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Evaluation of Trio Sci Cymru: Final report

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Evaluation of Trio Sci Cymru

Final report

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Glossary

AOLE

Areas of Learning Experience

CfW

Curriculum for Wales

ESF

European Social Funding

EU

European Union

FTE

Full Time Equivalent

IOP

Institute of Physics

JBs

Joint Beneficiaries

NSA

National Science Academy

STEM

Science, Technology, Engineering and Maths

TSC

Trio Sci Cymru

VfM

Value for Money

WEFO

Welsh European Funding Office

WFGA

Well-being of Future Generations Act

WG

Welsh Government

1. Introduction

1.1. Trio Sci Cymru background

Trio Sci Cymru (TSC) is a £6.2m ESF funded collaborative operation between the Welsh Government and four Welsh Universities, Cardiff University, Swansea University, Aberystwyth University, and Bangor University. It aimed to increase take up of and attainment in Science, Technology, Engineering and Maths (STEM) subjects^[footnote1] amongst 11-to-19-year-olds in Wales, through a range of interventions that enrich but do not duplicate mainstream education and other extra-curricular activities. The operation's delivery was initially due to commence in October 2018 but was pushed back until early 2019 due to delays in receiving the initial funding confirmation from the Welsh European Funding Office (WEFO). The operation was initially due to end in September 2021 but was extended until December 2022. This adjustment accounted for the disruption posed by the COVID-19 pandemic, which prevented in-person engagement in schools.

1.2. Evaluation background

The Welsh Government commissioned Miller Research to undertake an independent evaluation of TSC as a condition of ESF funding, to assess the delivery of the operation against expected impacts and the processes by which those impacts were achieved.

The evaluation was required to:

- assess the alignment of TSC with Welsh Government and EU strategic policy objectives – those relevant at the operation's inception and any policy developments throughout its duration
- examine the effectiveness of the operation's management by the NSA/Welsh Government, and by the operation's Joint Beneficiaries
- assess the progress of TSC in meeting achieving its output indicator targets
- explore and assess the impact of TSC on its aims, including the increased take-up of STEM subjects at GCSE and A-Level
- explore and assess feedback from participants on their satisfaction and level of engagement with the operation, including an exploration of any activity type, mode of

Footnotes:

[1] For the purpose of our analysis STEM subjects included: Additional Science, Biological Sciences, Chemistry, Design and Technology, Information and Communication Technology, Mathematics, Other Science, Physics and Single Science.

delivery (e.g., face-to-face, virtual), language of delivery, age or gender differences in responses

- identify any facilitators or barriers to the delivery of the operation
- provide an assessment of how COVID-19 may or may not have impacted delivery
- compare and assess the impact and cost effectiveness of the different approaches adopted by the Delivery Partners
- provide an assessment of the value for money (cost effectiveness and/or cost benefit) of the operation as a whole
- provide recommendations and lessons learned for similar operations in Wales
- assess and report on the operation's delivery against any cross-cutting themes and associated indicators

1.3. Report structure

The remainder of this report is structured as follows:

- Section 2 summarised the evaluation methodology
- Section 3 considers the drivers of the operation, including the policy context and need, and the appropriateness of the operation's objectives to address these operational drivers
- Section 4 focuses on delivery of the operation to date, including key inputs, activities and outputs delivered (including assessment against target outputs) and any external factors which affected operational delivery
- Section 5 outlines the key outcomes and impacts expected to be delivered through TSC and makes an assessment on the availability and strength of evidence to support the achievement of these outcomes and impacts
- Section 6 draws conclusions on the operation based on available evidence and provides recommendations for Welsh Government and Joint Beneficiaries based on lessons learned that should be considered by similar operations in future

2. Methodology

The methodology set out below outlines our evaluation approach. It was designed to capture the more tangible 'hard' outcomes of the operations such as changes in subject take up and attainment as well as 'softer' outcomes such as changes in attitudes towards and confidence in STEM subjects.

The methodology for this evaluation was comprised of the following activities.

2.1. Scoping

The aim of the scoping phase was to obtain a complete understanding of the operation and Business Plan and identify, access and integrate all relevant information and data required to assess progress to date, the efficacy of managing and monitoring systems, and any potential barriers to delivery. The scoping phase included the following:

- comprehensive review of the relevant policy documents, TSC operation documentation and participant data
- two scoping interviews were conducted with four representatives from the Lead Beneficiary and WEFO
- development of an operation logic model
- Logic Model and Assumptions Mapping Workshop
- development of an Evaluation framework

2.2. Fieldwork

The fieldwork phase was comprised of a combination of interviews and workshops to comprehensively capture the experiences of learners, teachers, delivery staff, and wider stakeholders. Overall, the fieldwork phase included the following:

- sampling Framework development
- development of topic guides for stakeholders, teachers and learners
- survey scripts developed for a learner survey for TSC beneficiaries and non-beneficiaries.
- 5 stakeholder interviews held with the Welsh Government (the lead beneficiary) delivery team, WEFO, as well as stakeholders from the Joint Beneficiaries; Cardiff University, Aberystwyth University and Swansea University.^[footnote2]
- stakeholder workshop with four stakeholders from three of the Joint Beneficiaries; Cardiff University, Aberystwyth University, and Swansea University
- one wider stakeholder interview was conducted with a representative from Engineering Education Scheme Wales (EESW), an organisation involved in promoting STEM subjects. However, EESW is not a directly involved stakeholder in this ESF operation.^[footnote3]

Footnotes:

[2] Bangor University and the Institute of Physics could not be contacted for the purpose of the evaluation due to staff having left the organisations.

[3] EESW is an independent registered charity running STEM enrichment programmes to inspire and motivate young people aged 8 to 19 to choose careers in STEM subjects.

- the evaluation team conducted 5 interviews with STEM teachers at participating schools across three out of four Joint Beneficiaries; Cardiff University, Aberystwyth University, and Swansea University.^[footnote4]
- the evaluation team conducted one learner workshop with 14 learners (7 boys and 7 girls) from one school that had previously engaged with the TSC operation through Cardiff University. Whilst a good representation of both genders was achieved through an even gender split (broadly in line with the gender split of the participants engaged) overall the sample represented a very small number of the overall population of TSC learners engaged^[footnote5] and did not include learners who had received interventions from Aberystwyth University, Bangor University or Swansea University. Therefore, caution needs to be applied when interpreting these findings and their application more widely to the overall TSC learner cohort.

2.3. Analysis

The analysis phase comprised of analysis of the available participant monitoring data, as well as longitudinal education data⁶ from the Welsh Government on TSC and non-TSC schools and data gathered through the evaluation fieldwork. Overall, the analysis phase included the following:

- quantitative analysis of the participating data to assess the number of participants engaged and participant demographic characteristics
- qualitative, thematic analysis of the feedback received through fieldwork with stakeholders, teachers and learners
- quantitative analysis comparing longitudinal education outcomes data for TSC and non TSC schools
- an assessment of the operations' Value for Money

2.4. Limitations to the Evaluation Approach

Several limitations impacted the scope and depth of this evaluation, influencing the availability of data and the comprehensiveness of the findings. These limitations are important to acknowledge in understanding the constraints for evaluating the TSC operation's full impact.

[4] Schools engaged by Bangor University were unable to be engaged as part of the evaluation.

[5] Approximately 0.37% of the total 3,808 eligible participants engaged.

Footnotes

[6] The value of longitudinal data is compromised by the COVID-19 pandemic, which had a particularly big impact on attainment data, as in the years 2020 and 2021, GCSE and A-Level results were based on Centre Assessed Grades, and in 2022, Qualifications Wales announced that exams would be graded more generously than before the pandemic to reflect the long-term impact of the pandemic on learners.

The evaluation team faced challenges in engaging with certain key stakeholders, notably those at Bangor University and the Institute of Physics (IOP). The closure of relevant departments and significant staff turnover hindered access to individuals involved in TSC's delivery. Consequently, valuable insights from these partners are missing, limiting the ability to assess their contributions to the operation.

The significant time lapse between the delivery of TSC and the evaluation posed challenges in accurately assessing the operation's impacts. This delay affected stakeholders' and beneficiaries' recall of specific activities and impacts, particularly among teachers and learners who were involved in TSC. Mitigation strategies were put in place including recruiting back up samples of teachers and aiming to promote engagement through Joint Beneficiaries with limited success. As a result, data gathered through fieldwork may lack the precision and detail that more immediate evaluations would capture, affecting the reliability of certain insights.

The evaluation encountered a low response rate from schools, primarily due to the time elapsed since TSC delivery and the high turnover of teachers who had initially managed TSC activities. This low response rate limits the representativeness of the evaluation findings. Most of the schools that participated in the evaluation were recruited through Joint Beneficiaries actively encouraging participation, which introduced a degree of sample bias. Schools engaged by Bangor University were notably absent from the participant pool, meaning the perspectives of a subset of beneficiaries are missing, and the feedback gathered may reflect the experiences of the more engaged schools.

A further limitation was the absence of baseline data collection prior to TSC's intervention. For most Joint Beneficiaries, longitudinal data was not captured, which limits the ability to assess changes over time and directly attribute impacts to the TSC operation. Swansea University was an exception, having collected some longitudinal data that is expected to be analysed and published. However, the lack of baseline and longitudinal data across other areas restricts the evaluation's capacity to fully assess the operation's sustained impact on STEM engagement.

Due to the above limitations in capturing systematic data on the impact that TSC interventions had on learners it was determined that there would be insufficient data to undertake the initially planned comparison of cost effectiveness between different approaches adopted by Joint Beneficiaries as well as the overall value for money assessment beyond a simple calculation of the cost per pupil for TSC overall.

