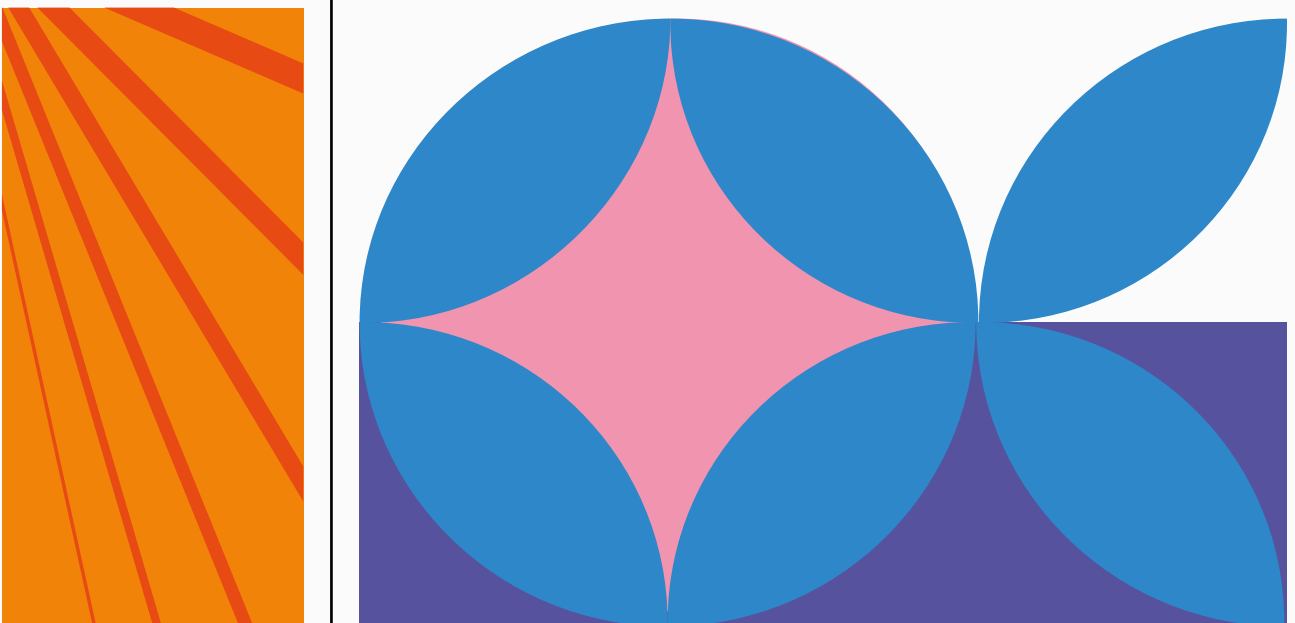# Impact Evaluation Toolkit

06

This section is aimed at educators and educational coordinators wishing to evaluate activities associated with Open Schooling practices. It is a guide to creating an evaluation approach for such projects and programmes, and includes descriptions of different evaluation forms so that educators can accurately choose the form which suits their needs.

This section contains a set of five methodologies. Each method is explored in practical detail and accompanied by an OSHub case study, so that the reader may see how it was implemented, thus acting as inspiration for adaptation.

6.1   What is Evaluation?

Evaluation is a process that determines, using a systematic evidence-based approach, whether a project has met its aims and objectives. In doing this, it also provides a deeper understanding of what worked well across a project and what could be improved. Evaluation involves continuously collecting and documenting information throughout a project, as well as reporting findings, sharing final outputs and disseminating outcomes of the project.

Evaluation is not about highlighting successes; instead it is a structured and replicable way of identifying both the positives and negatives that may arise over the lifetime of a project . These results inform the project development and underscore aspects of the project that could be improved. Evaluation also creates an invaluable opportunity for stakeholder reflection both internal and external to the project.

Evaluation is an iterative process. When utilised consistently, it will shift and shape the parameters of a project as it develops, allowing a project to remain dynamic and responsive to multiple stakeholders. Evaluators will encounter new questions, alter methodologies and seek new participants. It is an integral process that should continuously inform the project.

6.1.1   Evaluation of Open Schooling

In Open Science Hub we aim to understand the value and impact the project has had for and on its audiences, including students, teachers, stakeholders, local and wider communities. Developing a robust evaluation strategy enables us to successfully identify and focus on specific priorities that are important to the project, the partners, and the stakeholders. Some of these priorities include; community development, relationships between stakeholders, the level and types of innovation, the interest that learners have in science, citizenship education, and the challenges faced in the implementation of Open Schooling projects.

Evaluation can assist and inform project design by determining and ensuring that the methodologies and initiatives developed are accessible, inclusive, and robust over time. Evaluation also encourages project leaders to critically reflect on the real value, relevance and meaning of the work carried out, and to identify potential points for further development and scaling of the project.

6.2   Preparing an Evaluation

The evaluation process is essential to the success of projects, programmes and businesses alike. In this section, various forms of evaluation are outlined and the crucial elements of an evaluative framework are highlighted.

6.2.1   Forms of Evaluation

Evaluation can take many forms, depending on project context, aims, and limitations. Various methods are often combined within a project's evaluation framework to broaden its scope and ensure the validity of results. OSHub's evaluation framework applies a mixture of reflective, outcome, and process evaluation methods.

- **Auditing Evaluation**

  Implemented at various stages of the programme depending on the programme's needs. This approach is often highly specific and the outcomes and outputs are measured against a strict rubric. Quantitative indicators are most commonly relied upon for auditing evaluation.

- **Summative Evaluation**

  Conducted after the completion of a programme, or at the end of a programme cycle. It generates data on the efficacy and/or efficiency of the programme's outputs and outcomes in relation to its target audience. It is useful in quantifying the project's effects on participants.

- **Formative Evaluation**

  Implemented before the programme begins. It generates data informed by the needs of the programme and continuously evolves during a project through baseline monitoring. This approach identifies areas for improvement and provides insights on programme priorities . This helps managers to determine areas of focus.

- **Reflective Evaluation**

  Typically conducted at the end of a programme, but can also be implemented throughout. This approach collects personal and emotional responses to a programme. It is useful in identifying how those involved connected with the programme, its topics, and implementation.

- **Outcome Evaluation**

  Typically conducted during the programme. It aims to generate data on the programme's outcomes and the influences the programme has had on those outcomes. It is useful in measuring the programme's areas of effectiveness.

- **Impact Evaluation**

  Evaluates the entirety of the programme, with a focus on the long term effects. It is usually implemented after the programme has ended or at specific time intervals.

- **Process Evaluation**

  Implemented at the beginning of the programme. It measures how effective and efficient the programme's procedures are. The data it generates is useful in identifying inefficiencies and streamlining processes. This helps to avoid potential issues and ensure project effectiveness.

6.2.2   Evaluation Framework

An evaluation framework sets out an approach to measuring particular outcomes, including choosing the aims of the evaluation, identifying indicators, planning data collection, analysis, and sharing results. Evaluations require stakeholder input and resources, therefore detailed planning is important from the outset. Each OSHub case study and corresponding evaluation method is outlined in this handbook according to this framework.

Step 1 – Understanding the objectives

The first step in developing an evaluation framework is understanding the objectives of the project. Critical questions to consider include:

- What do you want to achieve?
- How are you going to achieve it?
- Who needs to be involved?
- Where/When is this going to happen?

Understanding these early on will provide a clearer understanding of the framework.

Step 2 – Establish indicators of success

An indicator is something that can be measured over the course of the project, or compared from the beginning to the end. Establishing indicators early on is a critical exercise to conduct, though it is important to keep in mind that these indicators may change and evolve with the project. Indicators should be SMART[8]:

- **Specific:**

  The indicators should be well defined and not leave room for interpretation. e.g. "Students will improve their skills over the course of the programme" is not sufficiently specific. "Students will improve their digital skills over the course of the programme" is more concise.

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8.   Identify SMART indicators. (n.d.). Colorado State University. Retrieved 7 October 2022, from
         https://extension.colostate.edu/docs/staffres/program/Identify-SMART-Indicators.pdf

To move from a goal to an indicator, a pathway to providing evidence should be mentioned e.g. "Students will improve their digital skills over the course of the programme, and demonstrate these by writing a piece of code using Python."

- **Measurable:**

  The indicators should be quantitative, but qualitative data may also be collected. Qualitative data can be converted to quantitative using a method called 'Coding' – a method of organising data to identify repeating themes or ideas. A code is assigned to a response depending on its content, and after the data has been analysed, the frequency of each code can be measured. See Step 7 for a more detailed explanation.

  Eg. The goal of the evaluation is to see if all students improved their digital skills. Qualitative data collected is interviews with students discussing the skills they felt they developed. A quantitative indicator is the number of students who mentioned digital skills in their answer.

- **Attainable:**

  Goals should be realistic and measurable within a given timeframe. Every participant or stakeholder may not get involved in the project, but sufficient data may be derived from a subset of these.

  Eg. Data must be analysed within one month of the end of the project, and 80% of students that participated in the project must be interviewed.

- **Relevant:**

  The goals and indicators of the evaluation should align with the long-term aims of the project while upholding the beliefs and integrity of the project.

  Eg. The overall objective of the workshop is to provide students with skills required for scientific research. One of these skill subsets is "explaining scientific phenomena", which the goal and indicator are related to.

- **Timely:**

  Indicators be reflective of current affairs and challenges surrounding the project at the time of collection.

  Eg. Digital literacy is low in students attending the workshop, however with current advances in technology within society, improvement in this is vital.

Step 3 – Question development

Once the indicators have been established, the next step is deciding on the questions that will be used to measure the indicators. These questions can be either quantitative or qualitative in nature.

- **Quantitative Questions**

  Quantitative questions generate results that can easily be described through numerical data. They can be useful in measuring amounts (e.g. how many participants grew up in a rural or urban community), frequency (e.g. how often a participant has visited a particular museum), or to get a general overview of agreement or satisfaction through use of a scale (eg. 'On a scale from 1-5, with one being the lowest and five being the highest, how informative was the workshop for you?'). This type of scale is sometimes called a Likert scale.

  Quantitative questions should be carefully worded in order to prevent or mitigate misinterpretation. The answers available to the participant must be exact, such as a yes/no, a number for frequency, one answer from a discrete set of possibilities (multiple choice), or a number that indicates positioning on a scale related to the statement provided.

- **Qualitative Questions**

  Qualitative questions are used to gain a more detailed understanding of a phenomena, with answers that are not as straightforward as a yes/no or a numerical value ; these allow for participants to give more detailed descriptions of their experiences. Open ended survey and interview questions, as well as questions that probe specific domains of a participant's experience (e.g. 'Can you describe how your confidence in the subject changed during the programme?') generate qualitative data.

Step 4 – Choosing the right evaluation method

The evaluation method should be determined by the information desired, the general ability of participants, the resources available, and most importantly, the time allowed.

In this section, a number of different evaluation methods that were used during the OSHub project, and which can be adapted for open-schooling practices, are presented:

- **Surveys / Questionnaires**

  Pre – and post-, providing quantitative data from before (pre) and after (post) the programme.

