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Prioritising community over content: value shifts in science centres

Jennifer DeWitt and Shaaron Leverment

Abstract

Science centres are increasingly adopting co-development as a tool to engage diverse audiences with science. The case study featured in this practice insight draws on an evaluation of a programme that aimed to move U.K. science centres towards more inclusive practice. Interviews with staff from eight U.K. science centres and their community partner organisations reflected shifts in science centre practitioners' understanding and valuing of co-development approaches, and, especially, the centrality placed on relationships with communities. This case study can contribute to our understanding and help us reflect on how to align our practice with a commitment to equity.

Keywords Informal learning; Science centres and museums; Social inclusion

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Introduction

There have been many critiques in recent years of traditional forms of science communication and public engagement, including that practiced by science centres and museums [Dawson, 2019; Dawson, Hughes, Lock & Wahome, 2022]. These highlight that much public engagement activity has reinforced patterns of participation/exclusion from science found in schools, wider society and in science itself [Dawson, 2014; Finlay et al., 2021]. Informal science institutions have historically excluded marginalised and minoritised individuals and their communities, leading to calls for fostering inclusive engagement practices [Dawson, 2019; Feinstein, 2017]. Equity researchers have specifically called for science and discovery centres and museums to become more equitable and to rethink how they operate.

Substantial efforts towards more equitable practice have been taking place in the U.S.A. (cf. the establishment of the National Science Foundation-funded REVISE Center for Informal STEM Education[1]), and European-based informal science

[1] Reimagining Equity and Values in Informal STEM Education: https://www.informalscience.org/.

organisations and practitioners are coming to recognise that achieving equity requires a change in what they do and especially *how* they do it, rather than trying to change the people coming (or not) through their doors. It is increasingly accepted that lack of participation in science (in school and out) is not due to a lack of interest, but rather that individuals from marginalised or nondominant communities have not been welcome or felt comfortable in our science spaces [Dawson, 2019; DeWitt & Archer, 2017; Godec, Archer & Dawson, 2022].

While a glance at sessions in recent science centre conferences also suggests a shift in values and priorities towards a stronger focus on equity and collaborating with communities, the field in the U.K. is in the early stages of this journey. There is clearly an appetite for working in an inclusive and participatory way, but how to approach such work, where to start and what might be needed for it to be successful is still an open question for many. This case study, which comes from the evaluation of Explore Your Universe, Phase 4 (EYU4) provides insight into this question at a pivotal moment for the field, pointing the way towards how such efforts can be initiated and what might be needed to move forward.

About the project

EYU4 is the Association of Science and Discovery Centres' (ASDC) national strategic STEM programme which has been delivered by science centres and partners across the U.K. Funded by the Science and Technology Facilities Council (STFC), it aims to engage children and adults with astronomy, physics and space science. Initially launched in 2011, four phases have been developed and delivered. Phase 4, which ran from autumn 2019 through autumn 2021 and is the focus of this practice insight, signalled a quite radical departure from previous phases. While still aiming to engage families and school-age children with STFC's science, this phase was a move from 'content-led' to 'audience-led', drawing on participatory approaches and partnerships with community organisations to develop activities that aimed to engage deeply with smaller numbers of individuals, with a particular focus on those from communities who have not traditionally engaged with science and discovery centres.

In Phase 4, co-development of activity [e.g. Villar, 2021] was a key aspect of the approach to engagement. Phase 4 had two main stages where science centres worked with community organisations to develop and deliver activities, with a break in between due to pandemic lockdowns, which some centres were able to use for relationship-building with community organisations. During this break, practitioners from each science centre also engaged in reflective meetings led by an external facilitator.

ASDC was originally quite prescriptive about the activity of the main stages, asking the science centres to co-develop (with a community organisation) and deliver six weekly workshops for families with children between ages 8 and 14, with the same families attending each workshop. However, deep and respectful engagement with community organisations became central to EYU4. This both led to and necessitated a fundamental shift in what was prioritised by the science centres, and the funder, to align with the values and missions of the community organisations with whom they worked.