3. Drivers

3.1. Importance of STEM

3.1.1. Economic value

STEM plays a significant role in the Welsh and UK economy, and is a [cornerstone of economic policy for both governments](#). While it remains difficult to accurately calculate the science and technology sector's contribution to the UK economy due to the way in which the sector is divided and financially reported, it nonetheless represents a major component of economic activity. For example, the life sciences sector alone contributes £43.3 billion to the UK economy. In September 2024, the [ONS reported](#) the following gross value added figures for other areas of the UK economy, including:^[footnote7]

- £20.6 billion for scientific research and development
- the manufacture of certain machinery, computer and electrical components (valued at £38 billion)
- telecommunications (valued at £34.5 billion)

These three sectors combined amount to £93.1 billion, representing approximately 3.4% of the UK's GVA. Many other economic sectors also contribute to STEM-related output, such as the manufacture of spacecraft and related machinery, which is grouped in ONS data with aircraft manufacturing, a sector valued at £10.8bn in 2023.^[footnote7]

Fields relating to STEM employ large proportions of the UK's workforce, with [STEM industries as a whole employing 9.4 million people](#), and prominent sub-sectors including the digital sector ([providing 1.66 million jobs](#)), [life sciences \(providing 482,000 jobs\)](#), and the [aerospace sector \(providing 280,000 jobs\)](#).

3.1.2. Skills shortage

The UK economy incurs an annual loss of £1.5 billion due to shortages in STEM skills.^[footnote7] STEM industries are experiencing rapid growth, which has led to an increased demand for skilled workers. By investing in STEM education and supporting career pathways, interest in STEM can be nurtured, thereby supplying the skilled workforce needed to bridge the [current shortfall in skills and mitigate the economic deficit](#).

[7] Taylor, R. (2024). Science and technology's contribution to the UK economy.

3.2. Policy Context

This section of the report outlines the key policy context of TSC to provide an assessment on the extent to which TSC aligns with the policy context in Wales prior to inception as well as more recent policy developments since inception.

The key EU and Welsh Government policy drivers identified through the evaluation were as follows.

3.2.1. Policy 1: European Social Fund Priority Axis 3, Specific Objective 3.3

To increase engagement and attainment of STEM subjects among 11–19-year-olds in [West Wales and the Valleys](#) (WWV), to increase take up post-16, and to promote STEM pathways through secondary school into higher education and employment. A further action is to increase engagement of girls with STEM subjects.

TSC delivery aimed to increase engagement with STEM subjects during the key period following transition to secondary schools and prior to GCSE subject selection. TSC aimed to encourage take up and attainment in STEM subjects through offering practical, hands-on learning opportunities in STEM to promote STEM pathways. Where possible individuals delivering enrichment in schools were selected to represent a range of backgrounds including women in STEM to encourage young girls to engage more with STEM subjects.

3.2.2. Policy 2: Science for Wales: a strategic agenda for science and innovation (2012)^[footnote8]

A strategy to build a strong science base that supports the economic and national development of Wales. It acknowledged the critical role of education in achieving these aims.

TSC aimed to increase engagement, uptake and attainment in STEM subjects through further education and encourage career development in the STEM space.

3.2.3. Policy 3: Science, Technology, Engineering and Mathematics (STEM) in education and training – a delivery plan for Wales (2016)^[footnote9]

This plan sets out the Welsh Government's strategic objectives to provide STEM education for 3–19-year-olds in Wales.

Footnotes

[8] Science for Wales: a strategic agenda for science and innovation, *Welsh Government*, 2012

[9] Science, technology, engineering and mathematics (STEM) in education and training: a delivery plan for Wales, *Welsh Government*, 2016

TSC aimed to improve uptake of STEM subjects in Welsh schools to contribute towards an educated and skilled workforce. This includes efforts to improve participation in STEM learning among girls.

3.2.4. Policy 4: [Wellbeing of Future Generations \(Wales\) Act \(2015\)](#)

This act strives to improve the social, economic, environmental and cultural wellbeing of Wales. It encourages public bodies to think and act in the long term and in the interests of all communities, including future generations. The Act enshrines in law seven wellbeing goals which should guide the work of national and local government, local health boards and public bodies:

- a Prosperous Wales
- a Resilient Wales
- a More Equal Wales
- a Healthier Wales
- a Wales of Cohesive Communities
- a Wales of Vibrant Culture & Thriving Welsh Language
- a Globally Responsible Wales

TSC aligns with six of the seven wellbeing goals in the following ways. TSC aims to encourage engagement and uptake of STEM subjects into secondary and further education, to follow into careers in the sector, which would contribute to businesses, communities and the economy. This includes supporting learners into careers in healthcare and the environmental field to tackle issues of health, wellbeing, climate change and global challenges. TSC promotes equal access to STEM education and training opportunities for young people in Wales, including Welsh Language Speakers.

3.2.5. Policy 5: Prosperity for All: economic action plan (2017)

[Wales' national strategy](#) for improving quality of life and well-being. Focusing on five priority areas: early years, housing, social care, mental health and skills and employability.

TSC promotes engagement and uptake of STEM subjects, and development of key competencies to support Wales in becoming more competitive, innovative and prosperous by supporting improved skills and employability.

3.2.6. Policy 6: Programme for Government in Wales: Taking Wales Forward (2016-2021)

This [policy](#), which was in place at the beginning of the TSC operation but was replaced by an updated programme in 2021, set out how the Welsh Government would deliver jobs and security for the Welsh economy.

TSC supports ambitions to engage and educate Welsh learners, regardless of background, with particular focus on digital and science skills, through secondary and further education and into the workforce.

3.2.7. Policy 7: [Curriculum for Wales \(2008\)](#)

The 2008 school curriculum for Wales outlined the Welsh Government's requirements for teaching in Welsh schools.

The aim of TSC was to deliver extra-curricular STEM enrichment activities to improve engagement and attainment in STEM. While these activities were designed to avoid duplication of curriculum delivery, Joint Beneficiaries noted increased engagement from schools where delivery could be linked to curriculum delivery, while still providing a more novel, hands-on learning experience. Teachers appreciated the sharing of resources by Joint Beneficiaries, particularly during COVID-19 and felt that it helped inspire them to develop new ways of delivering the curriculum, especially with the introduction of the updated Curriculum for Wales (2022).

3.2.8. Policy 8: [Digital Competence Framework in Wales \(2016\)](#)

Outlined the key digital skills that all learners in Wales would need, heavily emphasising the use of technology to support STEM learning for young people.

While some elements of digital skills were embedded into TSC delivery this was largely associated with the necessity to shift delivery and resources online during the COVID-19 pandemic rather than a conscious effort to embed digital skills in delivery. Joint Beneficiary subject area delivery was predominantly based on a combination of their institution's academic expertise and resources, as well as which topic areas were selected by schools.

3.2.9. Policy 9: Welsh Government's Employability Plan (2018)

The Welsh Government's [programme](#) to deliver employability and skills support to tackle unemployment and economic inactivity. TSC aimed to improve STEM uptake into further education and employment, especially among girls, and to plug the skills shortage in STEM areas in the Welsh economy.

3.2.10. Policy 10: [The Welsh Language \(Wales\) Measure \(2011\)](#)

A legal framework to ensure the Welsh language is treated no less favourably than the English language, especially in the delivery of public services.

TSC resources were made available bilingually where required, however actual Welsh language delivery was dependent on demand from participating schools and the capacity of the joint beneficiaries to deliver in Welsh.

3.2.11. Policy 11: Institute of Physics report: The role of physics in supporting economic growth and national productivity in Wales (2017)

This [report](#) highlights the importance of physics to the Welsh economy by assessing its contribution to various industries and the role they play in productivity and economic growth.

TSC aimed to improve STEM engagement, take up and attainment to increase opportunities for learners to undertake STEM career pathways, thus aiming to support building a STEM skills pipeline and associated economic and productivity gains.

3.3. New Policies

Throughout the timescale of TSC, the alignment of the operation within the policy landscape has remained strong. TSC has been aligned with a number of new policies which are outlined below.

In 2019 the Welsh Government [declared a climate emergency](#) and published [Prosperity for All: A Low Carbon Wales](#), which included priorities to invest in higher level STEM and technical skills to support decarbonisation.

In 2021, the Welsh Government released their new [Programme for Government](#). TSC aligns with the priorities of the programme which include:

- Improving educational outcomes and reducing the attainment gap between disadvantaged learners and their peers through supporting the development of Science Capital.
- Developing the Welsh economy by helping to address skills gaps in STEM industries and promoting innovation and entrepreneurship.
- Supporting the transition to a low-carbon economy and tackle climate change; a key priority of the 2021 Programme for Government in Wales.

In 2022, the Welsh Government published their [Curriculum for Wales \(2022\)](#) which expands on the previous curriculum by supporting an inclusive approach to learning and teaching in STEM subjects. It also focuses on integration of careers and work-related experience (CWRE) within the curriculum. The STEM agenda of TSC aligned strongly with the new curriculum's Area of Learning and Experience: Science and Technology.

TSC stakeholders, including teachers, commented on the need for clearer messaging around careers in STEM to better align with the curriculum. One teacher noted that they would have liked to have seen bite sized careers information fed through the TSC delivery such as short video clips which could be aligned with the topic areas covered i.e., for the delivery around Chemistry short clips around examples of careers in Chemistry to feed in careers information rather than including

it as a standalone topic. Another teacher proposed increasing linkages between STEM and other subject areas, such as physical education and the Arts, noting the provision they had received from Aberystwyth University regarding energy production through stationary bikes and the chemical make-up of paint which emphasised these links. It was felt that these activities helped promote STEM to a wider range of pupils including those who considered themselves more 'creatively minded'. It was felt that these adaptations could support future STEM enrichment to better align with the new curriculum's goals of integration across subject areas and embedding CWRE elements throughout curriculum delivery whilst also supporting a wider range of pupils to engage with STEM. A good example of this was Aberystwyth University's operation 'Healthy Humans/Healthy Planet' which combined learning about diet, exercise, and electrical energy usage.