- **Semi-structured Interviews**

  Periodic interviews that happen once or twice throughout the programme, which provide qualitative data through the use of open questions. Semi-structured refers to an approach that the researcher has created or structured a predetermined set of questions. It can be somewhat scripted but the interviewer is able to be responsive to their interviewee, and has the freedom to follow up on threads of conversation which are particularly pertinent to the project.

- **Skill Archive**

  A two-question structured survey provided to learners at various time points throughout their project. It provides quantitative and qualitative data.

- **Zines**

  Creative reflective diaries that yield highly detailed qualitative data based on learners' perspectives and experiences. These small diaries can contain both text and image-based data.

Section 6.3 below provides an overview of each of these methods, including a case study detailing how each method was implemented as part of the OSHub project.

Step 5 – Implementation of method – gathering data

Once the methods have been chosen, questions formulated, and resources gathered, the next step is implementation. Good facilitation is an important component of evaluation. In some cases, the designers of the evaluation (e.g. researchers or programme directors/coordinators) might not be able to be on location, and so responsibility for collecting evaluation data might fall to teachers, workshop facilitators, or others involved in the programme. These facilitators should be informed of the evaluation timeline, methods, and points of contact, and be prepared to answer participant questions on the subject, or to direct participant questions appropriately.

Step 6 – Privacy and consent

When carrying out an evaluation, it is integral to consider consent, data protection and privacy regulation, and how these will affect the collection, storage and presentation of data. It is fundamentally necessary in the EU to follow General Data Protection Regulations (GDPR) and to adhere strictly to these guidelines.

When carrying out an evaluation, informed consent must be obtained from the participants (or their legal guardians if they are under a certain age) to store and use their data for a specific purpose. Consent can be given either verbally or in writing, but it must be recorded. Before collecting consent from participants it is essential that they are informed, either verbally or in writing (though ideally both) what data will be collected or how this data will be used. If the data is to be used for means other than those described to the participants, consent must then be renewed before the data is used.

When collecting and storing data, it is important to go through the process of anonymisation so that the participants cannot be identified. Names are not the only way a person might be identified, so multiple elements may need to be anonymised. For example, if every teacher in a school has been interviewed, but only one teacher is female, and only one is under 30, then either the gender and ages of the teachers must be anonymised, or the school itself.

As a rule of thumb, only seek essential information. This serves to lessen the workload and ensures you are not saving unnecessary and possibly sensitive data. Furthermore, data must be stored and processed in line with institutional, national and international regulations. Most organisations have Data Management Plans, and personnel responsible for secure management and storage of data – evaluators should work with those responsible within their organisation to ensure all data is properly managed.

These are general guidelines, but it is essential to check and align with local, national and international regulations around data, privacy and consent.

Step 7 – Analysing the data

After collecting the data, the final steps of the process are organising, analysing and sharing the data. In this regard, quantitative surveys are typically simplest, as graphs can be generated directly from the collected data. Qualitative data can be a little more complex as the data has to be coded and analysed. Creative evaluation methods, which ask for participants to describe their experience in alternative ways to answering questions (e.g. zines, art-based mapping, photograpahy), can be even more complex, as a rubric for particular indicators must be developed. An example of this can be found in ection 6.3.2 (table 6.5).

When analysing the data, it is helpful to commit to a methodology that is simple, easy to follow and succinct. While there are many approaches to analysing qualitative data, thematic analysis is an adaptable and reliable approach. Braun and Clarke (2006[9]) describe the process of thematic analysis as searching across a dataset to identify patterns of meaning. They outline six key phases:

- • A. Familiarisation with the data
- • B. Generating initial codes
- • C. Collating codes to search for themes
- • D. Checking themes against coded data
- • E. Defining and naming themes
- • F. Reporting

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9. Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. Qualitative Research in Psychology, 3(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

In Step B, generating codes involves labelling and organising your results into different categories and subsequently identifying themes and patterns within them. To do this, a codebook is required, which describes a specific idea or indicator of interest to the project, and the corresponding codes that will be assigned to segments of the data which demonstrate or enact those indicators. – For example, a quote from a learner who says *"I loved working with the others on my team to build the robot"* may be assigned to the code "collaboration" as well as "engineering skills".

A codebook should be written in a way that all evaluators going through the data should be able to apply codes and end up with similar categorisation. Biases can still occur, and therefore it is important that there are at least two coders involved to reduce the influence of one person's perspective. To reduce bias even further, coders should check their intercoder reliability on a subset of the data. They can do this by each coding the subset and comparing the results. This simple test will reveal whether th codebook needs to be refined for clarity . Intercoder reliability can be measured using a number of statistical methods. For more information on how to ensure intercoder reliability, see *this website*.

Coders should go through the data more than once, as codes may change or new ones arise as the data is organised. For further reading on coding, see *The Coding Manual for Qualitative Researchers* (Saldaña, 2013[10]).

Following the coding stage, the codes can be gathered together to form overall themes – for example, codes "collaboration", "communication" and "confidence" may be grouped together as one theme related to "interpersonal skills", while "engineering skills", "scientific content knowledge", "digital skills" and "mathematical reasoning" may be grouped together to demonstrate a theme around "STEM disciplinary knowledge and skills".

As cautioned by Braun and Clarke (2020)[11] it is important to remember that generating codes and themes is not enough to analyse qualitative data. he key step in thematic analysis is the one in which the researcher infer meaning from the themes that they have generated from the dataset. It is also important to remember that themes do not "emerge" from the dataset – they are generated by the researcher, and influenced by the researchers' own knowledge, and experiences – two different researchers may generate different themes from the same data. Again, inputs and perspectives from multiple evaluators/researchers can be useful in mitigating biases and reaching a reliable and actionable agreement on the meaning and relevance of the results.

6.2.3 Open Science Hub Evaluation – Case Study

The OSHub project provided the means to develop, test and implement evaluation techniques for open schooling practices. As a project with nine consortium partners across Europe, OSHub represented a unique opportunity to create methods that may be easily adapted in different contexts without losing meaning or impact. Below, the local contexts of each OSHub are outlined and the evaluation approach used to measure a number of project outcomes, both locally and at the consortium level, are described.

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10.   Saldaña, J. (2013). The coding manual for qualitative researchers (2nd ed.). London: Sage.

11.   Braun, V., & Clarke, V. (2021). One size fits all? What counts as quality practice in (reflexive) thematic analysis?. Qualitative research in psychology, 18(3), 328-352.

6.2.3.1   Local OSHub Contexts

The objectives of each OSHub, while in keeping with the principles of open schooling, were specific to the needs of their local community and partners. The evaluation methods outlined in this handbook were implemented for a number of these hubs, and therefore when considering their findings, it is important to consider the disparate contexts in which each OSHub is situated. Table 6.1 provides an outline of the goals of each participating OSHub and their context.

Table 6.1: Local contexts and goals of each OSHub.

OS-HUB	LOCAL GOALS AND CONTEXT
Austria	• To tackle community need for digital literacy in regional schools and schools where students come from low socio-economic backgrounds. • To give agency to young people in determining the roles that humans and machines will play in the future. • Aligns with the Digital Humanism mission of OSHub partner Ars Electronica.
Czech Republic	• To establish a school-led form of education, which engages students, teachers, parents and various local actors for knowledge-based community development • To tackle environmental, historical, cultural, and socio-economic issues faced by local communities. • To build relationships and networks between different levels of stakeholders concerned with sustainable development of local communities.
Ireland	• Student retention in Delivering Equality of Opportunity In Schools (DEIS) schools in socioeconomically disadvantaged areas. • Increasing youth leadership skills. • Student co-creation: challenges defined during the process by the students. • Showcasing future life opportunities for students. • Building / strengthening school relationships in a pandemic. • Tackling *SDGs* with the local community and emphasising the role of science in society.

France	• A neighbourhood with social and economic difficulties that increased due to the pandemic. • Surge of violence • Helping students to develop their knowledge, their feeling of being an active part of their community ("well being together"). • Capacitate teachers and stakeholders with fabrication skills. • Promote connections and collaborations between local partners and schools.
Greece	• Lemnos island: geographically isolated and with less access to STEM opportunities. • To create tangible projects that address real issues in Lemnos. • To create a live network between school and local stakeholders. • To drive student and teacher engagement in STEM education. • To increase student awareness of SDGs and environmental issues in Lemnos.
Netherlands	• Educational inequality; pupils falling behind in their academic, creative and emotional development. • Increased teacher workload due to teacher shortage. • Social/economic disadvantaged neighbourhoods in the Hague, with increased challenges due to COVID-19 pandemic.
Portugal	• Low population density territory in the border between Portugal and Spain • Reduced citizen participation and low collaboration between partners and school • Low connectedness between students and research & innovation • Low digital literacy of students and teachers • Low motivation, autonomy and confidence of teachers for more open and collaborative approaches
Switzerland	• Making: strengths and technical competences of OSHub partner Onl'fait • Interregional: located at the border with France • Sustainability: key issue identified by Department of Public Education; recently introduced in school programmes • Collaboration: schools looking for collaborative / applied projects; engaging with science and technology; inspiration about careers

6.2.3.2   OSHub Evaluation Approach

So, how do you evaluate an open schooling project with various partners, stakeholders and objectives involved? The solution initially adopted by the OS Hub project was to evaluate at three different levels: 1) The consortium, 2) the school network, 3) the learners. Each level had different outcomes to be measured and involved different actors. Therefore it was necessary to evaluate these separately to ensure meaningful findings could be formulated. By centering the evaluation approach on these three levels we developed further evaluation tools in order to obtain an in-depth and holistic view of each level and the ways in which they functioned together to support open schooling practices.

Level 1: The Consortium

The first of these levels examined the European network-wide consortium of nine partner institutions: University Leiden (NL), Science Gallery at Trinity College Dublin (IE), Impact Hub Siracusa (IT), Onl'fait (CH), Ars Electronica (AT), CCSTI de Grenoble – La Casemate (FR), ESA-ESERO Česká Republika (CZ), Plataforma de Ciência Aberta-MFCR (PT), and SCICO (GR). These partners represent a range of institutions across Europe, and as such, interacted with different audiences with a variety of cultural backgrounds. Each partner tackled projects with their local stakeholders, including learners, that related to specific socio-economic, cultural and environmental challenges in their communities. This cohort provides insight into the progress of the overall project, the development at each stage, project sustainability and insights into resource management, and training requirements. We also evaluated the processes of communication and collaboration between the partners of the OSHub.Network.

Level 2: The School Network

The second level focused on the bridge between local OSHubs and the learners: the schools and teachers. It was essential to gain a deep understanding of the effects an OSHub can have on participating teachers, without whom the local networks would not exist. The teachers' experiences with OSHub resources were evaluated. We also sought to understand the ways in which these resources, teachers' professional development, and best practices worked together, with a particular focus on the teachers' views on open schooling and the aspects which they felt were most important to improving the experience of learners

Level 3: The Learners

The third level evaluated the individual OSHubs and their projects and programmes. Focus was placed on investigating participant experiences (specifically the experience of learners) within each OSHub project.