Project participants and activities

The eight science and discovery centres involved represented a range of venues of varied sizes, funding models, age and geography, distributed across England, Northern Ireland, Scotland and Wales.

During the first stage (autumn 2019–early 2020), a total of 42 sessions were delivered by the staff from the eight centres, with 491 children and young people (generally ages 8–12) taking part. During the second (2021), a total of 75 sessions took place, involving 339 young people. Approximately half of participating young people identified as female, some were autistic/neurodiverse and most were from backgrounds traditionally underrepresented in science,[2] and between 2/3 and 3/4 came to multiple sessions. Staff from the community organisations were present at each of the sessions.

Science centre practitioners chose which community organisations to approach about this project, and a wide range were included, from after-school clubs, to local community groups, to groups working with autistic young people, to adventure playgrounds and more. In some cases, they had prior relationships with the organisations and in others, the relationships were new. Participants were those whom the community organisation already worked with and it was community practitioners who invited families/young people to participate.

The majority of the sessions, in both phases, were interactive, hands-on workshops related, in some way, to STFC science. These sometimes included science shows or a visit by a mobile planetarium, while others involved young people creating their own shows, demos or presentations, or even writing articles for a science centre magazine. What differed over the course of the programme was the context and degree of input the community partners and participants (families and youth) had over the focus or particular activities in the sessions.

About the evaluation

This practice insight focusses on evaluation data collected during EYU4, reflecting on what supported co-development in this context, practitioners' evolving understanding of co-development, and possible outcomes for participating families and young people. Despite the limitations presented by the Covid-19 pandemic, the evaluation used a range of methods, primarily qualitative. It aimed to capture perspectives of science centre staff, employees of community-based organisations and participating families and young people — with an emphasis on those of community participants [Garibay & Teasdale, 2019].

In order to be responsive to the contexts of individual partnerships and activity, we used a table which listed the areas about which data was required by the funder. A bespoke evaluation plan, detailing which evaluation tools would be used and in which sessions, was created with each of the science centres. These evolved through multiple conversations with science centre practitioners as the projects

[2] Because of the project's focus on equity, we were concerned about using conventional measures of 'deprivation' or collecting intrusive data such as postcodes. Consequently, we drew on relationships with the community partners to confirm that the families and young people the science centres were engaging with were from backgrounds traditionally underrepresented in science and/or under-resourced communities.

progressed. Some data (e.g. about participant experience and outcomes) were collected directly from participants while others (e.g. metrics, session content, observations) were recorded in 'reflection diary' entries completed by staff after each session. The diaries were used to capture 'in the moment' observations and feedback, as well as supporting practitioner reflection throughout the project. (See Appendix.)

We conducted semi-structured focus groups and interviews with practitioners from all eight science centres, as well as their community partner organisations. Two focus groups (after the first stage) and nine interviews (after the second) were conducted with 15 practitioners from the eight centres. These covered the activity carried out as well as perspectives on partnerships, co-development, organisational and personal learning and change, and project legacy.

Staff from 16 community partner organisations also participated in interviews. Altogether, 22 interviews were conducted with community partners across the two stages, to gain their perspectives on the project activity and the partnerships, as well as further insight into participants, their contexts and perceived outcomes.

A range of creative methods were used to collect data directly from participants. In developing these tools and methods, the project remained mindful of not detracting from the experience of the participants as well as respecting the resource limitations faced by science centre and community organisation practitioners. The instruments used included physical rating scales, sticky dot rating scales, feedback on sticky notes, drawing, and feedback forms using graphics and images, such as an 'Alien emoji sheet' to capture participants' emotions. (See Appendix.)

All of the evaluation data was read through at least twice. We used data collected directly from participants to form an initial picture of their experience in the sessions and outcomes of participation. Science centre practitioner and community partner interviews were coded inductively, which provided further depth and understanding of the experience of all involved (families and young people, community partners and science centre staff), and the interview data helped triangulate the initial findings from the participant data. Throughout the evaluation, we placed particular weight on the data from participants and the accounts of the community partners. For the purposes of this practice insight, we regard the data collected across the programme as a case study, but our reflections rely most strongly on interview data from science centre and community practitioners. We hope this case study, in turn, may contribute to the science centre field's reflections on and understanding of co-development.