Also in 2022, the Welsh Government published '[Stronger, fairer, greener Wales: a plan for employability and skills](#)'. This agenda builds on the 2018 employability plan's aims of tackling skills shortages and gaps in sectors critical for economic growth – including the STEM, Net Zero skills, and manufacturing sectors. TSC aligns with the goals of this operation by encouraging uptake of STEM subjects through education and into careers, thereby supporting the provision of a skilled workforce for these sectors.

3.4. Needs

The following section assesses the extent to which the design and delivery of TSC align with the broader economic and educational needs in Wales.

3.4.1. Economic Needs

3.4.1.1 Need 1: Need for Economic Development

There is a need to drive sustainable economic growth in Wales through the skills development of people to deliver economic benefits associated with skills development, including productivity gains and access to higher paid employment.^[footnote10]

TSC aimed to promote engagement with STEM subjects, to encourage increased take up of and attainment in STEM subjects and to support learners to consider pursuing STEM career pathways.

3.4.1.2 Need 2: Increase demand for STEM skills

As Wales seeks to align its economic priorities with high-skill sectors, [demand for STEM skills continues to increase](#). In particular, Advanced Manufacturing and Tradeable Services are flagged

Footnotes

[10] Thomas Weston, 'Importance of skills: Economic and social benefits', House of Lords Library, 2024, Available at: <https://lordslibrary.parliament.uk/the-importance-of-skills-economic-and-social-benefits/>

as [two key priority areas for growth in Wales](#), both of these sectors have a clear need for STEM skills to support businesses to flourish.

TSC promoted opportunities to engage in STEM in a practical, hands-on way to support learners to engage more with STEM, develop their interest in STEM, and pursue qualification choices that would support their development of STEM skills.

3.4.1.3 Need 3: Improve future employability of young people

Enhancing young people's STEM skills and overall skill level is expected to [improve their future employability](#) and ability to meet the evolving demands of the workforce.

TSC aimed to indirectly improve young people's employability through encouraging them to increase their take up of and engagement with STEM as well as encouraging them to consider a wider range of STEM careers pathways. Through an increase in STEM knowledge and skills it is expected that learners would develop key competencies which would serve them well when competing in the jobs market.

3.4.1.4 Need 4: Meet employers' needs for a sustainable workforce

Employers require a workforce equipped with STEM competencies to maintain growth and innovation^[footnote11] as well as to make Wales an attractive place for current and future businesses to invest in.

TSC aimed to increase engagement with STEM competencies through further education and encouraging learners to consider a range of STEM career pathways.

3.4.1.5 Need 5: Connecting young people with STEM jobs

It is crucial to connect young people with a wide range of career opportunities in STEM to [meet future workforce needs](#).

TSC exposed participants to scientists and academics, as well as people working within a wider range of STEM careers to showcase the availability of STEM work and STEM opportunities in Wales.

3.4.1.6 Need 6: Reduce Gender Pay Gap

Promoting STEM education among underrepresented groups, especially girls, is vital to reducing gender disparities in pay.^[footnote12] Female leadership potential can be improved with gender

Footnotes:

[11] Department for Science, Innovation and Technology, 'Science and Technology Framework', 2023 p.11

[12] Welsh Government. 'Science, Technology, Engineering and Mathematics in education, A delivery plan for Wales', 2016, p.32, Legislation.gov, 'Equality Act 2010', Available at: <https://www.legislation.gov.uk/ukpga/2010/15/contents>

equality focussed interventions.^[footnote13] STEM industries engaging with schools is a key aim to improve women's uptake in triple science subjects.^[footnote14]

TSC aimed to improve the gender balance of STEM subject uptake in Welsh schools. It made efforts to improve participation in STEM learning among girls by exposing them to female scientists and wider female leaders in STEM. Participants were exposed to information about a range of careers pathways in STEM.

3.4.2. Education Needs

3.4.2.1 Need 7: Decline in GCSE and A-Level entries for STEM subjects in Wales

The decreasing number of learners GCSE and A-Level entries into STEM subjects in Wales highlights the need to stimulate interest in and uptake of these subjects.^[footnote15]

TSC's target was to increase triple science GCSE uptake through targeting year groups of learners prior to the year where learners would typically make choices about their GCSE subject choices, as well as aiming to counteract some of the reported drop off in STEM interest which occurs through the transition between primary and secondary school.

3.4.2.2 Need 8: Need for improved attainment in STEM subjects

There is a need to raise achievement levels in STEM subjects to ensure learners are well-prepared for future academic and career paths. Additionally recent PISA scores indicate that Wales continues to perform poorly in Science and Maths compared to relevant comparator countries.

TSC aimed to engage with learners in Year 7-9 to increase engagement, uptake and attainment in STEM subjects through offering novel and more accessible ways of engaging with STEM which go beyond the delivery of the core curriculum content.

3.4.2.3 Need 9: Need to improve "social capital" of STEM subjects

Increasing the perceived value and relevance of STEM subjects among learners and families is essential to boosting engagement.^[footnote16]

TSC aimed to support changes in learner attitudes towards and engagement with STEM through delivery of engaging STEM activities and promotion of a range of STEM career pathways.

[13] Arad Research, Baseline Evidence and Research Operation for Gender Equality in STEM, 2020 Available at: Baseline Evidence and Research Operation for Gender Equality in STEM final report: literature review p. 37

Footnotes:

[14] Arad Research, Baseline evidence and research operation for Gender Equality in STEM: Stakeholder Views, 2020 Available at: Baseline evidence and research operation for gender equality in STEM: stakeholder views p.14

[15] Welsh Government. 'Science, Technology, Engineering and Mathematics in education, A delivery plan for Wales', 2016, p.5

Footnotes:

[16] Welsh Government. 'Science, Technology, Engineering and Mathematics in education, A delivery plan for Wales', 2016.

3.4.2.4 Need 10: STEM engagement tailored to local strengths

STEM activities must be tailored to local strengths and opportunities, ensuring relevance to the specific needs of Welsh learners.^[footnote17]

Joint Beneficiaries were able to tailor their offering based on their institutional expertise and experience as well as adapting material to suit the learner contexts. Joint Beneficiaries overall had a good understanding of the context in which local schools were delivering and their challenges faced, and adapted their delivery models and content appropriately.

3.4.2.5 Need 11: Barriers to STEM activities, e.g. cost for schools, quality assurance of STEM opportunities, availability of information

There are a number of barriers which learners face to access STEM enrichment activities, such as the cost for schools or learners' families, lack of appropriate equipment and facilities, lack of coordination and quality assurance, and insufficient information for teachers and learners about available opportunities.

TSC provided free high quality STEM enrichment opportunities at no additional cost to the schools or learners engaged. Joint Beneficiaries often supported schools where possible to reduce the administration and logistics burden of site visits and access to appropriate equipment and facilities. During the COVID-19 pandemic, TSC Joint Beneficiaries shifted their delivery to virtual resources to be able to provide greater access to STEM enrichment for learners where school closures and restrictions became a barrier to delivery of STEM enrichment activities.

3.4.2.6 Need 12: Need to improve transition from primary to secondary STEM education

There is a need for better support during learners' transition from primary to secondary school to maintain learners interest in and engagement with STEM.^[footnote18]

TSC targeted key age groups early in their secondary school journey to support engagement with STEM through a more novel, hands-on approach to delivery than is typically delivered through core curriculum delivery in secondary schools in an attempt to maintain STEM engagement levels following this transition period.

[17] HWB, 'School improvement guidance: framework for evaluation, improvement and accountability', 2022, p.28 Available at: [School improvement guidance - Hwb](#)

Footnotes:

[18] Welsh Government, 'STEM in education, plan for Wales', 2016. Huw Lewis, 'Written Statement - A curriculum for Wales, a curriculum for life', 2015

3.4.2.7 Need 13: Lack of “Science capital” which steer choice of learners

Many families lack the "Science Capital" (knowledge, attitudes, experiences, and resources) that [could influence learners' choices](#) in STEM subjects, which must be addressed to widen participation.

It is important to capture the extent to which levels of learners Science Capital has been achieved through monitoring and evaluation. TSC encouraged learners from all backgrounds to engage with STEM material in more novel and often accessible ways in order to provide effective entry routes to engagement with STEM.

3.4.3 Objectives

The core objective of TSC was to promote and enhance STEM education in schools across Wales. This was achieved by providing a variety of interventions that aimed to complement curriculum delivery, through providing practical hands-on learning opportunities in STEM without duplicating existing efforts. The operation’s formal objectives were as follows:

- increase attainment and engagement in STEM subjects among learners aged 11-19
- encourage a greater number of learners to take triple science subjects (Biology, Chemistry, Physics) at the GCSE level
- enthuse and motivate secondary school learners through various STEM activities, fostering deeper engagement with STEM subjects
- provide learners with opportunities to meet STEM professionals, including female scientists, to challenge stereotypes and expand their understanding of STEM careers

The objectives align well with the need for STEM enrichment identified in the previous section on needs. These include the need for improved attainment in STEM subjects, as well as higher level economic needs such as the need for increased skill levels to meet the high-skill demand for STEM skills in the Welsh economy and the need to improve the future employability of young people. They were realistic and achievable within the timeframe of TSC and were within its remit.

Stakeholders reviewed the objectives and concluded that the operation’s aims are effectively centred on inspiring enthusiasm in children through a diverse array of STEM activities, with a focus on enhancing youth employment prospects and academic attainment. The operation adopted a forward-looking perspective, helping learners envision their potential futures in STEM fields. A key objective of the operation was to provide learners with exposure to scientists who can serve as role models, including female role models, and to introduce ideas around various career pathways. This initiative also aims to deepen learners' understanding of scientific concepts.

4. Delivery

4.1 Inputs

This section of the report includes an evaluation of the inputs used to facilitate the TSC operation. These include an assessment of the operation's costs, management and governance arrangements, 'human resource' (i.e., the expertise of delivery staff) and the marketing and communications used to promote the fund.

