mean understanding people's different opinions *"But I think we all need to suspend our judgements where we are now in order to move forward. And we're not all going to agree where we should move forward to"* (SI, ED, C1p17).
 - More social events: In course 4 one partner wanted more social events: *"you know, just things like organising the social before we met this week, thinking, 'Actually we need something like that to bring us back together, to put a bit of glue back in place'"* (SI,KC,C4 p.12). However, also in course 4 one partner thought that real world socialisation was better in the face to face courses: *"I think the food one shows that we're trying as hard as we can to make social things happen within the course. But it's not the same. And I don't think that bond with the participants is really developing as it does in the real world"*(SI, ED, C4, p.10)
 - Continuity from previous course going forward: One partner in course 4 thought that instead of thinking about doing things differently, lessons should be learned from the digital aspect which can be taken through to the next course whether it be face to face or online: *"Yeah. I don't really want to do anything else differently at this point. I think we've had to do so many things differently in the last year that actually just a bit of continuity would be nice"* (SI,KC,C4 p.13).

- o Suggestion for how to take photologs: One partner in course 4 had an idea of how to view the photolog experience: *“with the photo logs, if people sort of treat them in an expansive sense and not focus just on the Teams format, that suddenly you’re out in the countryside or in the middle of a metropolitan area or something like that, it’s kind of interesting”* (SI, EO, C4p7).
- o Making changes to the scoring system for course participants following courses 3&5: *“So they might score highly on our CV and on our application system and all that, you know, scoring system. And so we might want to give them a place. But we might also need to read through the bit where it says what it is that they want to do sci-culture for, maybe we need to look at that and go, ‘You know what? That isn’t actually what it’s all about. Are you sure this is for you?’* (SI, LH, C3/C5 p13).
- o More flexibility of the system needed following C3/5: *“So it’s the difficulty of trying to do something creative and flexible in an inflexible system.”* (SI, ED, C3/C5 p7).
- o In courses 3&5 Participants wanted clearer direction: *“So I think for us, like for me specifically, a little bit more clear direction from the beginning, throughout the project, very concrete goals and timelines would have alleviated a lot of, like, the floundering”* (FG2, C3/5, p2).
- o In courses 3&5 One participant wanted more acknowledgement of participants professionalism:



Figure 66 Mural Reflection comment C3/5

3.4 Emergent themes

Other emergent themes from the strategic partnership are as follows:

- Balance between process, content and outcome: In course 2 staff interviews revealed some interesting observations regarding balancing fragmentation and homogeneity in process and outcome in relation to the theme: *“I think that for the third one it might be desirable to find some balance between the fragmentation of the first and the homogeneity [of the 2nd]. Even though content is to me, in my opinion, of secondary importance compared to the process itself for the participants, because the process is what matters you know, foster their skills and so on.”* (SI, GT, C2, p5). In course 4 it seemed that it was still a little unclear about the focus of the course as process rather than end product: *“I think one of the conversations we had alongside it was I was talking about the fact that even when they present something this afternoon it’s never really finished. There’s always threads that are left, there’s always the next steps, there’s always the ongoing conversation. Oh no, it was in the embodied dialogue*

session we were talking about that. And really trying to kind of reassure them that we're not looking for a product as part of the course, that it's about the process and the quality of that. Yeah. (SI, KC, C4 p.8)

- New approaches within the team: In course 1 some partners commented that the course had given them new approaches to the course itself. This was approached through taking risks *"me trying different things and trying new things"* (SI, NL, C1p14), *"On the normal teaching that I do, the theme is the content, the theme is the arts content, whereas on the Athens course the sort of art is the method and a little bit of the method but the content is the theme, you know, the educational futures theme."* (SI, KC, C1p6); understanding the possibilities the course provides *"I produced a rhythm where I had many more possibilities for at least three points where we paused..."* (SI, EO, C1p7) and understanding that everyone is constantly learning *"We're learning about how to run this thing"* (SI, ED, C1p2). Personal learning/progression was also visible for team members after Course 2 according to some partners' interviews: *"...I got things from Partner/Trainer 1's work, Partner/Trainer 2's work and Partner/Trainer 6's structure."* (SI, GT, C2, p3).
- Questioning how the transdisciplinary element can work better: In course 4 One partner thought that the disciplines came together for the participants during the course: *"I think there is a more even balance perhaps of the different disciplines coming together this time. I don't know why that would be. Whether that's something to do with the digital or whether we're just getting better as a team as to how we offer them things. I don't know"* (SI, KC, C4 p.5). However, many partners were questioning how it could work better in future: *"And now we come to the point that we need to be transdisciplinary for ourselves as well. We do develop the course from different perspectives. Design thinking is kind of the backbone of the course. But I think it feels like we still have different angles. So like dance, art, entrepreneurship. And I think how could we make our own domains transdisciplinary? So how to already make connections between the different topics and to let the students work with that. So I think that the biggest step to take is how transdisciplinary is the team of partners, actually."* (SI, MvdS, C4 p1) and One partner thought it would be good to try to work out how individual sessions work together: *"it would be nice to have a sense of how different individual sessions sort of work together somehow. Hard to do, though, like I say, when everybody's busy."* (SI, LH, C4p11)
- Personal learning/progression for team members: In course 1 five staff commented that they felt the course had contributed to their own professional learning in different capacities, for example: *"learning in the sense that the role that I was in as a project manager, facilitator, partner"* (SI, NL, C1p12).