Practitioner learning about co-development

Over the course of the project, science centre practitioners reflected on their co-development efforts in discussion groups, interviews, reflective diaries and staff meetings and understandings of co-development emerged and evolved. In early stages, practitioners regarded co-development as the science centre and the community partner collaborating 'equally' to create science activities for young people. This perspective brought associated challenges, in that the community partners' knowledge base related to STFC science was limited and generally outside of their comfort zone. However, over the course of the project, science centre practitioners arrived at a richer and more nuanced understanding of

co-development, as a practice in which both partners contribute their *own* expertise — which is equally valuable and valued, but distinct — to a shared endeavour, the details of which vary by partnership.

It became increasingly clear that the success of co-development depends on a *strong relationship*, built over time, between the science centre and community organisation, with *respect for the expertise of the community partner* playing a critical role. Every community partner interviewed noted that the science centres looked to them for guidance — from logistics, to what would work for the lives of participants, and, even more critically, what would make them feel comfortable and welcome. This signalled a shift in values of the science centres, including a willingness to give up some of their power in the situation. This allowed the relationships to flourish and, as reported by science centre and community practitioners, the activities to support deeper engagement. The respect and valuing experienced by the community partners is reflected in their reporting that the relationships were deeply collaborative:

> 'It's such a great partnership and cooperation between us, so we are taking care of the local aspects, and the science centre team are taking care of the scientific and academic aspects, so that's a nice combination. I can't really say that one group is leading the other one, we are just interacting together in a very good way and we just try to make things happen in the best way possible.' (Community partner)

In terms of what this looked like in practice, science centres took the *lead on content* — they proposed the activities in broad terms, which were then shaped with community partners' input. The community partners drew upon their deep knowledge of the young people and their families, and in interviews many were able to identify elements (e.g. a creche for younger siblings, not using paper in a muddy adventure playground, providing a verbal warning of upcoming loud noises in a demo) they had suggested in the activities delivered. This mutual shaping of activity was specifically facilitated by science centre practitioners being open and asking questions, which also was a means of sharing power, signalling to the community partner that their expertise was valued and their ideas taken on board:

> 'They were asking all the right questions. They wanted to know how to make it, what they're going to do better, and they were open to all suggestions and ideas… That was really refreshing for us all the way through — they kept us involved and asked us, rather than saying we're coming in to do this for you, they wanted to know *how* can we come in and do this for you?' (Community partner)

Flexibility and responsiveness on the part of the science centre, both around the activities and the degree of involvement preferred by the community partner, was a further support for successful co-development efforts. While going in with a completely open slate may not be effective, being open to possibilities is. However, what was most helpful varied and flexibility was critical. For some community partners, having objectives but fleshing out a plan together is effective and can further develop a relationship. Other organisations preferred that possibilities were presented and then elaborated with their input. Some collaborations were

intensive: 'We tried at every step to have multiple check-in meetings, every little decision, running it by them' (Science centre practitioner), while other community partners preferred lighter touch involvement, such as providing suggestions about logistics and/or smaller adjustments that might support participants' engagement.

Science centre shifts

All of the science centre practitioners involved stepped outside their comfort zone on this project, which supported their learning about co-development and what it meant in context, as described above, and ongoing conversations with practitioners during the project suggested that their confidence in using these approaches grew. In many ways, EYU4 acted as a catalyst for new approaches, extending beyond this specific programme. One area in which multiple science centres reported making changes aligned with a co-development ethos was in their planning and initial sessions with community groups — being more flexible and responsive to participants' interests, rather than going in with a pre-determined offer.