4.1.1 Funding

The TSC operation was initially awarded £8.2 million grant funding from the European Social Fund (ESF). However, £2 million of funding was decommitted when the Institute of Physics withdrew from the operation prior to delivery. Additionally challenges with collection and storage of data (outlined in greater detail in the 'External Factors' section) further affected the number of participants engaged which could be claimed under WEFO regulations. This led to a reduction in funding available for the TSC operation by a further £1.9 million, taking the overall funding which could be claimed for TSC through the ESF to £4.3 million. The Welsh Government provided £1.9 million match funding to bring the final operational budget to just over £6.2 million.

Table 4.1: Initial and Revised Operation

	Approved Values	Change	Re-profiled values
Total Operation Cost (£)	£8,203,557.00	-£1,995,704	£6,207,853.00
Total Eligible Operation Cost (£)	£8,203,557.00	-£1,995,704	£6,181,897.00
Total Eligible Match Funding (£)	£2,461,067.00	-£598,712	£1,862,355.30
Total ESF Grant (£)	£5,742,490.00	-£1,396,994.30	£4,325,403.00
Intervention Rate	70%		

Source: TSC Progress Report

4.1.2 Institutional capacity and expertise

The TSC operation was a collaborative partnership between the Welsh Government and the following Joint Beneficiaries; Cardiff University (CU), Swansea University (SU) Aberystwyth University (AU) and Bangor University (BU). Each university had pre-existing STEM enrichment experience and delivered according to their institutional research expertise as well as preferred approach to delivery, leading to variation in the approaches taken by Joint Beneficiaries. Joint Beneficiaries also worked together to deliver activities where there were gaps in their expertise; for example, Bangor (Biology) and Aberystwyth University (Chemistry and Physics) worked together to offer all three science subjects, whereas individually they would have been limited to in their subject offerings.

Engagement was conducted directly between the universities and schools, partly building on existing relationships with local schools, as well as developing new relationships with schools not previously engaged. Catchment areas for schools engaged varied according to each Joint Beneficiary with some such as Aberystwyth taking a much wider approach to the geography of schools engaged, owing in part due to its rural location. This approach was welcomed by teachers at more rural schools, who appreciated that the STEM enrichment activities were brought to them, rather than the schools having to transport learners to the university campus. Planned delivery was often iterated based on the feedback of schools engaged to ensure relevance to particular school and learner needs.

Teachers noted that due to pressures on school budgets, schools often did not have the resources or specialised equipment to enable learners to do more practical experiments during classroom

delivery.

4.1.3 Management and governance

The number of full-time equivalent staff planned for the operation was originally six FTE employees of the National Science Academy; in reality stakeholders described the Welsh Government as being frequently understaffed – with just one full time member of staff for most of the operation – which limited their capacity to oversee and coordinate delivery by Joint Beneficiaries and respond to queries in a timely manner. This was attributed to a Welsh Government moratorium on recruitment during the pandemic as well as issues with staff retention, which meant that Welsh Government was performing the Lead Beneficiary role with substantially less capacity than initially planned.

One stakeholder highlighted the problems associated with the Institute of Physics withdrawing from the operation, as Joint Beneficiaries had interwoven their delivery plans under the assumption of the Institute's involvement. The Institute of Physics' withdrawal was mainly attributed to the inflexibility of the funding model from the Welsh Government, as WEFO were unwilling to cover the running cost of IOP's lab in a lorry, alongside decisions made nationally to move away from outreach activities. The Institute of Physics was unable to be engaged as part of the stakeholder fieldwork to discuss further their reasons for withdrawal, due to staff turnover at the organisation.

4.1.4 Delivery staff

Teachers expressed positive experiences with the TSC operation delivery staff, expressing appreciation for the clear communication and organisation around delivery and understanding of the context and challenges within which schools were operating. They were positive about the engagement from an external provider who could offer fresh perspectives for learners and provide insights to staff on ways of teaching STEM subject areas. They commented on the ability of the delivery staff to enthuse and inspire learners, and especially appreciated the resources and equipment the delivery staff provided for their activities. Several teachers referenced the value of the delivery staff in inspiring learners to take up STEM into further education and consider careers in the sector – although one teacher suggested that this focus could be expanded to include a wider range of STEM role models from more vocational careers including Doctors and Nurses rather than focussing on more academic and research focussed careers.

4.1.5 Marketing and communications

[The TSC website](#) was accessible to schools and provided resources for teachers and learners. Participating schools were able to share their online resources through open access during the

pandemic. However, the possibility of assessing the impact of available online resources for non-participant schools and learners was limited as data on the number of unique participants could not be recorded prior to the development of closed virtual learning environments which provided access through learner registration, to provide an estimate of the overall number of learners engaged through the online resources.

4.2 Activities

This section details the activities delivered by each Joint Beneficiary partner over the course of the operation from 2018 – 2022, and stakeholder perceptions of these activities.

Joint Beneficiaries were forced to implement significant changes to the design and delivery of TSC due to the outbreak of COVID-19 and associated school and university closures. Notably shifting a largely in-person and ‘hands-on’ approach towards a virtual delivery model for much of the project period. This included the development of virtual resources and adjusting delivery to digital platforms through a more blended approach. Towards the end of the delivery period, as restrictions eased, some in-person activities were able to be delivered, however not to the extent originally planned.

An extension was requested to the operation in 2021 to account for the disruption caused by COVID-19 to school engagement, as well as a related underspend. This was intended to provide three of the Joint Beneficiaries^[footnote19] with additional time to deliver and collect the necessary data to fully evidence participants who were engaged through the operation. Swansea decided to take advantage of the project extension to continue to deliver workshops to learners until March 2022, as part of their response to the COVID-19 pandemic.

4.2.1 WP 1 Cardiff University

Cardiff University’s approach focussed on delivery of in-person workshops. Schools were offered the ability to select one topic from a menu of options which covered all three science subjects: Biology (Apothecary Bees), Chemistry (Chemistry in the 3rd Dimension) and Physics (UniverseLab). One teacher interviewed expressed that while they appreciated the ability to select from these options, they would have liked to have had the opportunity to select more than one option to be delivered over the school year.

UniverseLab was a work package designed to develop resources that align with themes such as sustainability and environmental monitoring. UniverseLab sourced Raspberry Pi-based weather stations for schools, creating a citizen science network to monitor climate variables. These stations

Footnotes

[19] Aberystwyth University, Bangor University, and Cardiff University

gather data that learners can analyse, exploring environmental trends and the impact of air pollutants. They also provided training for learners to operate and read the data from these stations. UniverseLab additionally developed a Mars-themed board game to complement workshops, which was distributed to participating schools. The game aimed to make STEM learning interactive and engaging. UniverseLab integrated sustainability topics within the context of space exploration, discussing sustainable practices essential for exploring new planets.

Chemistry in the 3rd Dimension focussed on making challenging chemistry concepts more accessible and engaging for learners through hands-on resources and sustainability-themed workshops. The initial plan for these workshops included molecular modelling kits to get learners working with their hands in an interactive way, it also helped learners visualise and interact with chemical concepts. One teacher interviewed noted that learners engaged positively with the molecular modelling kits and appreciated that Cardiff University were able to bring equipment into the school, as it is not something to which they would regularly have access.

The Apothecary Bees delivery focussed on educating learners about antimicrobial resistance. The initiative was designed to engage learners through STEM workshops and interactive content, including animations and videos that explain the science behind antimicrobial resistance. The Apothecary Bees operation was structured to be accessible and engaging, helping learners understand this important health issue in a hands-on, practical way.

Cardiff University used a closed virtual learning environment (VLE) to host resources related to the above topics and other STEM-related materials with learners in TSC schools. One stakeholder noted that it was more straight forward for Cardiff to adapt their delivery to online, as their team offered the necessary expertise to create a website and upload resources. Cardiff has since focussed their efforts on consolidating resources created for TSC, ensuring they are published and accessible on the TSC website and align with the refreshed Curriculum for Wales.

4.2.2 WP2 Swansea University

Swansea's overall approach centred on intensive, repeated delivery with the same learners over a longer time period rather than one-off workshops with different groups of learners. The schools targeted as part of Swansea's approach focussed more heavily on schools with high levels of deprivation. Swansea's delivery as part of TSC included, workshops, day trips, and site visits to the University Campus to enable access to specialised equipment and to break down barriers between learners and the university.

Swansea University designed and delivered a series of I Discover and I Explore workshops with schools which spanned various STEM topics and used both in-person and digital resources, allowing learners to participate in hands-on experiments and digital learning. Swansea University

developed workshops on environmental sustainability, genetics, and physics, offering these to schools via the S4 portal and a range of loan boxes.

My Science included interactive activities on topics including health, and climate change. Swansea University's workshops focussed on practical applications of science, helping learners understand concepts like renewable energy and food science through modules available on the S4 platform.

Swansea University also hosted an exhibition called Trees are a wonderful thing, in which they provided workshops to explore the ecosystem services performed by trees and applications of dendrology.

Swansea University felt that repeated interventions with the same learners over time increased the efficiency and effectiveness of delivery, enabling them to tailor their delivery to learner needs and to build up relationships with schools and learners over time. One stakeholder expressed that they felt that this relationship building with schools, especially during COVID-19 was invaluable when navigating challenges engaging with schools during the pandemic.

Swansea University provided learners with physical materials during COVID-19, which meant that learners could continue with their interactive learning and conduct experiments from home. This meant that there was no expectation or need for a parent to be academically versed or science literate, expanding the number of learners who could engage through a low barrier of entry.