The OSHub evaluation approach aimed to investigate students' skills and competencies as they developed over time, the relationship students are developing with science in society, and their engagement with their OSHub and community. Students were assessed on their experiences in workshops and throughout the project development. This was explored through pre – and post – questionnaires, alongside continuous reflection throughout the programme using the skill archive and learner-led zine creation.

6.2.3.3 Research Instruments

To complete the evaluation of the OSHub.Network project at the three levels described above, a set of evaluation instruments were developed and used. It is important to note that many of these techniques were deployed via different formats from partner to partner, and those detailed in this handbook are meant to serve as examples for guidance. The evaluation methods described are flexible and modular; they can be implemented at various times, and in various ways. The protocols are not overly restrictive , as we worked with a very diverse group of learners and coordinators.

These instruments provided OSHubs with an adaptable means of evaluation to capture the experiences, feedback, thoughts and needs of partners, stakeholders, and students throughout the OSHub Network. They also informed the overall project management as well as necessary future actions to ensure the project's future sustainability. They were created as a form of approachable evaluation, intended to ease the pressure on learners and coordinators to spend excessive time working on the evaluation, allowing the evaluation methods to be easily applied in different settings.

The variety and accessibility of these evaluation instruments allowed for a homogeneous evaluation approach across multiple aspects of the OSHub.Network. These instruments also allowed the consortium to adapt their processes by identifying the needs of partners or participants and providing further resources as needed.

Table 6.2 provides an overview of the various instruments outlined in the next section along with their corresponding level, the actors involved and the type of data generated by the instrument.

Table 6.2: Evaluation tools and their corresponding levels.

LEVEL	EVALUATION TOOLS	WHO IS INVOLVED	TYPE OF DATA
1.Consortium	Coordinator Interviews	OSHub Coordinators	Transcripts – Qualitative
2. School Network	Teacher Evaluation	Teachers of students taking part in OSHub project	Transcripts & written reflections – Qualitative
3. Learners	Skill Archive	Students	Counts of skills – Quantitative / Short reflections – Qualitative
3. Learners	Pre/Post STEAM Relationship Surveys	Students (can also be used for teachers)	Quantitative
3. Learners	Zines	Students	Creative reflections – Qualitative

6.3   Evaluation Methods

As described in Table 6.2, this section contains five evaluation methods utilised to measure outcomes for the three levels identified for OSHub evaluation. For each evaluation method, we will include the following:

- **Introduction:**

  A general introduction to the method and an overview of possible outcomes it can be used to measure.

- **Implementation:**

  An explanation of how to implement each method, with a focus on evaluating open schooling practices.

- **Evaluation:**

  A description of how to analyse the data gathered (eg. use of codebooks, indicators).

- **Open Science Hub Case Study:**

  An overview of how the technique was used in the context of the OSHub project including specific findings and discussions on the use of the method.

The results described in the case studies below are from some of the OSHubs outlined in Table 6.1. As mentioned before, the evaluation methods outlined here can be adapted to suit the needs of any open-schooling project. Resources developed during OSHub have been added as an example, but how you collect and organise your data can be decided upon by you and your team.

6.3.1   Coordinator Interviews
(Level 1: The Consortium)

In Open Science Hub we aim to understand the value and impact the project has had for and on its audiences, including students, teachers, stakeholders, local and wider communities. Developing a robust evaluation strategy enables us to successfully identify and focus on specific priorities that are important to the project, the partners, and the stakeholders. Some of these priorities include; community development, relationships between stakeholders, the level and types of innovation, the interest that learners have in science, citizenship education, and the challenges faced in the implementation of Open Schooling projects.

6.3.1.1   Introduction

Interviews give voice to participants, offering an alternative way to express their knowledge, experiences, concerns and needs as opposed to the closed-ended format of questionnaires. Interviews come in three basic forms; structured, semi-structured and unstructured. Structured and semi-structured interviews follow a set of predetermined questions, where the former follows the questions more rigidly, while the latter allows new directions and questions to be introduced depending on the responses of the interviewee. Unstructured interviews do not follow a set of predetermined questions.

In the case of our open schooling interviews, we focus on semi-structured interviews, which were designed to capture different aspects of the partners' experiences, potential future goals, and their unique opinions on open schooling.

The questions are open-ended to allow the interviewee to express the information they felt was most important with little restriction. However, it is important that the questions were developed in line with the goals and indicators of the overall evaluation.

6.3.1.2   Implementation

Some key indicators that would be useful to consider within an open schooling project in might include references to;

- School engagement (positive and negative)
- Stakeholders which may include local authorities/ local organisations/ ministries of education) (positive and negative
- Local community sentiment
- Strength of OSHub community or consortium relationship
- OSHub value propositions (links to open schooling, open learning, open science hub, SDGs)
- OSHub specific activities (workshops, events, trips etc.,)
- Feasibility, technical and financial considerations
- Skills adopted or developed by students
- Skills adopted or developed by teachers
- Inclusivity, equality, and accessibility of the project

Coordinator interviews can be conducted in two ways. The questions can either be sent to coordinators as a digital questionnaire to answer, or the questions can act as a guiding script for an interview with coordinators. It is essential that the interview is recorded and transcribed, or that there is someone available to take detailed notes.

The interviews can be conducted in person or using a video communications software. If the interview is being recorded, the interviewee must be made aware of and subsequently consent to the recording. Interviews should not last too long, although with the open-ended format, interviewees are encouraged to speak openly, for as long as they wish, so time duration will vary per participant.

It is useful to carry out interviews at multiple times throughout the project (e.g. at the end of each year) to track the evolution of the coordinators' views throughout the project. Yearly reviewing also allows for adaptations to be made to improve the project, while supporting the identification and resolution of issues that may arise along the way.

6.3.1.3   Evaluation of results

Once you have identified the main points made within the coordinator interviews, it is important to then organise the data so that you can come to reliable and actionable conclusions. For instance, noting when and how often a specific indicator or idea appears (using the codebook) will give you a better indication of the coordinator's attitude towards different elements of the project.

The data should be analysed two or three times as the codebook may also need to be updated as the data is analysed. As mentioned previously. there should be a second coder who goes through the same data with the same codebook in order to reduce bias in the results. In the case study below, an example of a codebook is shown.

6.3.1.4   OSHub Case Study

Goals and Indicators

Table 6.3 shows an outline of the objectives of the coordinator interviews, and the indicators used to measure these.

Table 6.3: Goals of the OSHub coordinator interview evaluation and corresponding indicators.

OSHUB GOALS	INDICATORS
Develop a international network between OSHubs.	Comments regarding formation, development and strengthening of international collaborations and relationships between an OSHub and another entity.
Develop a network between local OSHubs and their local stakeholders.	Comments regarding formation, development and strengthening of local collaborations and relationships between an OSHub and a local stakeholder.
Develop a sustainable network that share OS resources.	Comments regarding resources, activity, process that allow for long term engagement & sustainability.
Develop a process of working that allows for successful implementation of open schooling.	Comments regarding activities, actions resources that facilitate open schooling.
Assist technically and financially to implement open schooling.	Comments regarding providing technologies, resources and financial aid to participants.
Evaluate the impact OS has on it participants.	Comments regarding notes of the impact open schooling has had on its participants.
Address issues of local community relevance related to the global SDG.	Comments regarding the effect open schooling projects has had on needs of the stakeholders local communities.

Questions for Participants

1. **What were the 3 most important additions to your local open science hub network?**

   a)   How did you manage to grow your network?

2.   **Did you feel like you had adequate support or training from the Open Science Hub project consortium?**

      a)   Did you use any of the tools from the consortium?

3.   **Thinking about the original aims and objectives of your OSHub, were you satisfied with the final outcomes?**

4.   **What do you feel have been the most impactful outcomes of the Open Science Hub project both locally and internationally?**

5.   **Will the Open Science Hub Project continue next year?**

      a)   If so, will it be different to this year, and how?

      b)   If not, why not?

6.   **Do you think there is a future for open schooling in education?**

Gathering data

Interviews were carried out with coordinators from the different OSHubs at the end of each year of the project. Each interview was semi-structured, lasted approximately 20 minutes, and was carried out online over video conferencing software.

The interviews we focus on for this case study were carried out at the end of Year 3 (2021/2022) of the OSHub Project, and involved four OSHubs.

Privacy and consent

All interviewees were asked for consent before the interview began. They consented to take part in the interview, to have the interview recorded, and for the results to be utilised in research outputs including conferences, papers and reports.. The results were anonymised and stored following GDPR. As there are only a small number of coordinators, it was important that any identifiable data was removed when presenting the results, to ensure that no data could be connected with a specific coordinator.

Data Analysis

In order to analyse the data collected, a codebook was created to identify indicators as outlined in the section 6.3.1.3 Evaluation. The breakdown of a subset of codes can be found in Table 6.4. Each code corresponds to a specific goal of the evaluation, which is associated with an indicator to measure. For the full table, see Appendix, Section 7.1.

Table 6.4: A snapshot of the codes used for coordinator interviews.

GOALS	CODE	EXPLANATION
Develop a network between international OSHubs and local stakeholders.	Networking / collaborating	Positive comments about increasing network or strengthening collaborations in already existing networks at an international level.
Develop a network between international OSHubs and local stakeholders.	Relationship building / building trust	Positive comments about developing relationships / trust in existing local networks e.g. between coordinators and teachers.
Develop a sustainable network that share OS resources.	Support	Positive comments regarding support offered by the OSHub consortium and management.
Develop a process of working that allows for successful implementation of open schooling.	Limiting the bureaucracy	Comments regarding the needs for action that allow for less bureaucracy to access community and stakeholders.
Assist technically and financially to implement open schooling.	Lack of resources	Comments regarding the lack of resources felt by schools and learners attending OSHub.

The above table represents how information provided in interviews can be transformed into information that can be readily analysed for evaluation. Once the data was organised, the evaluators began to turn the comments into coded items based on identified themes. The themes were related to identifiable goals/outcomes of the project. Below is a summary of five themes and corresponding outcomes identified using this method.

- **Sharing of resources:**

   The consortium provided tools to the local schools and associations they were working with, such as hardware (e.g. sensors), but also provided them access to new types of collaboration tools like Mural /Miro and co-creation methodologies for working on their projects. Partners mentioned that they received tools from the consortium too, such as co-creation and stakeholder management and evaluation methodology provided by TCD, and the self assessment and business canvas provided by Impact Hub.

- **Collaboration Locally / Local Needs / Issues:**

   Collaboration on a local level means schools becoming more connected to local universities, research institutes, and teachers. Making sure that teachers feel connected to the network is of utmost importance. Many partners commented that they aimed to strategically identify local stakeholders, such as associations that have similar goals and values , as they often lead to more productive opportunities.

- **Future of OSHub project in local area:**

  All partners plan to continue with their OSHib project next year. They have developed infrastructures that allow them to run similar projects in the future. Participation in the local network may vary depending on opportunities for projects and the type of local relevant challenges, however the initiative, desire, and preliminary plans for implementation are there. There is a particular drive to continue to design and implement more co-creation sessions inspired by activities from the OSHub project. A number of respondents also shared a vision for more international collaborations.