A focus on relationship-building with community partners lies at the heart of co-development, and in EYU4 whole project meetings science centres reported looking at their practices and processes, such as how they might structure staff time and rotas, to facilitate this. Such a movement towards putting a top priority on relationship-building (with content considered next) represents a complete shift to a new focus and way of working: 'It's building the personal relationships first and then the science will flow around it' (Science centre practitioner).

Related to this transition was the acceptance that a science centre project cannot always be the most immediate priority for community partners. The partnership — and co-development efforts — were more likely to flourish when science centres were able to *manage their own expectations*, accepting and understanding the challenges, aims and objectives of their partners. Overall, this flexibility, openness and responsiveness to the needs, interests, values and contexts of the communities, via the community partners, reflected a shift in values on the part of the science centres, and a deepening understanding of how to enact them.

Community group perspectives

We used a variety of tools to capture experiences and possible outcomes for participating young people and families. The evaluation data gathered from participants, as well as feedback from community group leaders, suggested that the overall goals of the programme were achieved. More specifically, participants felt a sense of welcome and belonging, and enjoyed the activities in which they were engaged. Their STEM knowledge and skills also seemed to be supported. While space prohibits further description of these outcomes in this case study, we want to bring to the fore some additional outcomes that emerged in the interviews with community partners. These were less directly related to STFC's science and did not form part of the articulated project aims. They were often equity-related outcomes for which science was the vehicle, rather than the destination and were raised by the community partners as important to them. By including them in this case study, we are not claiming that these outcomes were definitively attained by all or even most participants. Rather, we articulate them here as a way of amplifying the voice of the community partner organisations (and, indirectly, the participants), centring and valuing their perspectives, and to draw attention to the kinds of outcomes that may be possible from co-developed activity.

Broadening horizons. A number of community partners spoke about the limited experiences of those they work with and said they had decided to join the project in hopes that it would expose young people to new experiences they might not have otherwise, particularly with respect to science. They felt that participation likely expanded their sense of possibilities for themselves and increased awareness of experiences that are 'out there' in the wider world beyond their immediate neighbourhood.

> 'Some of the kids had said "I'd really love to do this when I'm older". They said things that they probably wouldn't have thought of doing before but some of the kids were really into it and they were saying "I'd love to do this as a job when I get older", so that was a magic moment.' (Community partner)

Confidence. Gains in young people's confidence was another key outcome for many of the community partners: confidence that they could engage with science and confidence that they could do the activities. For instance, workers from one of the Banbury (Oxford) youth groups spoke about how working on 'their bit' for a planetarium show had really given confidence to some of their youth, who tended to struggle in school and in social situations.

Agency and ownership. Such confidence was also manifest in young people's pride in what they had accomplished. This pride, linked with a sense of agency, seemed most evident in projects building to an 'end product' where young people decided on activities and were supported by staff in preparation and execution or delivery. In reference to the topic (animals) that young people chose when producing an issue of a science centre's 'Open Up Science' magazine, one community partner remarked:

> 'That was something that the children chose themselves, I could see that, and that's why they took the ownership and they really loved it'.

The development of a sense of agency was also supported by the co-development and consultancy process and responsiveness on the part of the science centre practitioners, when they visibly took on board input and suggestions from the young people.

Strengthened family relationships. This outcome was valued by community partners and was achieved through the provision of opportunities for young people and parents to engage in a way rarely afforded to them. For instance, sessions with Dynamic Earth offered young carers a chance to spend time with their parents to an extent that was simply not possible in their daily lives and which was highly valued by them. One of the reasons this was possible was due to a creche that the science centre provided for younger siblings during the sessions.