4.2.3 WP3 Aberystwyth University

Aberystwyth's overall approach included the delivery of workshops through on-site visits to schools which were often rurally located, and often beyond Aberystwyth's immediate catchment area, including schools in Pembrokeshire and Gwynedd. One rural school expressed appreciation that Aberystwyth were able to visit the school, noting that the school infrequently received external visitors and would have struggled to arrange the logistics for a visit to Aberystwyth University due to the distance between sites. Aberystwyth University partnered with Bangor University to be able to offer schools the option to select workshops from all three sciences, with Aberystwyth focussing on Physics and Biology, and Bangor University focussing on delivery of Chemistry workshops.

The AberSTEM: Space Exploration workshop engaged learners in hands-on learning related to space exploration, including topics like examining microscopic organisms (tardigrades) capable of surviving in space, constructing constellation models, and using spectrometers to observe spectral lines of various elements. Activities in this module aimed to enhance learners' understanding of the potential for life in space and the science behind space exploration.

The AberSTEM: Healthy Humans/Healthy Planet workshops focussed on health science and sustainability. These workshops incorporate various scientific topics, aiming to educate learners on both personal and planetary health including:

- herbal medicines
- immunology
- Science of chocolate
- Drugs from Daffodils
- the innovative urine test
- Incredible insects
- performance enhancing drugs
- biomechanics and sporting performance
- hay fever

These workshops also covered topics related to rural agricultural farming and livestock management, which were felt to be particularly relevant to learners living in more rural locations with an agricultural background. One teacher expressed an appreciation that Aberystwyth would integrate wider curriculum topic areas into their delivery including Art and P.E which were felt to be particularly relevant to the more integrated approach to delivery expected in the refreshed Curriculum for Wales, as well as enabling a more accessible route into STEM engagement for learners who considered themselves more creatively minded.

4.2.4 WP4 Bangor University

Bangor University's offering centred primarily around delivery of chemistry workshops, in alignment with the university's institutional research expertise in partnership with Aberystwyth University. These workshop interventions were delivered repeatedly with the learner cohort, who engaged in three workshops over the course of a year.

Bangor University developed several hands-on chemistry workshops, such as Chemistry of Water which explored the chemical properties of water, linking chemistry concepts to human biology. The sessions were designed to be hands-on and to engage learners in practical applications of chemistry which covered the intersections of chemistry, healthcare, and history. It included practical elements that connected chemistry to the development of healthcare and was specifically aligned with the revised Curriculum for Wales. These workshops were delivered bilingually and focussed on building learners' communication and presentation skills in Welsh and English.

Despite delivering STEM enrichment workshop activities to over 1,173 participant learners, Bangor University only qualify for 63 participants 'claimed' due to their inability to evidence WEFO

compliant data (principally full postal address as opposed to singular post code); as a result of internal advice provided by Bangor University's Ethics Committee. This impacted achievement against the total output indicator targets, as well as resulting in operational underspend as a substantial number of participants could not be verified as eligible and claimed for.

Unfortunately, the [Bangor University Chemistry department](#) was closed towards the end of the TSC delivery period in 2021, and due to this and associated staff turnover, Bangor University was unable to be engaged in this evaluation.

4.2.5 WP5 Institute of Physics – Lab Seren

The Institute of Physics withdrew from the operation due to limited flexibility in the economic model for Welsh Government funding as WEFO would not cover the operational costs for the lab in a lorry delivery. A broader decision was made by the IOP to move away from STEM outreach. The IOP delivery model was designed around a mobile form of STEM outreach which would enable access to laboratory equipment which could be readily transported across Welsh schools, which would otherwise have limited access to specialised equipment. The main drawbacks of the loss of the Institute of Physics were twofold:

- 1) the missed opportunity to take a more flexible, pan-Wales approach to delivery and engage more learners nation-wide
- 2) Joint Beneficiaries having to revise elements of their intervention design which relied on Institute of Physics participation.

The loss of the IOP also led to circa £2.1 million operational underspend, only some of which was able to be re-allocated to support other Joint Beneficiaries with their delivery. Unfortunately, due to the time elapsed between the project delivery and the evaluation and associated staff turnover, no contact at the IOP was able to participate in this evaluation.

4.2.6 Reflections on target age group

Stakeholders and teachers largely agreed that the 11–14 yr old age group targeted by TSC was the correct cohort to target, noting the need to address drop off in engagement with STEM between primary and secondary school.

Part of this drop off was attributed to the reduction in opportunities to deliver more hands-on, practical STEM learning experiences with learners due to limited access to specialised equipment, budget and staffing resource to deliver these opportunities. Teachers and stakeholders did however note that TSC and wider STEM enrichment activities aimed at this age group would need to be complemented by further initiatives along the learner pathway to ensure continuity of engagement and to avoid earlier drop off in STEM interest.

Interestingly, feedback from the learner workshop indicated that learners felt that the interventions were delivered too early and dropped off too soon with no follow up after Year 8. Learners felt that Year 9 would be a better age group to target as prior to Year 9 they were not actively considering potential careers pathways and how this would affect their subject choices.

4.2.7 Mode of delivery

While the pivot to virtual delivery was not a pre-planned element of TSC delivery, it is worth considering the impact this shift to online delivery had on learners and their willingness to engage with more virtual or remote forms of delivery.

According to the Joint Beneficiaries and teachers, delivery was much more effective in-person as teachers and learners were better able to engage with the operation. Teaching staff also appreciated that university partners came to visit the participating schools and were able to bring specialised equipment that learners would not necessarily have access to at home. Although attempts were made to deliver STEM enrichment to learners at home during the COVID-19 pandemic (i.e. through Swansea's provision of at home experiment kits) it is unclear the extent to which learners engaged with these kits, kits were not delivered during the lockdown period but were used afterwards. One teacher noted that the school did not have capacity to deliver the experiment kits to learners during the pandemic and instead used them to facilitate experiments once learners had returned to school.

Where virtual resources were shared during COVID-19, schools with prior engagement with TSC benefit from having established relationships with delivery partners. During COVID-19, schools were grateful for any virtual resources that TSC could provide; these were primarily shared on a secure virtual platform where learners could access and explore different activities, information on at-home experiments, and information on career pathways. While data was collected on number of website visits and the number of unique participants accessing the material, it was unclear the extent to which learners had engaged with the online content. Teachers expressed that engagement with learners through virtual means of teaching during school closures was a general challenge during this time, rather than an issue which was specific to TSC or the delivery of STEM enrichment. Anecdotally, teachers recall that attendance and engagement with virtual delivery was challenge for all learners, but was particularly pronounced among learners from disadvantaged backgrounds who may not have had access to suitable equipment or learning environments.

However, this shift to virtual delivery enabled some level of continuity of delivery during periods of school and university closures and restrictions. It also enabled the development of virtual resources which can be used by teachers and learners going forward, with one teacher noting that they had sought to integrate some of the virtual resources into future curriculum planning.

Additionally, the creation of online resources, some of which were published on open access platforms, enabled a wider range of learners (including non-TSC school learners) to access these resources than would have been possible through an in-person delivery model. Wider benefits noted by stakeholders and teachers regarding remote delivery options included the ability to engage with more rural schools – which would have been difficult to access otherwise – as well as the carbon emissions savings associated with not having to travel to schools to deliver STEM enrichment activities.

However, learners who had experienced in-person delivery felt that the project benefitted from a hands-on and practical approach which piqued their interest and desire to engage with STEM. Overall, learners and teachers both expressed a strong preference for in-person modes of delivery over virtual modes of delivery.

4.3 Cross Cutting Themes

4.3.1 Gender Mainstreaming

Joint Beneficiaries generally worked with classes of mixed gender, and this is reflected in the overall participant gender breakdown outlined in Table 4.2; which suggests a broadly equal participation rate with a slight skew towards girls (53%) over boys (47%), likely reflective of the class demographics of participating schools.

While the project did not specifically target girls in terms of participation, elements of the activities delivered did highlight STEM career pathways for women and girls. This was enabled through the inclusion of women scientists in in-person delivery, and development of careers resources to demonstrate role models for women in STEM. One Joint Beneficiary noted that while selection of scientists which would be most relevant to girls in STEM was a factor, they did not necessarily want to draw too much attention to the gender of role models, in order to normalise perceptions of STEM careers being accessible to all.

Female learners who engaged with the evaluation suggested that they did not perceive gender as being a factor that affected their engagement with STEM or perceptions of whether STEM education and career pathways were ‘for them’, however this was based on a small sample of the overall female learners who took part in TSC, who had parents who worked in STEM and otherwise high levels of [STEM capital](#).^[footnote20]

Footnotes:

[20] STEM capital encompasses all the STEM related knowledge, social contacts, attitudes, skills and experiences a pupil or person has and how those resources inform their engagement and choices in school. It recognises the significance of what you know, how you think, what you do and who you know in shaping your relationship with science and technology.

One teacher noted that the use of binary gender categories in the participant monitoring forms (Male/Female) were felt to be outdated and in not currently inclusive or representational of all the learners that would be taking part in the operation. The teacher noted that this led to some parents and learners refusing to submit consent forms and, as a result, TSC were not able to claim these participants.

Table 4.2: Breakdown of Trio Sci Cymru participants by Gender

Gender	Number of participants	Percentage of participants (%)
Female	2015	53
Male	1792	47

Source: Analysis of Participant Monitoring data

4.3.2 Poverty and social exclusion

TSC was open to learners from a range of socio-economic backgrounds and did not target a particular participant demographic, although the schools TSC worked with had a higher than national average eligibility for free school meals and the majority were in the upper two quintiles of the Welsh Index of Multiple Deprivation (WIMD).

Some Joint Beneficiaries, notably Swansea University, did take a more targeted approach to schools with particularly high levels of deprivation, other Joint Beneficiaries took a more general approach. An aim of the operation was to support learners to develop their levels of STEM capital, offering STEM enrichment activities which were free to access on the basis that participants from more disadvantaged backgrounds may have fewer opportunities to develop their STEM capital.

Where access to suitable equipment during the COVID-19 pandemic posed a barrier to learner engagement with schooling, Swansea University was able to lend laptops to learners from TSC schools to support school recovery plans.