- **Value of Project:**

  The primary values that have been identified by the partners are focused on the utility of having the support and extra resources to develop projects in the local context in new ways and the impacts these projects have on the community. There are still questions around the long term impact of these individual projects. However, partners have developed a customised format where they can re-run projects with schools, which is also beneficial to the host hubs. They also provide a kind of scaffolding with which to imagine and design future projects. The coordinators also emphasised the value of these formats in addressing very specific community needs.

- **Open Schooling / Learning:**

  It is believed that open schooling has a very real future in education, as it allows students to both practically and creatively connect to local issues, organisations and opportunities. It also supports their exploration of new perspectives and approaches. In order to maximise positive impact, it is recommended that these projects be grounded in the value they i contribute to society. These contributions should be clear to the students as well, in order to make the most out of the learning potential for each project. . There must be contributions from both bottom-up (creators and educators in schools such as us) and top-down (government, policy makers, universities and public bodies) approaches to society in order to make open schooling become relevant and sustainable. The issues of relevance must be identified through bottom up approaches, and then supported by those with resources at the top.

Discussion

Positive takeaways

Semi-structured interviews provided participants the opportunity to freely express their knowledge and experiences, it allowed evaluators to push for more in-depth answers that would not be generated and available using quantitative questions or a structured interview format. The consortium provided a wealth of valuable information, such as how impactful each OSHub was in its community, whether they were able to meet their objectives, and what the future for both OSHub and open schooling in general could be. . There was overwhelming positive feedback regarding the experiences of the learners, teachers and consortium members throughout the project. The future outlook on open schooling and OSHub are positive overall. Partners stated that they planned to continue their OSHub initiatives but that strategies were still being defined with local stakeholders

Limitations

Interviews take time and resources to carry out. Even after the interview has taken place, it must be transcribed, coded and analysed (multiple times with at least two coders). Therefore, the planning and allocating of resources must be well defined before embarking on this type of evaluation. interviews also take the time of an interviewee, so you must be cautious to ensure interviews are no longer than the previously agreed time. Staff constraints and time commitments may change over the course of the project, so you may not be able to interview the same individual multiple times over the duration of a project. This was the case for OSHub.

During the first two years, all coordinators were interviewed, but in the final year, a number of staff changes meant that only four interviews could be carried out. Despite these limitations however, the data generated over time, that is to say through multiple interviews conducted with the same individual, is of particular value. These longitudinal approaches, even with a small number of interviewees, can provide a researcher with invaluable insights into the ways a projects' impacts may grow, diminish or change over time, along with the attitudes, and perspectives of the interviewees.

Recommendations

Semi structured interviews allow the interviewer and interviewee the freedom to explore unanticipated results.. Begin these interviews early on as you may uncover surprising or unexpected results, which is crucial for understanding novel projects. New indicators may arise during the interviews that have not yet been considered, but are highly useful for such evaluations.

6.3.2   Teacher Evaluation (Level 2: School Network)

6.3.2.1   Introduction

Semi-structured interviews are interviews with predetermined questions. They are more free flowing than surveys or structured interviews as they allow for diversion to new topics that may not be predetermined, and encourage the participant to provide detailed anecdotal evidence.

This method will focus on semi-structured interviews used to evaluate the experience of a teacher/facilitator within an open-schooling project. Teachers are in direct contact with learners and receive first hand experience of how they respond to the activities. They also must implement the activities, and therefore can provide important insight into what works, and what doesn't in practice. The questions should first seek to get an understanding of the learners' experience throughout the project and whether there were any positive or negative impacts on the learners, the teachers and the local school network. This includes knowledge acquisition, behavioural changes, skill and competency development, but can also be an assessment of their feelings towards open schooling methodology.

6.3.2.2   Implementation

Goals and indicators should be set out based on what you want to learn from the teachers, and therefore will likely be split into two sets; those focused on the learner's experience, and those focused on the teachers'. With this in mind, two sets of questions are also recommended covering the same topics. Participants should be asked to answer each section in as much detail as possible, providing reasons and evidence for their answers. Questions may have sub-questions/ secondary-questions below labelled as letters (a-c), these allow us to dive deeper. These can be used as a prompt when participants do not fully answer the question.

Some key indicators that would be useful to look out for with an open schooling project in mind would be any reference to;

- School engagement (positive and negative)

- Stakeholders (positive and negative)
- Local community (positive and negative)
- Any specific challenges/suggestions
- Open schooling value propositions (open learning, SDGs etc.,)
- Open schooling specific activities (workshops, events, trips etc.,)
- Feasibility, technical and financial considerations
- Skills adopted/developed by students
- Skills adopted/developed by teachers
- Inclusivity, equality, accessibility of the project

Teacher interviews can be conducted in two ways. The questions can either be sent to teachers as a form / questionnaire to answer, or the questions can act like a script for an interview for coordinators. It is important to make sure the interview is recorded and transcribed, or that there is someone available to take notes.

The interviews can be conducted in person or using a video communications software. If the interview is being recorded, the interviewee must be aware and consent to the recording. Interviews should not last too long, however with the open-ended format, interviewees are encouraged to speak as openly, long or short as they wish, so time duration will vary per interview.

6.3.2.3   Evaluation of results

When evaluating teacher responses, it is advisable to have an evaluation rubric/tool on hand to assist with identifying indicators within the data.

Once you have identified the main points made within the teacher responses, it is important to then organise the data so that you can come to reasonable conclusions. For instance, noting when and how often a specific indicator or idea appears will give you a better idea in terms of the teacher's attitude towards the different elements of the project. Use of a codebook is a beneficial way to organise and analyse data. See Step 7, Section 6.2.2

6.3.2.4   OSHub Case Study

Goals and Indicators

Below is an outline of the objectives of the teacher interviews, and the indicators used to measure these.

Table 6.5: Goals of the OSHub teacher interview evaluation and corresponding indicators.

OSHUB GOALS	INDICATORS
Evaluate the effectiveness of OSHub programme on the learners.	Comments regarding notes of the impact open schooling has had on its participants.

Evaluate the effectiveness of OSHub programme on the teachers.	Comments regarding notes of the impact open schooling has had on its participants.
Developing a sustainable network that shares OS resources.	Comments regarding resources, activity, process that allow for long term engagement & sustainability.
Develop a process of working that allows for successful implementation of open schooling.	Comments regarding activities, actions resources that facilitate open schooling.
Assist technically and financially to implement open schooling.	Comments regarding providing technologies, resources and financial aid to participants.
Address issues of local community relevance related to the global SDG.	Comments regarding the effect open schooling projects has had on needs of the stakeholders local communities.

Questions for Participants

Primary Questions have been numbered per each section (1-5). Participants should be asked to answer each section in as much detail as possible, providing reasons and evidence for their answers. Questions may have sub-questions/ secondary-questions below labelled as letters (a-c).

Learner-focused Questions:

1.   **How did you feel the experience was for students / learners of the programme?**

   a)   What benefits did you feel the learners had from taking part?

   b)   Were there any negative aspects of the experience you think the students had?

2.   **How did you feel the programme interacted with the school curriculum?**

   a)   Did you feel it complemented or impeded on the curriculum?

3.   **Did you feel the programme was accessible, diverse, inclusive and equitable for learners?**

   a)   Were there any sections of the programme that you feel had accessibility issues for the learners?

   b)   If you think there were accessibility issues for the learners, how do you feel these could be overcome?

4.   **What do you feel was the most significant change for the learners over the course of OSHub?**

5.   **Do you have anything else to add regarding the students' experience of OSHub?**

Teacher-focused Questions:

1. **What was your experience from taking part in the programme?**

    a) Do you feel like the programme benefited you in any way? (e.g. Did you learn anything ? / Get resources? / Improve your practices? / Increase network?)

    b) Did the programme impact you negatively in any way? i.e. Were there any drawbacks or complications to taking part?

2. **What skills do you feel you used most during your time on OSHub?**

    a) What do you feel like you improved on the most?

    b) What do you feel are the most important skills / competencies for a teacher/facilitator carrying out a programme like OSHub?

3. **Has OSHub changed your teaching practice in any way?**

4. **What benefit, if any, do you think OSHub brought to your school or could bring to your school?**

5. **Do you think Open Schooling, or a similar model to Open Science Hub, is important for the future of education?**

    a) Do you think it is possible to enact this type of education, if so how?

    b) If not, why?

6. **Did you feel supported throughout the Open Science Hub programmes / Did you feel you had enough support throughout your activities by Open Science Hub? (e.g. Did you receive adequate training / Resources provided / Anything else)**

Gathering data

Throughout the course of the project, information was gathered from two teachers per hub. Teachers were interviewed at the end of every year, with more casual exchanges happening throughout.

Privacy and consent

All interviewees were asked for consent for the interview to be recorded and their results used. The results were anonymised and stored following GDPR guidelines. As there are only a small number of teachers, it was important that any identifiable data was removed when presenting the results, to ensure that no result could be connected to a specific teacher.

Data Analysis

The interviews were analysed using the codes seen in Table 6.6 to identify indicators connected to themes of interest (see Section 6.3.2.2). Note that Table 6 does not contain all codes, but a full overview is available in the Appendix Section 7.2. Using this method of result organisation, evaluators were able to analyse the results and produce helpful findings.

Table 6: Codes used to identity indicators within the OSHub teacher interviews.

GOALS	CODE	EXPLANATION
Evaluate the effectiveness of OSHub programme on the teachers	Novel Content / Experience / Idea	The teachers and students are introduced to new ideas and contents.
	Skills	Comments regarding skills that teachers and students acquired by taking part in OSHub that they did not happen in school.
	Positive change	Comments on the general positive effect OSHub had on teachers and students.
	Critiques	Comments by teachers about issues students had.
Evaluate the effectiveness of OSHub programme on the learners	Sense of Accomplishment / Achievement	Positive comments regarding the accomplishments felt by the students.
	Group work / teamwork	Comments regarding the effectiveness that group work had on the students.
	Research	Positive comments regarding the research methods and strategies the students had to follow.
	School trips	Positive comments regarding school trips the students went on.

- **Novel Content:**

  Teachers commented that the material and content the students were learning was new and "refreshing", "broke away from other school life" where the students could be their own investigators and "learning was more intentional" for the students.

- **Skills:**

  Many teachers commented on the types of skills that were introduced to students such as organisational and collaborative skills. Teachers commented that they themselves were also able to learn new

skills e.g. technical skills such as building a Raspberry Pi computer, or creating a Wordpress website; as well as developing facilitation skills that can be used in the classroom.

- **Adaptability:**

  Teachers commented on the flexible approach open schooling allows. In one case the programme could be "broken down into more accessible bite sized pieces", while another commented that it allowed them to "asses the individual needs and experiences of the students"

- **Critiques:**

  Teachers provided constructive critiques on many aspects of the programmes. In one case they thought the "zines were overused" and they were unable to cover all aspects of the programme. Some teachers found that timing for workshops was an issue, and in some cases students felt disconnected for the long term projects.