Community cohesion. A final example of an outcome completely unanticipated by ASDC comes from a youth group connected to a social housing association, who partnered with Science Oxford. Although three youth groups were involved, one (with a new space) had been trying for years to collaborate with others from different areas of Banbury. On a 'family showcase' day in which young people

presented their version of a planetarium show, leaders had carefully arranged the schedule so that youth from the different groups would overlap as little as possible, partly because of Covid but mainly due to postcode warfare between gangs in the different areas where the youth groups are based. However, they did overlap, with results that surprised the leaders:

> 'But they do tend to hang outside and they play football and they just of hang around, and at the end of the session, and at lunchtime, when they were waiting for the transport, taxis and that to arrive, they were a little bit delayed, so they all played together, and they started to play football and that out together. And that was just amazing to see because that is something we will have dreamed to have seen. We make it sound like the Bronx don't we, we're not really like that, but it is something that is just lovely and we would love, that was a stepping stone for us to — I think now we've done that once we wouldn't be afraid to actually say, and actually we're going to proactively do this, where we can bring the two groups together. Because we've seen that it works and that was really positive.' (Youth group leader)

While these sorts of impacts were not articulated as project outcomes, nor are they directly linked to the science involved, they are arguably the most powerful outcomes from the programme, as they get to the heart of what is critical to these young people, their families and their lives, and centre their priorities and concerns. Yet, without the deep knowledge that community partners have of those they work with, and the respect and value placed by the science centre on this, which lies at the heart of co-development, such outcomes would not only go unnoticed but are likely unattainable.

Further reflections (or, 'It's not what you do, it's how you do it')

Over the course of the project, science centre practitioners' understanding of co-development evolved, to a deeper insight of it as a practice in which they and community partners contributed their own distinct expertise to a shared endeavour. Practitioners' awareness of the centrality of relationships for co-development grew, manifested in how they valued the expertise of the community partners, being open and asking questions throughout the development process. The resulting activities or the 'what' — a carousel of hands-on activities related to space, a science centre magazine, a planetarium show — may have looked quite similar to activities that were not co-developed. However, the 'how' differed, with the activities related to a particular topic requested by participants in a previous session and preceded by snacks from refugee participants' native country, the focus of the magazine being entirely of the young people's choosing and the writing and design under their control, and the planetarium show scripted and delivered by young people.

The deep and careful attention to, and valuing of, community partner expertise in the development of activities represents a shift in values away from science centres being the primary experts in the process and giving up some of their power in this situation. Simultaneously, a key challenge for this programme and for other initiatives striving towards a more equitable vision of science concerns areas of science, such as physics and astrophysics, that are less clearly relatable to the daily life of participants. But with co-development, and a willingness to let science be the vehicle, rather than the destination, possibilities are opened.

In this case, the funder and ASDC gave up some of their power to the science centres (and, in turn, to their community partners), allowing for a flexible interpretation of what 'engagement with STFC science' might mean and what structure the activities might take. Such ceding of power gave the partnerships an opportunity to co-develop experiences that happened 'under the umbrella' of STFC science, leading to activities with differing degrees of connection to the science. While likely challenging for a funder, with its contrast to more conventional science communication activities of promoting or inspiring with the science, this willingness allowed for experiences that, according to the community partners, were deeply meaningful for the participants.

Limitations, looking back and moving forward

The diverse nature of the projects in EYU4 and limited resources for evaluation, not to mention the Covid pandemic, meant that disparate data was collected across the projects and was primarily qualitative in nature (interviews and focus groups), supplemented by more quantitative but creative and participatory approaches. This led to challenges for the evaluation and consequently, the assertions made in this case study are necessarily tentative. Nevertheless, the consistency in the accounts of the community partners and science centre practitioners give some confidence in the findings emerging from the evaluation. Moreover, its alignment with other perspectives on work with communities is encouraging about the possibility that these learnings can contribute to practitioners' understanding of how to carry out this work. Much remains to be done, however, including further evaluation that can add to this picture and, we hope, convince funders of the value of this work.

EYU4 began with an aim to engage families from backgrounds traditionally underrepresented in or excluded from science with STFC's science. With a well-intentioned aspiration to achieve impact, the programme initially was quite prescriptive in terms of who science centres might work with and how. However, STFC did not set target numbers for reach, and ASDC's framework of the project aimed to allow time for science centre practitioners to develop relationships with community organisations, on which co-development efforts could be built. The project encouraged deep listening, getting to know communities and their contexts, and reflective practice. Such elements seemed to scaffold a shift in values on the part of the science centres, as well as ASDC, that encouraged centring the voices and experiences of their communities, as they worked with community partners to co-develop activities. What co-development actually looked like, as well as the resulting activity, varied by partnership, as would be expected when science centre practitioners are being reflexive and responsive to the values, capacity and contexts of those with whom they engage.