4.3.3 Welsh language

The majority of participants as outlined in Table 4.3 (52%) indicated that they had received partial provision in Welsh, with most resources being provided bilingually where students requested Welsh medium resources. For Joint Beneficiaries, there was a reliance on internal capacity for translation and delivery of resources. Additionally, one university noted that they already had a Welsh speaker in their department and so were able to deliver in Welsh if needed, but otherwise would have struggled to recruit a Welsh-speaking scientist for the purpose of TSC delivery due to

funding issues. Three members of the Swansea University team had been attending Welsh lessons delivered by the University, however these lessons were subsequently disrupted due to COVID-19.

Table 4.3: Breakdown of participants by provision received in Welsh

Received provision in Welsh	Number of participants	Percentage of participants (%)
Yes - partially	1980	52
No	1827	48

Source: Analysis of Participant Monitoring Data

Demand for Welsh Language delivery varied according to Joint Beneficiaries, with the majority of Welsh Language provision being delivered by Aberystwyth and Bangor Universities. According to an analysis of the participant monitoring data, the percentages of those who received teaching provision in their preferred language of choice was as follows:

- 58% of learners received provision in their preferred method of communication
- 39% of learners received provision in Welsh when English was their preferred method of communication
- 3% of learners received provision in English when Welsh was their preferred method of communication

Unfortunately, no Welsh Medium TSC schools were able to be engaged in the evaluation, so the ability to explore learner experiences of Welsh medium provision were limited. Teachers and learners in English medium schools did note that resources were made available in Welsh, however demand for Welsh language resources in these schools was low.

4.3.4 Sustainable development

Some elements of TSC delivery did include environmental sustainability themes, such as Aberystwyth's Healthy Humans / Healthy Planet and Cardiff University's Apothecary Bees. However, the nature of topics covered and their relevance to sustainability varied depending on each Joint Beneficiary's research individual approach. Learners recalled taking part in experiments that explored sustainable practises such as using stationary bicycles to convert kinetic energy into electrical energy, and learning about carbon capture from car exhausts with Aberystwyth University. While it was unclear as to the impact on learner's own practices, TSC activities will have raised awareness of sustainability among participants.

It is expected that there was some carbon savings associated with shift to virtual delivery during the COVID-19 pandemic, however there is no data available to indicate the extent of such carbon savings and based on feedback from teachers and learners, it is likely that these savings came at a trade-off of reduced learner engagement. However, future virtual teaching can be supported by online resources developed for TSC which means learning can be delivered with a lower carbon cost.

4.4 Performance against Operation Targets

TSC originally aimed to deliver 140,197 hours of strategic learner engagement and engage 5,690 learners in total across all Joint Beneficiaries. However, these output targets were revised to a target of 4,500 learners following an operation reprofile to account for the loss of the Institute of Physics as a Joint Beneficiary and disruption caused to engagement due to COVID-19. The list of expected WEFO outputs is detailed in the Operation Logic Table in Annex C.

Table 4.4 below shows the performance of the TSC operation as a whole against the revised target outputs for total number of learners engaged. The figure of 3,808 represents 84.62% achievement in respect of the revised 4,500 target output, in large part this is due to the inability to recognise a large number of learners as engaged learners due to lack of WEFO compliant data evidenced.

Table 4.4: Performance against total learner engagement targets

Original target engagement of learners	Revised target engagement of learners	Total engaged learners (not all eligible)	Total engaged learners (eligible)
5,690	4,500	6,095	3,808

Source: Output monitoring data

Table 5.4 below demonstrates the Joint Beneficiary breakdown of number of (eligible) schools and learners engaged. These figures do not include the participants engaged whose participation could not be claimed as eligible under WEFO requirements due to insufficient data to evidence unique participation of learners. This issue particularly affected the output figures for Bangor University who were only able to evidence 5.4% of total participants engaged in line with WEFO requirements.

Table 4.5: Learner and School (Total and WEFO eligible) outputs achieved by Joint Beneficiary

Joint Beneficiary	Target engagement of learners	Total engaged learners (not all eligible)	Total engaged learners (eligible)	Total engaged schools^[footnote21]
Aberystwyth University	1,500	1,299	1,245	18
Cardiff University	2,790	2,302	1,545	13
Swansea University	500	1,321	955	7
Bangor University	900	1,173	63	11
Total	5,690	6,095	3,808	49

Source: Output monitoring data

4.4.1 Cardiff University

Cardiff University engaged 2,302 learners (not all eligible) over 13 schools, with a total of 7,297 contact hours. The table below breaks down the outputs (eligible and non-eligible) achieved by Cardiff University.

Table 4.6: Cardiff University Outputs Achieved against target

Original target engagement of learners	Total engaged learners (not all eligible)	Total engaged learners (eligible)	Target number of contact hours	Actual number of contact hours	Number of workshops delivered	Number of schools engaged
2,790	2,302	1,545	51,615	7,297	220	13

Source: Output monitoring data

4.4.2 Swansea University

Swansea University was able to engage 1,321 learners over 7 schools, with a total of 7,297 contact hours. The table below breaks down the outputs (eligible and non-eligible) achieved by Swansea University.

Table 4.7: Swansea University Outputs Achieved against target

Footnotes:

[21] Whilst no specific targets were set around the number of schools engaged it was expected that TSC would engage up to 30 schools in total.

Original target engagement of learners	Total engaged learners (not all eligible)	Total engaged learners (eligible)	Target number of contact hours	Actual number of contact hours	Number of workshops delivered	Number of schools engaged
500	1,321	955	33,750	8,067	93	7

Source: Output monitoring data

4.4.3 Aberystwyth University

Aberystwyth University was able to engage 1,299 learners over 18 schools, with a total of 6,928 contact hours. The table below breaks down the outputs (eligible and non-eligible) achieved by Aberystwyth University.

Table 4.8: Aberystwyth University Outputs Achieved against target

Original target engagement of learners	Total engaged learners (not all eligible)	Total engaged learners (eligible)	Target number of contact hours	Actual number of contact hours	Number of workshops delivered	Number of schools engaged
1,500	1,299	1,245	36,322	6,928	96	18

Source: Output monitoring data

4.4.4 Bangor University

Bangor University engaged 1,173 learners over 11 schools, with a total of 2,372 contact hours. The table below breaks down the outputs (eligible and non-eligible) achieved by Bangor University.

Table 4.9: Bangor University Outputs Achieved against target

Original target engagement of learners	Total engaged learners (not all eligible)	Total engaged learners (eligible)	Target number of contact hours	Actual number of contact hours	Number of workshops delivered	Number of schools engaged
900	1,173	63	8,100	2,372	86	11

Source: Output monitoring data

Bangor University delivered STEM enrichment to 1,173 learners, however were only able to provide sufficient data to claim 63 eligible participants in line with WEFO compliance requirements. This was due to internal advice provided by Bangor University's Ethics Committee to not capture full participant postal address data. This resulted in a detrimental effect upon the total eligible outputs achieved. This issue was flagged with WEFO between 01.04.2020 – 30.06.2020 as noted in the Claim 6 Progress report and Welsh Government had been working with Bangor University to support them with this issue as Claim 11 indicates that Welsh Government had continued to review the workshop registers provided by Joint Beneficiaries to ensure the eligible contact hours had sufficient evidence.

4.5 External Factors

As part of the evaluation, it is important to understand the potential impacts that external factors and challenges have had on operation delivery as well as expected outcomes and impacts. Following engagement with delivery staff, teachers and wider stakeholders, a number of key external factors were identified through the evaluation and are outlined below.

4.5.1 Funding confirmation delays

TSC experienced significant delays during its initiation and throughout its delivery, largely due to funding confirmation issues. These delays had a ripple effect on operation momentum, Joint Beneficiary engagement, and the effective use of allocated resources.

One of the major challenges encountered was a six-month delay in the confirmation of funding from WEFO. The delay was caused by the delays to the initial TSC set up, as well as later staff turnover within WEFO. This delay caused a late start to the operation, leading to immediate challenges in maintaining Joint Beneficiary engagement. With the operation timeline already reduced, Joint Beneficiaries faced pressure to utilise their allocated funding within a tighter time frame, which contributed to difficulties in delivering planned activities as originally scheduled.

In addition to the delayed start, joint beneficiaries expressed frustration over further delays in receiving approval for specific funding requests. These delays had direct implications on the ability to undertake necessary training and other preparatory activities, further impacting the smooth delivery of the operation. As Joint Beneficiaries had been counting on timely approval of these funds to execute key elements of the operation, the delays created bottlenecks in training, planning, and resource allocation.

Despite these challenges, Joint Beneficiaries did express appreciation for the flexibility demonstrated by WEFO in adapting to the unexpected challenges posed by the COVID-19 pandemic. WEFO's willingness to allow modifications to delivery approaches helped them respond to the shifting landscape, enabling a more dynamic adaptation of the operation in light of the difficulties created by the pandemic. This flexibility mitigated some of the issues related to the operation's delayed start, allowing for alternative solutions such as virtual delivery to be explored and implemented where necessary.

4.5.2 Loss of the Institute of Physics

An additional constraint to the operation's capacity came with the early departure of the IOP, one of TSC's key Joint Beneficiaries. The IOP withdrew from the operation due to limited flexibility within the WG funding model, to cover the running costs of the Lab in a lorry delivery model which restricted their ability to recruit the necessary staff to participate fully in the operation. The loss of the IOP had significant repercussions, as they were expected to contribute to the delivery of pan-Wales activities.

The departure of this IOP not only affected TSC's ability to meet its targets but also contributed to a £1 million operation-related underspend. This underspend required TSC to be reprofiled, limiting the operation's initial ambitions. The loss of the IOP also diminished TSC's capacity to deliver STEM activities across Wales as initially planned, creating a substantial gap in the delivery network that impacted the breadth of the operation's outreach.