Discussion

Positive takeaways

The teacher interviews provided beneficial insight into the implementation of OSHub activities and programmes within different local contexts.It's clear that teachers found open schooling practices as positive and worthwhile. This gives OSHub confirmation that such a project can be implemented and received well within school networks, no matter the location. These interviews also allow teachers to be open about their own experience, resulting in constructive criticism that can be used to improve such activities and projects in the future.

Limitations

Not all teachers were able to provide feedback. The teacher evaluation commenced after the school projects finished in June, therefore teachers had already begun their break and could not contribute over their holiday period. Teachers also answered the questions in a written format. These answers were less detailed than those who participated in interviews

Recommendations

Teachers have very limited capacity, it's recommended to use their time as wisely as possible, for us in person/online 20 minute interviews allowed teachers to express themselves more openly than written surveys. The better relationship interviewees have with the interviewer the more open, honest and constructive the answers will be, therefore its recommended to have 5-10 minutes before questions to explain the importance of the interview and what the answers will be used for.

6.3.3   Skill Archive
(Level 3: The Learners)

6.3.3.1   Introduction

The skill archive was inspired by a self assessment tool developed by the Horizon 2020 project *SySTEM 2020: Science Learning Outside of the Classroom (2018-2021)*[12], led by Trinity College Dublin (IE). The tool was expanded upon here and consisted of a two-question survey that asks learners to identify a skill they feel they have improved on (scientific, creativity, communication etc.) and to provide justification and an example for their choice. This allows us to quickly sample how learners are progressing within a particular programme.

The two questions both have a quantitative & qualitative element to them. The first question asks the learners to identify skills they feel they have improved on. These skills were chosen from the OSHub pilot evaluation, in which students were asked to complete the sentence "The Open Science Hub programme helped me to…..". This question allows us to keep track of what skills learners believe they are using on their course. For open schooling, these skills can be divided into eight categories:

- Scientific
- Digital
- Critical Thinking
- Creativity
- Collaboration
- Communication
- Citizenship
- Personal Development

The second question requires the learner to provide a justification and an example for their choice, providing us with qualitative reflective information. E.g. "Please give an explanation and an example as to why you think you improved your ……. skills".

6.3.3.2   Implementation

The goals of the skill archive are focused around understanding how the skills of learners' developed throughout a project, through their own perception of these skills. This can be broken down into more specific goals and their corresponding indicators. An example of such can be found in the case study in Section 3.3.4.

The skill archive is designed to be used as a 2 – 5 minute reflection that has two questions. This can be completed on any electronic device with internet connection. We recommend getting learners to scan a QR code to gain access to the link. It is recommended that the skill archive questionnaire is completed multiple times over the course of the programme or engagement (2 – 5 times) to see how the learners skills are progressing. Participants can be tracked over time if they have some identifiable nickname or username. Learners should write this nickname down so that they may refer to it each time they must complete the survey, otherwise they may forget it.

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12.   SySTEM 2020 received funding from the European Union's Horizon 2020 Research
         and Innovation Programme under Grant Agreement no. 788317

When first introducing the skill archive, ensure that you explain to the learners the overall goals of the survey, and how it should be completed.

6.3.3.3   Evaluation the results

It is useful to create and utilise a Skills & Competencies Indicator Key when analysing responses from the skill archive. Such a key separates skills into a number of categories, and explains how to identify skills from the data. An example of a key used in the OSHub evaluation can be seen in Table 6.7.

Table 6.7: Skills and Competencies Indicator Key Example (OSHub).

SKILLS	INDICATORS OF SKILLS	IMPLEMENTATIONS OF SKILLS
Scientific Literacy	Explain phenomena scientifically	Learners are referencing / explaining scientific phenomena.
	Designing scientific enquiry	Learners are referencing experimenting/evaluating.
	Interpret data and evidence scientifically	Learners are reflecting on data and making conclusions.
Digital Literacy	Learning operations	Learners are referencing doing operations oncomputers.
	Uses of Technology	Learners are referencing using technology to produce project outcomes.
Problem Solving & Critical Thinking	Developing an understanding of information (issue/problem/challenge)	Learners reference problem solving / completing the task.
	Acting as a team / Completing the task	Learners are referencing / explaining scientific phenomena.
	Reflecting and learning	Learners reference completing the task through doing.

Creativity	Learning by doing / Expression	Learners learn or perform creative skills through doing / acting.
	Knowledge Creation	Learners develop new pieces of information about the creation process.
	Cognitive Skills	Learners reference cognitive skills – such as imagination, divergent / convergent thinking, motivation etc.
Collaboration	Establishing and maintaining shared understanding	Learners are engaged in dialogue, share understanding, perspectives, visions and sharing roles.
	Working together	Learners reference the positive experiences of working together such as being inspired by peers, solving challenges and sharing responsibilities.
	Display Diversity, equity, inclusion and justice	Learners references sensitivity to the diversity of their group and audience, demonstrating flexibility, inclusion and trust.
Communication	Understanding others views	Learners reference interpreting and distilling information from diverse sources considering their perspective, emotions and experiences.
	Expressing views	Learners references expressing their own ideas and views using appropriate methods, language and protocols.
	Formats of communication	Learners reference the mixed methods they may use to communicate their views and ideas.
Citizenship and Community	Participation in community activities	Learners references gaining knowledge of their community, participating in community projects and show motivation to improve their community.

Personal development and Knowledge acquisition	Exposure to new knowledge	Learners references exploring novel topics and perspectives and expanding their own ideas, concepts and vocabulary.
	Personal Changes	Learners references improving personal skills such as social / motivation, changing how they view the world and increasing their awareness.

Using the key

When analysing the responses, we first look at the skill the learner has identified (e.g., scientific skills, communication skills etc. (Column 1, Table 6.7). This general section can be considered to be level one of the analysis (A) . The justification is then read, which leads to level 2 the "indicators of skills" (Column 2, Table 6.7). The response to an indicator (AA). Further explanations and emerging themes can also be found in the key (Column 3, Table 6.5).

Using the two levels of analysis (A and AA) outlined above, code the learner's responses and examine data across different audiences (e.g. different ages, gender, location) to identify what skills are being used by each audience, and to get a better understanding of the skills that learners feel they are utilising and developing the most throughout the duration of the project.

6.3.3.4 OSHub Case Study

Goals and Indicators

The goals and indicators set out for the Skill Archive when used to evaluate the OSHub project was as follow:

Table 6.8: Goals and corresponding indicators for the OSHub Skil Archive evaluation.

OSHUB GOALS	INDICATORS
Track the skills being used by the learners during the OSHub project.	Count of responses per skill and per OSHub.
Track the specific skills learners feel they are developing.	Change of skill count over time.

Gain an understanding of how learners are developing these skills during the OSHub project.

Qualitative responses from question two.

Identify if this skill development is in line with the original objectives and values of OSHub.

Comparison of high scoring skills and reflective answers with local goals of each OSHub.

Questions for Participants

Q1: **"Which of the following skills do you feel like you have improved the most?"**

Choose from: Scientific; Digital; Critical Thinking ; Creativity; Collaboration; Communication; Citizenship; Personal Development.

Q2: **"Please explain why you think you improved on this chosen skill?"**

This answer was qualitative, and learners could write as much or as little as they preferred for this explanation.

To assist with identifying skills, learners were also provided with an example as to what that skill is. These examples can be seen below.

- Scientific Skills might involve explaining scientific information, carrying out scientific experiments or interpreting information.

- Digital skills might involve working with computers to carry out tasks, finding new ways to solve problems and designing new pieces of information.

- Critical thinking skills involve understanding and exploring problems in different ways, representing the problems, designing plans and evaluating progress.

- Collaboration skills involve engaging with multiple people, organising the team based on knowledge abilities and perspectives, and maintaining a healthy working relationship.

- Communication skills involve understanding others views, expressing your own views effectively and using appropriate formats for communicating.

- Citizenship skills involve participating in community activities, gaining knowledge about your community and other types of communities and cultures.

- Creative skills involve expressing yourself in different ways, in creating new types of knowledge, and using different types of thinking skills and behaviours.

- Personal Development skills depend on you. They might involve gaining new knowledge or skills that were not listed above, it might be exposure to new ideas or it might be some personal changes.

Gathering Data

The Skill Archive was implemented 2-5 times across 5 different contexts (depending on the type of hub). The interface used was a Google Form. Students could access the form by scanning a QR code, allowing them to complete the form with their phones.

Learners logged their progress into the Skill Archive up to 5 times over the course of their programme. As each OSHub delivered a specific programme, learners would log the skill archive at different points. For

example, Ars Electronica hosted five workshops that spanned 3 months. After each workshop, learners would log their skill archive. Trinity College Dublin hosted a year-long programme as part of the school curriculum. Learners here logged the skill archive at the end of each of 4 sections of the curriculum.

Privacy and Consent

All learners were asked for their and their parents consent before participating in the skill archive. They were asked on google form to input their OSHub nickname which consisted of an animal-colour-birth date (e.g. redpenguin23), this allowed us to track participants over time.

Data Analysis

The data was then organised and analysed using microsoft spreadsheets.

The skill archive rubric used to evaluate the data can be found in Table 6.7. The skill archive consists of a list of skills that were identified over the course of the OSHub project. Each skill has a set of identifying indicators that were created based on a review of the literature. The set was then narrowed down for relevance, based on what was reported by the students in their responses to the Skill Archive survey. The following is a summary of the findings.

Total Skills Identified Across Each of the Hubs

Table 6.9: This is the individual count of skills logged per OSHub.

SKILLS	AE L (n=101)	TCD (n=94)	SCICO (n=18)	MCFR (n=50)	FAB (n=52)	TOTAL (n=315)
Scientific Skills	38	12		3	9	62
Digital Skills	8	6	3	9	2	28
Critical thinking	12	11	5	7	1	36
Creativity	30	25	3	12	12	82
Communication	11	9	6	2	14	42
Collaboration		25	1	6	6	38
Citizenship		1		6	1	8
Personal Development	2	5		5	7	19

Table 6.10: Percentage breakdown of the skills logged per each OSHub.

SKILLS	AE L (n=101)	TCD (n=94)	SCICO (n=18)	MCFR (n=50)	FAB (n=52)	TOTAL (n=315)
Scientific Skills	42.2%	12.8%	0.0%	6.0%	17.3%	19.7%
Digital Skills	8.9%	6.4%	16.7%	18.0%	3.8%	8.9%
Critical thinking	13.3%	11.7%	27.8%	14.0%	1.9%	11.4%
Creativity	33.3%	26.6%	16.7%	24.0%	23.1%	26.0%
Communication	12.2%	9.6%	33.3%	4.0%	26.9%	13.3%
Collaboration	0.0%	26.6%	5.6%	12.0%	11.5%	12.1%
Citizenship	0.0%	1.1%	0.0%	12.0%	1.9%	2.5%
Personal Development	2.2%	5.3%	0.0%	10.0%	13.5%	6.0%

Table 6.9 and 6.10 displays the total skills logged per each OSHub taken from the Skill Archive survey. Table 6.9 displays this information as skill count, while table 9 describes it in the form of percentages. We will focus on table 6.10, as some hubs had a much greater number of responses than others, therefore percentages allow us to more clearly compare each OSHub. When comparing, it is important to remember that the activities for each hub were quite different, and therefore the same skills could have been gained in various ways and over different timeframes.