EYU4 has left a legacy of science centre practitioners who now know more about working in partnership with community organisations, co-development, and engaging with individuals and families traditionally excluded from these spaces. Science centres also know details of what is required in terms of resource, meaning that any future investments in this kind of work can be more efficiently deployed and represent greater value for money. The boundary-pushing nature of this project, at least in the context of U.K. science centres, led to substantial learning for science centre practitioners, including catalysing changes to practice that support centring and valuing the perspectives and experiences of communities.

This way of working is also aligned with U.K. Research and Innovation's (UKRI's) new public engagement strategy, Research and innovation for all [UKRI, 2022], which emphasises working collaboratively with communities and valuing diverse forms of knowledge. Although universities — the main recipients of UKRI's funding — are making efforts to engage more with communities, science and discovery centres, by their very nature are often more central to their community and public engagement is at the heart of what they do in a way rarely possible for researchers in academia. EYU4 has highlighted the importance of allowing time for relationship building, as well as flexibility around the structure and nature of activities and even around how budgets are handled and distributed, which can be more challenging for large institutions like universities, compared with (often) more nimble science centres.

There has been a shift in values in the STEM engagement landscape, with increasing understanding in the U.K. and abroad about what inclusive and equitable informal STEM learning might look like. There is a corresponding ambition among the participating science centres to build upon the place-based knowledge and partnerships developed in the project to become true community resources — meaningful in their regions for those who do not feel that science currently is relevant or something 'for them' and pushing toward a more equitable STEM landscape for the future.

Appendix A. Examples of EYU4 evaluation tools

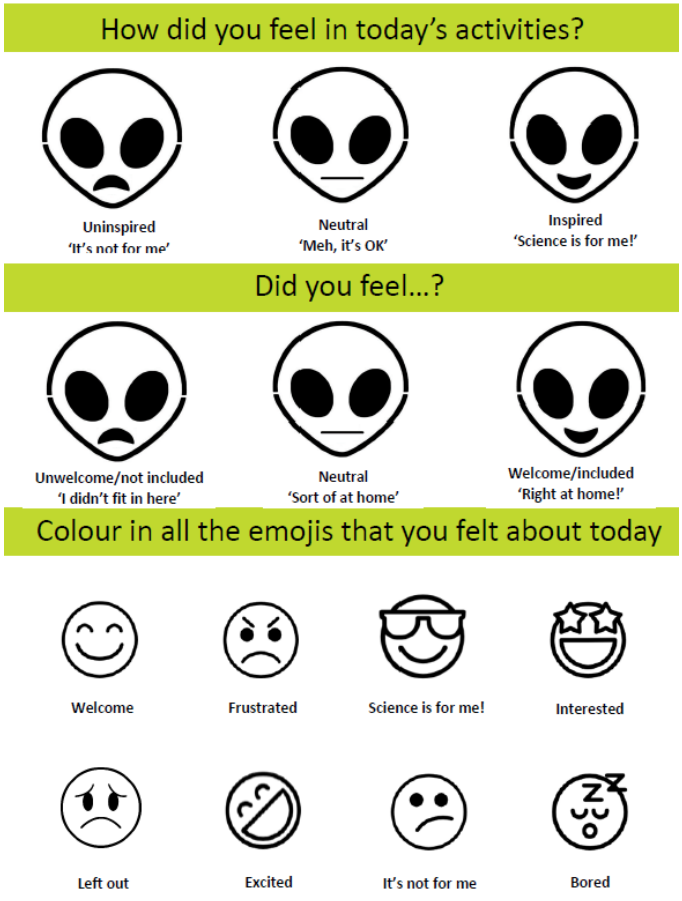

Figure 1. 'Alien Emoji Sheet'.