4.5.3 Recruitment and retention

The TSC operation faced considerable difficulties in recruitment and retention of key staff, both within the Welsh Government and among its Joint Beneficiaries. These challenges were exacerbated by the loss of a key Joint Beneficiary early in the operation planning stage, the loss of Institute of Physics, had implications for the operation's scope and ability to meet its targets, as well as its ability to deliver a truly 'pan Wales' operation.

A significant challenge arose from the Welsh Government's temporary moratorium on recruitment, implemented in response to the COVID-19 pandemic. This restriction severely limited the resourcing available to the Lead Beneficiary (Welsh Government) who initially planned for a team of ten staff members to manage the TSC operation. However, due to the moratorium, the operation was frequently left with only two or three staff members at any given time during the delivery period out of a total six FTE staffed members outlined the initial application. Additionally, the unexpected and unfortunate passing of one of the staff members further reduced the team's capacity.

The limited staffing levels caused delays and difficulties in maintaining engagement with joint beneficiaries, particularly during the six months of limited activity at the operation's start. While the Lead Beneficiary sought ministerial advice to underwrite funding for keeping Joint Beneficiary staff on a skeleton basis, they were unable to recruit sufficient WG staff to support the management of these relationships effectively. This contributed to a strained operational environment, where greater administrative resources were needed to track and support operation delivery adequately. Furthermore, the challenges associated with evidencing outputs and tracking data could have been mitigated had sufficient staff been available from the outset to effectively communicate WEFO requirements to joint beneficiaries.

4.5.4 COVID-19

The pandemic had a profound impact on the way the operation was delivered, especially in its efforts to engage schools and promote STEM take-up among learners.

One of the most immediate challenges was the difficulty faced by joint beneficiaries in building and maintaining relationships with schools. With schools across Wales closed or operating under restrictions for extended periods, in-person visits, a key component of relationship-building and operation delivery, were severely limited. Consequently, embedding TSC activities within school timetables became challenging, particularly when these activities were deprioritised to deal with the immediate pressures of delivering the core curriculum during a period of substantial disruption. One stakeholder commented that COVID-19 meant that Joint Beneficiaries did not share

methodologies and best practice as they should have, and that Welsh Government contacts were stretched to effectively coordinate the different participants of the operation.

In response to these challenges, Joint Beneficiaries quickly pivoted to online delivery models, offering live virtual workshops and hosting online resources that learners could access independently. While this shift ensured that STEM learning opportunities remained available during a period of disruption, it also introduced new complexities. While the expansion of online resources beyond the initial TSC target group, enabled the operation to achieve wider impact beyond participants initially intended to benefit from the operation, the initial lack of ability to track the usage of resources affected the ability of the operation to evidence its impact on its intended beneficiaries.

Notably, some Joint Beneficiaries were able to adapt more easily to online delivery due to pre-existing technological capacities and experience within their institutions. For instance, Aberystwyth University, having already developed online resources for engaging rural learners, found the shift smoother than some other partners. However, the shift to virtual learning presented limitations, particularly regarding the hands-on nature of STEM education.

Joint Beneficiaries adapted to the challenge of the COVID-19 pandemic in different ways. For example, Swansea University sought to mitigate this by trialling home experiment kits, allowing learners to conduct experiments at home by enabling access to all the equipment and guidance needed to conduct experiments at home. However, challenges remained in ensuring effective engagement without the direct interaction and engagement that would have been available in a classroom setting.

One positive outcome from the pandemic-induced shift to online learning is the legacy of digital STEM resources now available. These resources, while initially a solution to the challenges engaging learners during the pandemic, can continue to support STEM education in Wales, particularly as some Joint Beneficiaries are seeking to update these resources to align with the new Curriculum for Wales. However, the challenges of tracking and measuring engagement with these online tools highlight the ongoing difficulty of assessing the long-term impact of the operation's digital pivot.

4.5.5 Data collection and evaluation

The TSC operation faced several challenges in evidencing its delivery against output indicator targets, particularly due to issues with data collection and unforeseen external events. These difficulties impacted the operation's ability to demonstrate its full impact and satisfy WEFO requirements for verifying eligible participants.

A substantial challenge arose from the limited provision of postcode data from Bangor University, which is a crucial requirement for meeting the WEFO outputs. Without this data, TSC struggled to satisfy WEFO's strict reporting criteria. Although some missing information was eventually recovered through follow-up efforts, the lack of comprehensive data contributed to Bangor University's underperformance against expected KPIs, creating an incomplete picture of their contributions to the operation.

An unexpected external factor further complicated the evidence-gathering process. The flooding of Welsh Government offices resulted in the destruction of a number of consent forms and other critical documentation required to meet WEFO's evidence requirements. As these forms were unrecoverable, this led to significant challenges in fulfilling certain reporting obligations and evidencing operation outputs. The loss of these materials ultimately hindered TSC's ability to fully demonstrate its delivery against key targets.

One of the key output indicators for the TSC operation was the uptake of Triple Science at GCSE level. However, not all participating schools offered this option, as it required specialist teachers, appropriate timetabling, and enough interested learners, factors that were not always present in the schools chosen for engagement. This meant that, regardless of the joint beneficiaries' efforts, the target for increasing Triple Science uptake was unlikely to be met in many cases. As a result, this KPI did not fully reflect the broader impact TSC was having on STEM engagement across the range of participating schools.

Lastly, TSC's ability to gather longitudinal data and compare the effectiveness of different approaches across the Joint Beneficiaries was hindered by the late appointment of evaluators. Without evaluators in place from the outset, the operation missed early opportunities to collect data that could have informed a deeper understanding of long-term impacts of the activities delivered on learner engagement and progress. This gap also limited the ability to fully assess the relative merits of each Joint Beneficiary's methods, which could have been invaluable in refining and improving STEM delivery strategies throughout the course of the operation.

4.6 Outcomes and Impacts

The effects of TSC include its outcomes (the medium-term change arising from the outputs of its activities) and its impacts (the longer-term and much more indirect change, partially arising from the operation). This section will set out the intended outcomes of TSC as well as provide an assessment of how impact and the counterfactual can be best evaluated.

The outcomes and impacts included in the evaluation logic model were identified through reviewing operation documents and engagement with the lead beneficiary. They fall into two broad categories: a series of outcomes relating to an improved situation for the learner in relation to

STEM subjects, and outcomes relating to structural improvements in the provision of extracurricular STEM activities.

5. Outcomes

5.1 Increased participation in STEM subjects in target schools

The feedback from teachers indicated that TSC had improved learner engagement with STEM topics that were covered. Teachers reported that learners, including those who were previously disengaged, showed increased interest in STEM through the delivery of more practical, hands-on activities, which sparked further discussions about the topics being covered. One teacher noted that the operation strengthened home-school links, with learners sharing their positive experiences with their families, thereby fostering a supportive environment for continued interest in STEM.

While positive feedback was received on the ability of TSC to spark more immediate interest in STEM subjects through covering topics that were more engaging and relevant to learners and doing so in a novel, hands-on way, it is not clear from the available evidence the extent this led to sustained levels of increased participation in STEM subjects. Teachers noted that the impact of COVID-19 disrupted day-to-day school delivery as well as learner engagement with school, particularly in more deprived schools. Therefore, teachers felt unable to make an assessment of the impact the operation had on learners' participation in STEM subjects as it has decreased across the board as a result of the COVID-19 pandemic.

The evaluation team lacked suitable GCSE and A-Level enrolment data to calculate whether or not overall uptake of STEM subjects had increased as a proportion of overall GCSE enrolments in TSC schools.

5.2 Increased participation in triple science GCSE in target schools

One of the key aims of TSC was to increase the participation in triple science GCSE in target schools. This outcome is challenging to evaluate due to not all schools offering triple science, as it required a number of conditions to be met, including access to specialist teachers who could deliver Biology, Chemistry, and Physics, but also sufficient learner demand for triple science to make running classes viable. Although evidence collected from Swansea's S4 project suggested that in some schools, an uptake of STEM subjects had occurred, with one school being able to run triple science for the first time due to increased demand.

The evaluation team did not have detailed data on triple science enrolment in TSC and non-TSC schools, and therefore could not ascertain whether or not uptake of triple science in TSC schools had increased.

5.3 Increased achievement in STEM subjects in target schools

Quantitative data is available on GCSE attainment figures for schools in Wales, however due to the COVID-19 pandemic, and changes made to assessments considering disruptions to exams, the data for GCSE results awarded in 2020, 2021, and 2022 are not comparable with pre-2020 data nor data from 2023 onwards. It is possible, however, to compare attainment data from 2019 and earlier with 2023 data.

Data shows that while both TSC and non-TSC schools saw an increase in the proportion of A* results awarded between 2019 and 2023, the increase in TSC schools was higher (see Table 5.1), which saw a difference in percentage points of 4.21 for TSC schools and 2.74 for non-TSC schools, a difference of 1.46. This was shown to be a statistically significant difference by a t-test.^[footnote22]

However, this improvement in TSC schools is not reflected across other higher grade categories, with non-TSC schools performing better in the C grade category in particular (-2.15 difference for TSC schools against a 0.66 difference for non-TSC schools, a difference of 2.81). A test for statistical significance found that for the A*, A, and B categories, there was strong evidence that the proportion of grades between TSC and non-TSC schools differs, however no significant difference between other grades.^[footnote23]

Table 5.1: Difference in the average percentage of grades achieved in TSC and non-TSC schools, 2019-2023 (difference in percentage points)

	Diff in A*	Diff in A	Diff in B	Diff in C	Diff in D	Diff in E	Diff in F	Diff in G	Diff in U
TSC	4.21	-0.03	-2.17	-2.15	0.33	-0.23	1.17	0.27	0.34
Non-TSC	2.74	0.14	-1.27	0.66	-0.27	-0.30	-0.01	-0.14	0.26
Difference	1.47	-0.16	-0.90	-2.81	0.59	0.07	1.18	0.41	0.07

Footnotes:

[22] To determine whether the observed differences in the average percentage of grades achieved between TSC and non-TSC schools are statistically significant, a two-sample t-test was conducted. The t-test compared the differences in the average percentage of A* grades achieved by TSC and non-TSC schools between 2019 and 2023. The results indicate that the observed difference of 1.47 percentage points in the increase of A* grades between TSC and non-TSC schools is statistically significant, with a p-value of 0.01329 ($p < 0.05$). This suggests that the higher improvement in the proportion of A* grades in TSC schools is unlikely to have occurred by chance and reflects a genuine difference in performance trends.