It can be seen that the skills vary greatly depending on each OSHub. For example, improvement in collaboration skills was not noted in the survey for AE, but they were one out of two most improved skills for learners involved in the TCD survey. This is likely due to the difference in emphasis put on specific skills per OSHub.

Each OSHub has different aims and objectives depending on the partners involved, the local community, the learners, and sometimes even the facilities available. For example, TCD focused heavily on co-creation activities, where students would work together alongside teachers and other stakeholders to define challenges and develop solutions. This can be linked to 'collaboration' being one of the most improved skills. MFCR focused on open schooling within the discipline of Citizenship and Development. It is also interesting for OSHubs to acknowledge other skills that they may not have expected, and to consider how these skills may have come into play. For example, those who participated in the FAB programme most improved their communication skills, however this was not identified by FAB as the most important aspect of the programme.

The qualitative results of Q2 of the Skill Archive survey were coded and analysed, and from this a number of key points were identified.

- Students struggle to provide an adequate explanation as to why they are improving their skills. Some did not provide any, (e.g. One hub had n=18 participants, while only n=7 provided qualitative results). It is also important to note that learners have been observed mistaking which skills they have learned. For example, learners may state that they improved on a particular skill, such as communication, stating *"My group and I began to work better over the course of the project"*, therefore conflating the skill of collaboration with that of communication. This could also be caused by the explanation given by the OSHub facilitator.

- Students reflected that they developed their skills through completing the assigned work. This was either due to the students' self initiative or the design of the tasks and projects. This shows that students have an awareness of the skills they are using during a given task.

- Several students made a very clear note that they improved on some skills due to the fact there was a physical object that they created or developed using those skills. This point was extremely important to them.

- The project assisted with student confidence and reflection.

Discussion

Positive takeaways

The Skill Archive survey is a quick and simple means to evaluate the skills learners feel they have improved on over the course of a programme and yield both quantitative and qualitative data.The quantitative questions were easy for learners to fill out, and so many responses were recorded and analysis could be carried out. It asks the learner to carry out self-reflection throughout their learning journey, and provides both facilitators and evaluators a wealth of data surrounding their own activities and the learners' responses to these. It allows OSHubs to consider if their objectives with regards to skill development were achieved, or if areas need improvement.

Limitations

Some hubs found it difficult to implement multiple times which lead to reflections shorter and less in depth reflections as reflections improve. It was clear from the qualitative data that some students confused the different skills, leading to possible confusing results for Q1. Fewer learners also answered Q2, possibly indicating that they did not have a good grasp on reflection of skill development.

Recommendations

The effectiveness of the Skill Archive comes from its multiple implementations. The less it is used the less effective it is for understanding the overall programme. It's recommended to identify milestones in the timeline of the project to use the skill archive. Learners can find reflections challenging, it's recommended to give examples of what good reflections are and show how they can provide more in depth answers. This will provide the evaluator with better results.

6.3.4   Pre & Post STEAM Relationship Survey (Level 3: The Learner)

6.3.4.1   Introduction

Surveys or questionnaires are efficient ways to collect information from a large number of people. They can be completed in person, online, by mail or over the phone. Questions can consist of open ended or closed questions, multiple choice, Likert scales, ranking etc. Surveys can be used for any type of audience; special consideration will need to be taken for younger or vulnerable participants and surveys will need to be made accessible. Surveys can be given before and after (Pre/Post) a project to see a perceived change in participants. They can also be given at particular points throughout a programme/project.

The STEAM relationship survey captures learner demographic information, learner's perspectives around 'STEAM and active citizenship' and the relationship they each play within their own lives. Finally it asks learners to rate themselves on a scale from 1-5 on the eight key skills and competencies mentioned in the OSHub Skills & Competencies Indicator Key, table 5 (but also table 10 for convenience). Note that this can be adapted for different indicators depending on the project. The post STEAM survey asks the learner's the same questions, minus the section that concerns the learner's demographic information.

6.3.4.2   Implementation

Surveys or questionnaires are generally created with the indicators pre-determined. The STEAM relationship survey is focused around how learners interact with STEAM-based topics, therefore goals and indicators for this evaluation technique should be in keeping with this theme. For open schooling, the OSHub indicator key is a good example of the type indicators of which to evaluate (see Table 6.7). An example of such goals and indicators can also be found in the case study of this technique, in Section 6.3.4.4.

The survey can be made as a digital form using any questionnaire/survey software. The survey should take approximately 15 minutes to complete. The survey will need to be altered depending on the students' ages and abilities. Learners should be provided with multiple ways to complete the survey such as computers, mobile devices, on paper etc.

The STEAM Relationship survey needs to be completed once at the beginning of the project, before any engagement starts, and once at the end. You can implement a survey multiple times throughout an engagement, however students and teachers can become frustrated if given many forms to complete.

6.3.4.3   Evaluation of results

Organising the data into simple, clear tables on a spreadsheet will allow you to get a better idea of what responses the students had to each question. Once you have organised the data from both the pre and post surveys, you can then create a table that acts as a comparative whereby you subtract the post survey value responses for any given question from the pre survey value responses from that same question. See Section 6.3.4.3 for details.

The purpose of the survey is to provide demographic and quantitative information. Having both a pre and post STEAM survey should allow us to recognise any perceived changes in the learners. It is important to note that there can be multiple factors that influence a learners relationship with STEAM and not all can be accounted for in this survey.

6.3.4.3   OSHub Case Study

Goals

The questionnaire used in the OSHub project were designed to look at four main aspects:

Table 6.11: Goals and corresponding indicators for the OSHub STEAM survey evaluation.

OSHUB GOALS	INDICATORS
Collect demographic information of OSHub participants.	Quantity of students who identify their age, ethnicity, gender, place of residence, family quantity.
Learners' perspectives around 'STEAM and active citizenship'.	A count of students who agree / disagree that science, art and activism are interesting , easy and important.
The relationship they each play within the learners' lives.	Quantity of students who take part in scientific, artistic or activist based activities.
Developing a baseline understanding of students skills.	A count of students that rate themselves on a scale of 1-5 on how they perform at a number of skills.

Gathering Data

The pre and post survey was implemented across a number of OSHubs, at the beginning and end of each of their programmes. The pre-survey was completed by 122 participants across five OSHubs, while the post survey was completed by 100 participants across four OSHubs. Each hub had a different number of participants for the pre-survey as compared to the post-surveys, and three hubs only completed either the pre or post, but not both.

Questions for Participants

The pre and post surveys were identical with the exception of the first 7 questions on the pre-survey, which were demographic questions. These were not asked in the post survey. Because of this, we will only provide the questions from the pre-survey. The pre-survey can be found in the Appendix, Section 7.3.

Privacy and Consent

All learners were asked for their and their parents consent before participating in the skill archive. They were asked on google form to input their OSHub nickname which consisted of an animal-colour-birth date (e.g. redpenguin23), this allowed us to track participants over time.

Data Analysis

The pre and post surveys were collected, and comparison sheets for OSHub were created. Only a subset of the surveys were used for analysis. From this, it was possible to analyse the data for a number of elements including:

- Change in science perception
- Change in perception of other topics e.g. art and activism
- Change in skill evaluation
- Comparison of opinions and changes of opinions among different demographic categories

This survey can also be compared to results of other evaluation methods, such as the Skill Archive, to further evaluate development of skills and perceptions.

For this handbook, we will focus on two results to demonstrate how such data can be used:

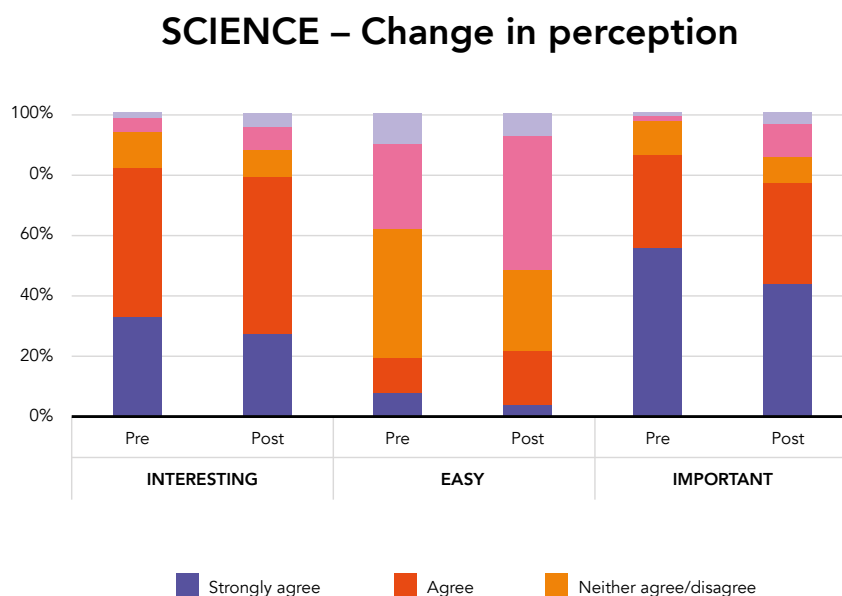*Science Perception*

SCIENCE – Change in perception

Figure 6.1: Change of perception in science (Q8). Credit: Cathal Fallon (TCD).

Figure 6.1 describes the results from the pre and post survey in percentages, demonstrating how the learner's perception of science changed over the course of the programme. Note that these are the total results of all learners from all OSHubs that took part in the survey.

It appears that the learners' opinions became stronger throughout the OSHub project, as less felt neutral about the aspects questioned in the post survey. While interest in science did not vary much, the perception of how 'easy' science is did. This could be due to learners' experience level with science, and therefore after working more closely with it, they get a better understanding of what is involved in certain science topics, which alters their perception.

Due to the demographic questions, we can also focus on how results differ between specific categories, such as gender or age. Here we present an example of how skill evaluation changed overall (Figure 6.2), and then focusing on males (Figure 6.3). The change in skills evaluation was found by comparing the given score (1-5) before and after for Q15 and rating an increase as positive, no change as neutral and decrease as negative. For this analysis, results could only be used from learners who completed both the pre and post surveys.
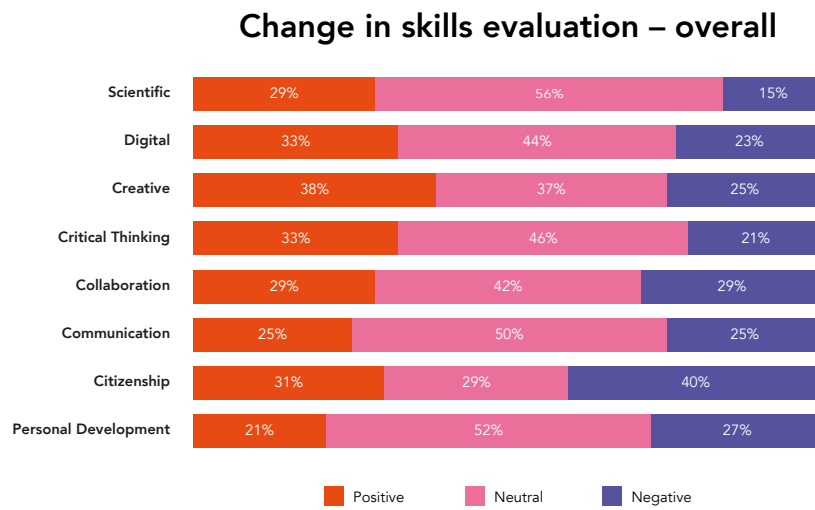
Change in skills evaluation – overall

	Positive	Neutral	Negative
Scientific	29%	56%	15%
Digital	33%	44%	23%
Creative	38%	37%	25%
Critical Thinking	33%	46%	21%
Collaboration	29%	42%	29%
Communication	25%	50%	25%
Citizenship	31%	29%	40%
Personal Development	21%	52%	27%

Figure 6.2: Overall change in skills evaluation. Credit: Cathal Fallon (TCD).