3.5 Other

- Participant suggestions: In course 4 A few participants commented on the selection process for participants, suggesting that it needs to be more thorough to choose people from different disciplines and at similar levels of education for example: *"I also thought that the participants would be students, artists or entrepreneurs.. which they weren't.. I am a bit disappointed at the level of discussion we were able to reach. Not only because of different disciplines but also because of a language barrier. I think the participants really make the course, therefore selection of these participants might be an important step of making the course better"* (PostQ, C4);
- Staff comment: Also in course 4 there was an interesting staff comment which doesn't really fit above arguing that Mural is 'less' than f2f. Despite the mural being a shared online platform (1 Mural used by all of them) the fact they all are connecting from their individual laptop would fragment the shared experience of the "logbook". If compared to face to face

interaction where participants are sitting around a table or in front of the 3D wall, the online interaction fragments the sense of being together around a shared material (the wall, the table with post its and shared ideas) and fragments the flow of exchange of ideas through words and moving post its, writing on the paper etc. Even if the mural is one and shared online, the participants are all dislocated each having a separate screen/laptop as an interface to connect and share. In this case the materiality of the computer and the screen can be seen as a “wall” blocking the flow of movement of ideas through the body (moving post its around, gestures, using other materials as clay, or even doodling on a paper while talking etc) and it becomes a barrier to the physical presence of sharing a 3D “real” space.

- Physical space vs digital space for example: Due to the nature of course 4 there was a lot of discussion about what worked better face to face or online. Discussion around spaces: *“You can have infinite space on a digital world, which allows a lot of possibilities. Partner/Trainer 1’s picture shows some limitations, you know? She’s done very well in adapting what she does for the online space and getting people to move on their own and stuff. I think it’s amazing thing. [...] But does she feel that was beneficial, that the real-world space still is better for what she does? For what I do, I think the online gives a different experience but it can be rewarding as well. It’s hard to know if it’s the same or not based on my feelings.” (SI, ED, C4, p.9).*

3.6 Summary

Participants were positive across most courses about the way the strategic partnership operated but less so in C3/5. Strengths in C1 and C2 were related to the way the partners/trainers responded to each other in terms of being adaptable and responding positively to feedback. The main reason for this was related to creative collaboration which led to partners/trainers being able to plan and organise the courses together easily. It was also noted that partners/trainers investment in the project meant that they put in effort to improve the courses. Strengths in C4 related mainly to the planning and delivery of the digital course as it was a new approach for this project. Thus, the main strength discussed was the affordance of the digital platform. In C3/5 strengths related to the professionalism of the partners and good communication which some partners felt was due to the partners working together for a long time and being on the same theoretical page. Timings relating mainly to planning but also the sessions schedules were the main challenges for the partnership in C1 and C4 but lack of flow of the sessions were highlighted in C2. Also in C2 were issues around space due to the location of the course, lack of communication between staff and the experience of partners/trainers with working within EU regulations with a small focus on the budget. In C4 minor challenges related to the nature of the digital course in relation to flow and fragmented process and loss of momentum due to having to plan for something completely new. In C3/5 the main challenges related to difficult participants and bureaucracy with some personal challenges within their own system highlighted. The main suggestions for changes going forward were related to adjusting timings across courses 1, 2 and 4, to allow more space for planning and deadlines, for participants to have time to breathe in between sessions, and for deadlines. In C1 and C2 it was highlighted that there needs to be more clarity on the framework in terms of embedding creative pedagogy and planning. Also in C1 and C2, it was also suggested that the transdisciplinary sessions were more co-led and embedded with embodiment and there were calls for greater partner presence in between sessions, better collaboration between staff and more focus on managing the expectations of the participants. With the absence of these suggestions in C4 it calls into question to whether these had been improved by the time this course proceeded. Suggestions in C4 mainly related to the digital nature of the course with partners/trainers wanting more face-to-face time; more social events; clarity on photologs and continuity going forward. In C3/5 suggestions going forward related to the flexibility of the system to allow more freedom in course delivery, changing the scoring system to ensure the right participants are chosen for

the course and participants needing clearer guidance. Other emergent themes from the strategic partnership included: Understanding and creating balance between process, content and outcome, the benefits of learning new teaching processes and a focus on how the transdisciplinary element can work better. The nature of the digital course in C4 was also the focus of a few comments relating to the face-to-face vs digital experience for participants and the selection process for participants.