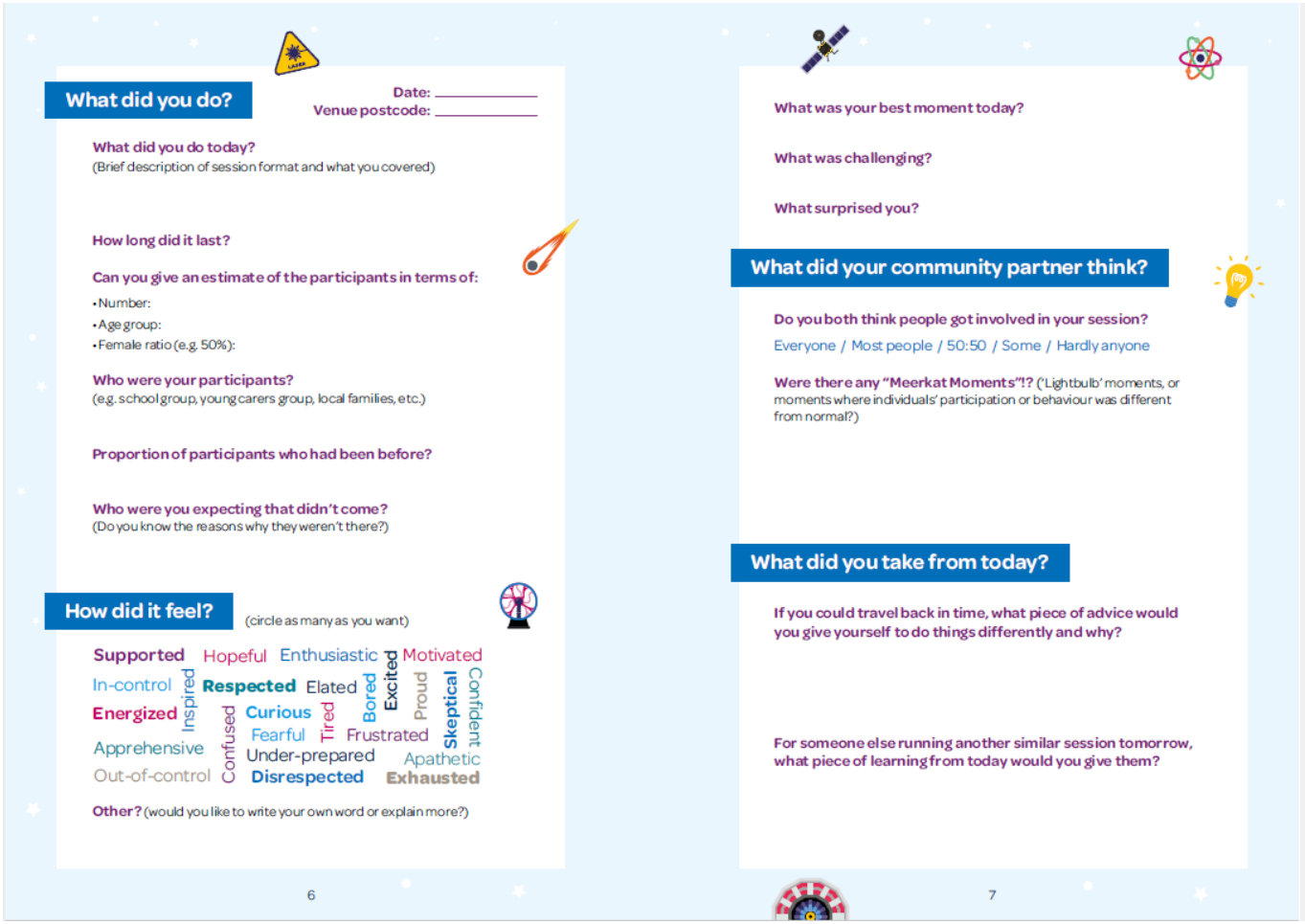

Figure 2. Reflection diary.

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