Change in skills evaluation – male

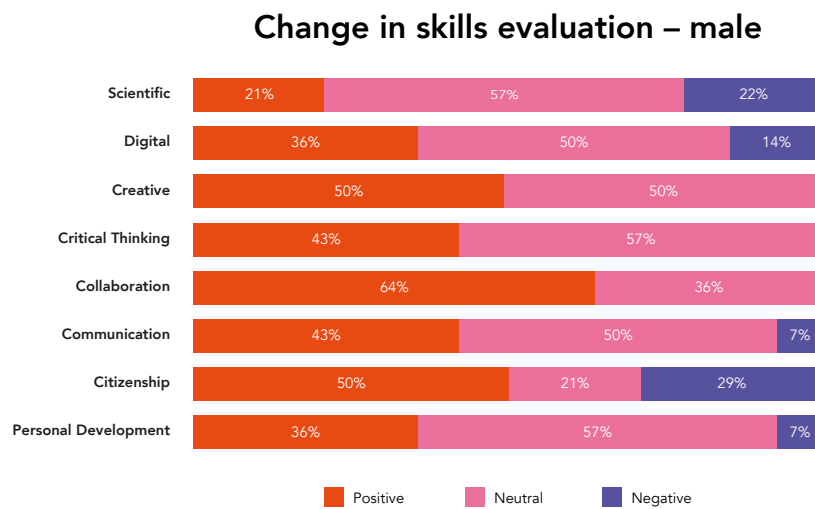|	Positive	Neutral	Negative
Scientific	21%	57%	22%
Digital	36%	50%	14%
Creative	50%	50%	
Critical Thinking	43%	57%	
Collaboration	64%	36%	
Communication	43%	50%	7%
Citizenship	50%	21%	29%
Personal Development	36%	57%	7%

Figure 6.3: Focus on change in skill evaluations for males.

Table 6.12: Demographic comparison of change in skill evaluation.

BIGGEST INCREASE IN SKILLS EVALUATION OVERALL		BIGGEST INCREASE IN SKILLS EVALUATION – MALE	
Creative	38%	Collaboration	64%
Critical thinking	33%	Creative	50%
Digital	33%	Citizenship	50%

BIGGEST DECREASE IN SKILLS EVALUATION OVERALL		BIGGEST INCREASE IN SKILLS DECREASE – MALE	
Citizenship	40%	Collaboration	29%
Collaboration	29%	Scientific	21%
Personal Development	27%	Digital	14%

Figure 6.2 demonstrates that in general, the majority of learners changed their perception of their own skills. This change of perception varied between improvement or disimprovement from what was previously thought. It is important to note that a negative change does not necessarily mean that the learner's felt the programme worsened their skills. This is an indicator more so of how their perception changed. Perhaps they first did not have experience with a particular skill, so made a guess, then as they gained more experience using the skill and reflecting on it, they felt that they actually had more room to improve the skill than originally expected. For example, a learner may think that they have good collaboration skills, but they have only ever worked with a group of friends. During the programme, they are required to work with people outside of their friend group who may have strong differences of opinions, and they may find this challenging. Therefore in the post survey, they will identify that perhaps their skills could be improved, thus providing a 'negative' result.

Comparing Figure 6.2 and 6.3 and the summary in Table 6.12, interesting results can be seen. It seems that male participants felt that their skills improved in general, especially in Collaboration, Creativity and Citizenship. The former two skill areas had no negative change, meaning that only those who listed genders other than male felt a negative change. Such analysis could be carried out for all demographics and could bring beneficial insight for bringing projects to different contexts.

Discussion

Positive takeaways

The Pre-Post survey method to understand how learners' perceptions have changed throughout. Demographic questions allow for comparisons to be made between specific contexts, and therefore if targeting a specific audience in a follow up programme, changes can be made to better suit that audience. The survey acted as an interesting indicator when it comes to knowledge and skill perception and evaluation.

Limitations

While some students perhaps felt an improvement in a specific skill, others likely came to a greater understanding of the skill, allowing them to accurately reflect on this skill and their own perceptions. However, to truly identify if this is the case, it would be beneficial to ask for a qualitative response to Q15 asking learners to further explain their answers. Learners show a reduction in their perceptions of science, art and activism in some cases. The novelty of these projects may provide new understanding of these terms to learners. Therefore further study is needed.

Recommendations

Surveys can be long and tedious activities for young learners. Therefore we tried to have a small number of surveys (2) and keep them short, this puts less stress on coordinators, teachers and learners. However, there are many questions left unanswered from the survey. It is recommended that there are multiple very short surveys used over the course of a project with the same group. Conversely if using two surveys (pre and post),

have a longer time commitment and aim to get as many in depth questions answered as possible. It is recommended to alter or create alternative surveys for participants of mixed abilities, for example a second survey was created for younger audiences (10-13) however this was not implemented.

6.3.5   Zines
(Level 3: The Learners)

6.3.5.1   Introduction

Zines are short booklets of text, images, and collage that may be used for personal reflection. They are often thought of as a cultural ephemera, mediums which may contain graphic, artistic or even poetic works. They can be created using low to no-cost materials that are widely available including extra pieces of paper, magazine clippings, photos, books, stickers, colours etc. The material accessibility of zines (with pen and paper anyone can create this small reflective booklet) is particularly relevant to those participants or organisations who do not have consistent or reliable access to other resources such as laptops or ipads. To learn more about zine culture, check out *this website*.

Zines are also used as a powerful instrument for reflection[13,14]. The use of zines as an evaluation tool has become increasingly popular due in part to their accessibility and adaptably within a wide variety of contexts. Learners may be encouraged to explore their own reactions, ideas, and experiences , or, particularly if there are time constraints, they can be guided and supported in their reflection with prompts and facilitation. Providing prompts may ease creative anxieties of participants. It is also important to note that while zines are often used to examine learners, emerging research utilises zines in evaluating and re-shaping institutional and organisational structures and practices. Through reflection, participants can document their process, analyse the work they have done,, and express their thoughts and perspectives in creative ways.

Reflections assist in processing and analysing experiences, thoughts, and emotions. It is a process whereby learners describe or look back on their learning journey and consider how it has changed over time and how their learning can be used to impact future conditions, experiences and goals. It allows for an emotional connection to be explored with the topic, which is beneficial when exploring social issues like climate change and inequity, which require action from the general public.

Zines are very useful in the scope of open schooling, with a focus on OSHub. Such projects involve co-creation and innovation, multidisciplinary topics and require skills that learners and participants may not be familiar with. Therefore self-reflection and introspection, which is advocated through zines, allows learners to reflect on a deeper level on these areas, identify elements where they would like to improve or that had great meaning to them, and inspire them for the future. Zines are also accessible to those who may struggle with language as they do not require the use of words.

6.3.5.2   Implementation

The first step of implementation involves setting out goals and deciding on indicators. Zines explore the

13.   Learning portfolios—Zines. (n.d.). SySTEM 2020 https://system2020.education/resources/learning-portfolio-zines/

14.   Brown, A., Hurley, M., Perry, S., & Roche, J. (2021). Zines as reflective evaluation within interdisciplinary learning programmes. In Frontiers in Education (p. 199). Frontiers.

topic, the learning journey involved, and the emotional responses throughout that learning journey. Zines can be examined from multiple perspectives, and these perspectives depend on your goals and indicators. Examples of such perspectives are outlined below.

Depth of Reflection: Examine how the learner is reflecting and what they're doing with their knowledge and experience. Is the learner describing their experience (reporting) or are they transforming the knowledge gained from their experience into something new (reconstructing).

Scope of Reflection: Examine who is involved in the learners reflecting. Open schooling is often used to promote global citizenship for learners. Therefore you may wish to investigate if the participants are reflecting on themselves personally, their local networks, or global society.

Skills Involved in Reflection: Investigate the type of skills the learners are either referring to, using, or displaying within their zines. It is helpful to identify the important skills your learners use and create a key from this that allows you to identify the skills learners are referencing/displaying within their zines.

Method of Reflection: Examine how the learner is reflecting. Are they using text, materials, or illustrations? Are they trying to present an argument or a message in their zines?

Thematic Reflections: Capture the theme the learner is reflecting on. Is it a campaign message against inequitable technology or is it a diary entry related to sustainable lifestyles?

Introducing zines to learners

The format for delivering zines should be identical throughout and adhere to the following steps (Brown, A., 2021).

- **Step 1 – Introduction to zines**

  The concept of zines should be first presented to the learners. This includes a brief history of zines, what they can be used for, and how to make/design a zine. For instructions on how to introduce zines and how to make a zine, see Appendix, Section 7.4 / 7.5.

- **Step 2 – Reflections**

  Facilitators should then present and explain the different types of reflection that can be done.

- **Step 3 – Prompts**

  Learners can be issued with prompts to aid their reflection journey. Learners may be issued with multiple prompts over the course of their programme.

- **Step 4 – Expectations**

  Learners should be given an allocated time and an allocated quantity of material to complete each of their reflections. For example, 1 page per reflection.

- **Step 5 – Presentation**

  Learners should have the opportunity to present their zines at the end of the programme. Note that reflective zines are often implemented at the end of a lesson or project, so that the learner may reflect on what they have learned and how they have interacted with the topic throughout the programme.

Develop a supportive environment

It is important to make the environment where learners are working as comfortable as possible. Encourage sharing of reflections, by maintaining a safe and confidential space. Learners should never feel pressured to share anything personal. A facilitator should be monitoring the content being placed in zines and checking in with learners frequently.

To create a suitable atmosphere, we recommend re-arranging the traditional style of the room (especially if carried out in a school setting). It makes learners feel as though the activity is different to standard lesson-time. We recommend having crafting materials to one side of the room from which learners can pick materials to decorate their zine with. Background music is a great way to create a fun and vibrant atmosphere. If learners are reflecting at home, it is important to provide them with any materials they may need. It is also necessary to provide some time to share reflections with one another and to recognise and appreciate their work.