Discussion

The development of the transdisciplinary aspect of the course was evidenced as the strongest across the courses with clear links between partners/trainers developing their understanding about what it is and it emerging more, and more fluidly during sessions, and partners/trainers trying to find ways in which to develop this further. This resonates with the evidence that the ease of planning and organisation alongside adaptability to feedback were the main strengths of the strategic partnership, meaning the ability to plan and organise efficiently may have had a direct impact on the understanding of transdisciplinarity.

There was also evidence that the development of the understanding of dialogue with partners/trainers took place in a similar way with it not only emerging as discussion but also embodiment in later courses and with participants expressing that they were engaging in continuous questioning of their ideas across all courses.

However, the questioning of ideas between participants emerged more in C2 than C4, C3/5 which could be related to the nature of dialogue on the digital platform. There was also a similar trend with individual, collaborative and communal activity but with it more weighted towards collaborative learning, particularly co-creation. There were differences in C4 where participants thought they engaged less with wider activities such as socialising. This was picked up as a concern amongst the strategic partnership as they felt the need for more social activities and breathing space for participants between sessions.

Partners/trainers were also thinking about possibilities across courses 1,2 and 4 which again could be linked to the strengths in the partnership in planning and adaptability. Participants were also asking 'what if' questions throughout the courses in different ways. Balance was evidenced across all of the courses in relation to the course planning and delivering by both partners/trainers and participants in C1, 2 and 4 but in relation to time and space in C3/5.

It is interesting also that there seems to be issues with balance in the strategic partnership where planning and delivery was seen as both a strength and a challenge in C1, C2 and C4 but not in C3/5. When observed in sessions balance and navigation was mainly related to relationships and difference in courses 1,2 and 4 and in relation to digital learning in C3/5. Again however, participants responses to whether they were given appropriate structure and freedom on their learning were more positive in C2 rather than C4 and C3/5 raising questions into the effect of the digital nature of C4 and C3/5 on balance and navigation.

Risk taking was related to planning and delivering in courses 1,2 and 4 which was seen as a challenge in places but also related to experimentation as was play and immersion. In C3/5 risk taking was briefly linked to transdisciplinary practice. Immersion was also related to embodiment and the material-dialogic space in later courses.

The main source of empowerment and agency was seen through the digital platform and related to the affordances of the digital tools for participants in C4. Partners/trainers thought they were also empowered in later courses but discussed it in relation to participant empowerment in C3/5. This could be linked to the evidence that partners/trainers were getting more comfortable with the understanding of many of the features as the courses evolved.

Across C1 and C2 partners/trainers were evidenced thinking about ethics a little in relation to spaces and relationships and in C3/5 in relation to inclusion, empathy and allowing space for learning.

Participants were observed being ethical across all courses. Interestingly however, most participants in C1 and C2 thought that the ethical implication of their work was important but in C4 participants disagreed raising questions to whether ethics can be captured easily on a digital platform. However, in C3/5 participants were seen as being ethical if it was prioritised showing that they are able to think about ethics within a digital environment. Trusteeship was evidenced a little between participants and as embodied in C1 and C4 and in relation to the transdisciplinary process in C3/5.

Recommendations

Overall the implementation of the creative pedagogies within the design thinking framework was evidenced to work well, with partner understanding of how to work in this way clearly developing over time. It is recommended that future projects continue with the same framework, educating new staff colleagues as appropriate in how to make this work, drawing on this report and the CourseKit planning tool. Alongside this, the following questions can be taken forward by future teams to continue to develop knowledge and understanding of this practice.

- How can partners/trainers promote embodied learning more both face-to-face and on the digital platform?
- How can learning spaces be better understood and improved?
- How can partners/trainers deal with conflict better?
- How can the understanding of transdisciplinarity continue to be improved and better articulated?
- How can partners/trainers ensure that participants understand the nature of the course and its relationship with process/end product and that the right participants engage with the course?
- How can timings be adjusted to allow for the balance between richer planning time, breathing space between sessions and meeting deadlines?
- How can the system be made more flexible to allow for better facilitation of transdisciplinary teaching and learning?
- How can the digital platform be understood better in relation to teaching and learning and the following features:
 - Paying more attention to the nature of dialogue on digital platform
 - How to engage in wider activities on a digital platform
 - How can you maintain balance and navigate sessions easily on a digital platform
 - How can you capture ethical considerations on a digital platform?

There seems to be a link between planning time and the understanding of some of the features which could be improved with more productive planning sessions. There is evidence, however that this improves in each course. As embodiment has arisen as key to the learning there may be a requirement for partners/trainers to learn how to teach this effectively, especially for those in disciplines where this type of learning has never arisen before. There may also be a need to train partners/trainers for a deeper understanding of how to clearly put across the nature of the course to the participants, as well as understanding how to create successful learning spaces. The implications for further research and practice are that to move forward with transdisciplinary teaching and learning more research would need conducting on more in-depth training for partners/trainers to understand its nature as well as time put aside for regular discussions around this. There is also a suggestion that it is beneficial for partners to be on the same theoretical page for this to work better. For digital or hybrid courses it may also be necessary to conduct further research into the nature of the features and their emergence within this type of environment.