6.3.5.3   Evaluation of results

Evaluation can be time consuming, especially when analysing highly qualitative information and material that is contained in zines. Having some form of assessment or criteria sheet that can help to evaluate the zines in an efficient and practical manner is recommended. Having a standardised guide in which all zine reflections can be analysed will allow us to learn more about the learner, about the type of reflection that the learner is using, the scope of their reflection, the skills employed in the reflection as well as any alternative formats being used for reflection.

By considering the context and the message of each zine, as well as the methods, it is possible to gain a more comprehensive insight into what the learner is reflecting on.

To create your rubric, you can refer to the evaluation perspectives outlined in Section 6.2.3.2. An example of such used for OSHub can be found in Table 12 the following section.

WHAT YOU MIGHT SEE (in a learner's zine)	WHAT THIS EXEMPLIFIES	WHAT THIS MEANS (depth of reflection)
"Today we dida a drama workshop about space" "I lerned how to..."	Describing an incident or experience	Reporting / Responding
"I realise now that some of the choices I have made about buying food and clothes in the past were not very sustainable"	Drawing a relationship between the event and prior experiences or knowledge	Relating
"We rely on plastic but it has so many issues, including pollution and health problems"	Considering broader ethical, social or political factors and impacts	Reasoning
"I think using science and art together can really change future technology" "Tomorrow I will..."	Developing a plan, hypothesis, model or imagining future actions or developments	Reconstructing

Figure 6.4: Reflection framework based on the 4R's evaluation method outlined in Ryan and Ryan (2015). Credit: Brown et al. 2021.

There are multiple ways zines can be evaluated, one example we used in OSHub is the 4R's method from Ryan and Ryan (2015)[15] (reporting/responding, relating, reasoning, and reconstructing), as outlined in Brown et al. (2021)[16]. For an example of this, and how it can be used to measure indicators, see Figure 6.4.

6.3.5.5   OSHub Case Study: Zine

Goals and Indicators

Table 6.13: An example of how evaluation perspectives of zines were used to identify indicators of specific goals in OSHub.

GOALS	INDICATORS	OBSERVATIONS
The learner increased their knowledge of a particular topic	— Depth topic knowledge displayed — Style of reflection used by the learner	— Depth of reflection — Thematic reflection
The learner developed a particular skill	— Referencing application of skills — Display of skills in their reflections	— Skills involved in reflection
The learner had a positive learning experience during OSHub	— Use of positive wording and imagery related to OSHub content — Discussion of future	— Thematic Reflection — Method of Reflection
The learner built positive relationships with stakeholders	— Mention of stakeholders accompanying positive phrasing	— Scope of Reflection — Thematic reflection

Questions for participants

When it came to implementing the evaluation using zines, each OSHub used the general prompts in Table 6.14 to then develop unique prompts (Table 6.15) to relate to the specific socio-scientific issues or topics being studied in that setting.

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15.   Ryan, M., and Ryan, M. (2015). "A Model for Reflection in the Pedagogic Field of Higher Education," in Teaching Reflective Learning in Higher Education. Editor M. E. Ryan (Cham: Springer), 15–27. doi:10.1007/978-3-319-09271-3_2

16.   Brown, A., Hurley, M., Perry, S., & Roche, J. (2021). Zines as reflective evaluation within interdisciplinary learning programmes. In Frontiers in Education (p. 199). Frontiers.

Table 6.14: General zine prompts to be adapted for a specific topic.

INDIVIDUAL	COMMUNITY	TOPICAL	FUTURE / SPECULATIVE
What matters most to me is...	My area / community is important because...	What I wish people knew about [INSERT TOPIC] is...	My hopes for the future are...
How do you think we can improve...	What have I learned? Who taught me? Why is it important?	Understanding [INSERT TOPIC] is important because...	A change I would most like to see is...
What do you think of when you hear / see...	...Is important to my area / community because...	Does [INSERT TOPIC] Remind you of anything?	The impacts of [INSERT TOPIC] are...
What have you found most surprising during your time working on OSHub?	In my community of... I am important because of...	Tell a story which includes text and/ or images about what you have discovered so far?	How does [INSERT TOPIC] affect...

Table 6.15: Specific zine prompts provided by OSHub. The left most column refers to the reflection number a set of prompts was used for.

	TCD (1)	TCD (2)	ULEI	MCFR	AE L	FAB
1.	What have you found most surprising during your time on Open Science Hub?	What has been the most interesting experience for you?	What questions do you have?	What have you experienced so far from working in citizenship and development?	How can I do better at self care?	How do you feel about Covid 19 / the climate crisis?
2.	Understanding microplastics is important because...	What I learned from OSHub is...	Why is water important for life?	What have I learned? Who taught me? Why is it important?	What can humans do to save our planet?	My hopes for 2022 are...

3.	My community is important to me because...		What have I learned? Why is it important?	What would I like the people to know about my project?	What would humans have to change about ourselves to be able to live on Mars?	A change that I'd like to see in my community is...
4.	A change I would most like to see in my community is...			How do you think your project will help the school community?	Tell a story about how the theme has changed your thinking of urban development?	Understanding the subject is important because...
5.						What do you remember about this activity?

Gathering Data

Throughout OSHub projects, learners were asked to complete four sets of reflections to complete their zines. All reflections were prompted, and there were four categories of prompts (individual , community, topical , future). Students would complete one prompt from each category, as chosen by the facilitator, with examples provided in Table 6.4. Learners were asked to complete 1-2 pages per reflective prompt. The zines were created after activities, workshops and programmes.

Privacy and Consent

All learners were asked for their consent before participating in zines, and parental or guardian consent as required. They were asked to anonymise their zines by writing a unique OSHub nickname on the front. Participants were asked to use this unique nickname across all evaluation materials.

Data Analysis

Below is a collection of zines (Figure 6.5) from multiple OSHubs, representing reflections on different topics.

Figure 6.5: A collection of reflective zines created by learners in multiple OSHubs. These zines were among those analysed as part of this case study.

A rubric (Zine Evaluation Sheet) was developed to support analysis of the zines. Part of this can be found in Table 16. The complete version can be found in the Appendix, Section 7.6.

Table 6.16: Snapshot of Zine Evaluation Rubric.

QUESTIONS	ANSWERS	EXPLANATION
What category best describes how the learner is reflecting?	Reporting	The learner reports on the events of the day. A summary of experience describing how they responded/took part in an event.
	Descriptive Reporting	The learner describes their experience including sensory details of the event, direct quotes or definitions, or point-to-point comparison between two incidents.
	Relating	The learner makes connections between the event with another realm of their knowledge, skill or experience etc. referencing another point in time, alternative conditions or a difference in their ability.
	Reasoning	The learner provides a detailed understanding and explanation of the event, they make reference to relevant theories or experience, and give analysis from an alternative perspectives.
	Reconstructing	The learner has reconstructed / reframed the information in a new way. Create alternative hypotheses / predictions based on the event. Their ideas are supported by information given / they ask "what if?' / the effect it can have on others.

Who does the learner appear to be reflecting on?	Themselves / Individually	The learner makes direct reference to themselves, their experience, perceptions, feeling, emotions and thoughts.
	Family & Friends	The learner makes reference to individuals close to them such as friends and family.
	Local Community	The learner makes reference to individuals from larger communities in their locality or groups of people within other communal cultures.
	Global / Wider Society	The learner makes reference to individuals from outside their communities or unfamiliar groups. Typically on a national or global scale.

Using the rubric, evaluators would assign data points if 'Answer(s)' (Column 2, Table 6.16) were identified within the reflection. If one 'Answer' was noticed, it received one point. Each 'Answer' can only receive at maximum one point per reflection. The aim is only to identify if a particular theme was reflected on, not how often it was mentioned.

The total number of points vary between reflections, as the number of students completing reflections changed. The zines analysed were a subset consisting of 43 zines from 5 partners, all who conducted more than one reflection.

Recurring themes across each OSHub

- **Trinity College Dublin**
    — Learners reflect on standout activities to them; things that were important such as workshops that resonate with them, people they enjoyed talking to, or novel experiences such as trips to the Science Gallery.
    — Learners reflect on their learning journey, such as their collaborations with others both internal and external to their class group.
    — Learners do show some existentialism in their reflections when they speculate on the future. One learner mentions humans in their zine because they have the solutions to fix the problems. For deeper reflections that are specific to microplastics, learners reflect on the current situation and issues, and discuss their hope to see these problems solved.
    — Learners that completed more reflections regularly mentioned the effect their project has on the community.

- **Onl'fait:**
    — Focus on concepts they have learned during the programme.
    — Reflection on what we need to do to transmit knowledge to improve our living conditions, i.e. what we need to do for our society.
    — Learners use irony and sarcasm when speculating on their future and the environment.
    — Learners focus on a call to action, what needs to be done to benefit the future and what society needs to invest in.

- **Ars Electronica:**
  — Learners comment on their friendship and happiness, the importance of self-care and tips to look after oneself.

  — Focus on sustainability, the environment and environmental protection. Other learners reference plastic use and local litter versus global production of plastic. Learners highlight the importance of biodiversity, and the positives and negatives of everyday uses, e.g. how having a bath can affect the environment.

  — Learners, when focusing on Mars and space exploration, comment on the important uses of technology and what they can do for humanity. This speculation leads them to ask questions about our future; "What else is possible?" and "What would it take to achieve this?"

  — Focus on local challenges, their living situation, and how specific development of these places can have positive effects (reduce CO_2, improved transport, better for young people).

- **Municipality of Figueira de Castelo Rodrigo:**
  — Learners reflect on what their project means for the community.

  — Learners reflect on why they are learning citizenship and how it helps you to become a better person, and that their projects are made with good will from everyone involved.

  — One learner reflects that to help "doesn't cost anything", and that it is good to help others. They also describe how their project brings together different communities such as their community and those in Ukraine.

  — One learner reflects that they have learned things that they would not have learned anywhere else.

  — One learner reflects on how challenging communication was for them, but that they improved on this throughout. The learner also reflects on how important it is to learn these skills as "communication skills are important because we meet lots of different people throughout our lives that are not equal to us."

Discussion

Positive Takeaways

Reflection journals proved to be enjoyable experiences for the learners. OSHubs reported that learners could reinforce their learning in their reflections, share their thoughts and feelings and physically create an object. The groups who provided the majority of reflections made journals did so as an organised activity in their OSHub programme. They provided more zines, with more reflections and the learners provided more depth in their reflections.

Limitations

One hub encouraged zines as a homework activity. Due to the high demand of work placed on students in school and short class times, the learners could not effectively complete their reflections. Younger participants provided much less content in their zines, and used their zines to provide answers to the questions rather than reflections. Many students lost their zines, or forgot to write their OSHub nickname on the front and so the zines could not be effectively gathered and analysed.

Recommendations

For zines to be effective they need to be built into the programme, given a specific time slot, and have a facilitator present with the correct materials provided. Questions and prompts to aid in reflection must be carefully discussed beforehand, and may need to be altered to best facilitate the reflections of the participants, for example it may not be suitable for younger learners. Storage of zines needs to be appointed to a particular person so they do not get lost.