[23] A t-test was conducted for each grade category comparing the difference between 2019 and 2023 attainment outcomes for TSC and non-TSC schools. The results were as follows, with $p < 0.05$: A – $p=0.0030$, B – $p=0.0076$, C – $p=0.0772$, D – $p=0.3926$, E – $p=0.4860$, F – $p=0.2119$, G – $p=0.1973$, U – $p=0.1973$.

While the data indicates that there is a meaningful difference between GCSE attainment for TSC and non-TSC schools for A* grades, the findings for other grades challenge the hypothesis that TSC intervention has seen a significant increase in higher grades overall outside of the A* category.

Table 5.2 demonstrates the difference between the weighted^[footnote24] average of the proportion of GCSE entries achieving an A* to B grade for TSC and non-TSC schools between 2019 and 2023. It demonstrates that across the higher grade categories of A*-B, TSC schools have seen a greater decline change in grades attained than non-TSC Schools. Both TSC and non-TSC schools saw a reduction in the proportion of grades within the A* to B range, however non-TSC schools saw a reduction in percentage points of 0.685 against the 1.442 seen by TSC schools. However, a t-test carried out to test the statistical significance of this difference returned a value that indicates that this difference is not statistically significant.^[footnote25]

Table 5.2: Weighted average percentage of entries achieving an A* to B result for TSC and non-TSC schools, 2019 and 2023 (difference in percentage points).

	2019	2023	Difference
TSC	14.385	12.942	-1.442
Non TSC	15.913	15.228	-0.685

Source: Welsh Government all-Wales GCSE attainment data

Evidence collected from Swansea’s S4 project suggested that some schools had seen an increased in assessment grades during delivery, with one school indicating that they had observed an overall increase in teacher assessment level of 1.6%, compared to an average increase of 0.3% across non-scientific subjects for the same cohort. This was also substantially above the changes observed in cohorts where no learners were enrolled in TSC.^[footnote26]

Footnotes:

[24] Weighted here meaning that the averages for each grade, A*, A and B, are weighted by their relative proportion within the total of those who attained these grades.

[25] The t-test, which compared the difference between the average A*-B grades achieved in each school as a proportion of total results between 2019 and 2023 returned a p=0.409, which is above the p=0.05 threshold for determining statistical significance.

Footnotes:

Qualitative data presents a mixed picture. Teachers interviewed regarding the impact of TSC on learner achievement in STEM subjects reveal mixed views about the ability to evidence the operation's impact. One teacher noted that there was no observed improvement, as the learners were already proficient and engaged in STEM prior to TSC. Teachers interviewed also highlighted the challenges of assessing impact on STEM grades achieved, due to the disruption caused by the COVID-19 pandemic, which made it difficult to measure progress effectively due to the impact of the pandemic on learner progress across the board as well as short term changes to the way in which grades were assessed which hindered the ability to fully evaluate the operation's impact on learner achievement.

One Joint Beneficiary noted that the challenges TSC had in its ability to evidence impact on learner progress were further exacerbated by limited support by the Welsh Government to support with longitudinal data capture. Joint Beneficiaries expected, in line with the operation business plan that Welsh Government would liaise with Knowledge & Analytical Services (KAS) to seek advice regarding the design, commission and management of evaluation and development of a Monitoring and Evaluation Plan to support a more robust assessment of the outcomes achieved for TSC participants. However, this was provided due to Limited Lead Beneficiary capacity as well as the reprioritisation of KAS personnel as a result of Brexit re-prioritisation work and limited resources.

Another Joint Beneficiary was able to capture longitudinal data utilising their own resources. An initial analysis of the schools they had engaged indicated an increase in teacher assessed grades, however this data has not been shared for the purposes of this evaluation and is expected to be subject to further in depth analysis at a later date.

5.4 Improved gender balance in STEM subject participation in target schools

A key aim of TSC was to provide learners with opportunities to meet STEM professionals, including female scientists, to challenge stereotypes and expand their understanding of STEM careers to encourage improved gender balance in the take up of STEM subjects. While TSC took a general class based approach to engagement and did not run activities specifically targeted at girls in STEM, the overall numbers of participants engaged skewed slightly more towards girls with 53% of participants identifying as female.

Efforts were made by Joint Beneficiaries where possible to ensure representation of women in STEM, when delivering activities to facilitate opportunities for girls to identify with the female

[26] 80% of the cohort were enrolled on TSC.

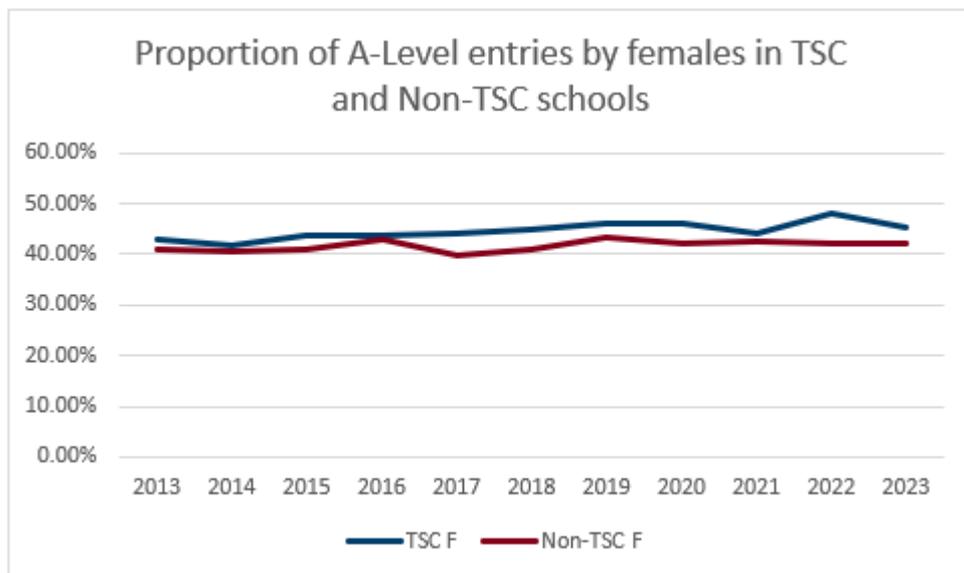
scientists delivering activities, enabling them the opportunity to be inspired by potential role models of women in STEM.

The feedback on the operation's impact regarding improved gender balance in across STEM subject participation in target schools presents a mixed picture. Although teachers appreciated the inclusion of female role models in the operation, there was uncertainty about the actual impact on participation rates, suggesting that while role models are valued, more effective strategies are needed to achieve a balanced gender representation in STEM fields, although it is noted that there is variation in the gendered patterns of subject take up across STEM subjects. Female participants in a learner workshop expressed that they had not previously considered gender as a factor influencing their career opportunities because of having mothers in STEM fields and therefore clear role models of women in STEM careers. Although it is noted that this represented a very small proportion of the overall female participants engaged through the operation from only one school.

One teacher highlighted a gender disparity in enrolment within STEM fields, noting that girls are more likely to choose Biology, while boys gravitate towards Mathematics and Physics, suggesting the need for targeted interventions to encourage girls to explore male-dominated fields like Physics, this was further noted by another teacher who highlighted the limited enrolment of girls in A Level Chemistry and Mathematics in their school, indicating potential gendered pattern of take up in these subjects in the schools of two of the teachers interviewed.

Participation data for A-Level between TSC and non-TSC schools demonstrates some improvement in female enrolment in TSC schools, however the data is not clear enough to claim with any certainty that TSC schools are exhibiting the impacts of TSC. The first year that any TSC learners will have been enrolled in A Levels is 2022. As seen below in Figure 5.1 and Table 5.3, 2022 is an outlier year, with a nearly 6% difference between TSC and non-TSC schools with regard to female enrolment in STEM A-Levels.

Figure 5.1: Proportion of STEM A-Level entries by females in TSC and non-TSC schools (%)



Source: Welsh Government all-Wales data on A-Level entries

Table 5.3 sets out the proportion of female entries for STEM A-level subjects for TSC and Non-TSC school.

Table 5.3: Percentage point difference in STEM A-Level entries between TSC and non-TSC schools (females)

Year	TSC Female entries as proportion of total entries (%)	Non-TSC Female entries as proportion of total entries (%)	Difference (%)
2013	43.01	41.02	2.00
2014	41.72	40.60	1.12
2015	43.63	40.86	2.77
2016	43.85	43.08	0.77
2017	44.03	39.75	4.28
2018	45.05	40.92	4.13
2019	46.00	43.21	2.79
2020	46.21	42.27	3.94
2021	43.98	42.52	1.46
2022	47.92	42.00	5.92
2023	45.43	42.28	3.15

Source: Welsh Government all-Wales data on A-Level entries

Table 5.4 presents the average difference in female STEM A-Level enrolment for two time periods, comparing TSC and Non-TSC cohorts. The average female enrolment in TSC schools is larger in 2022-2023 than in the nine years prior, being 1.96% higher than in previous years:

Table 5.4: Average percentage point difference between in STEM A-Level entries by females between TSC and non-TSC schools for two time periods

Time period	Average difference between TSC and non-TSC schools (%)
2013-2021	2.58
2022-2023	4.54

Source: Welsh Government all-Wales data on A-Level entries

However, with the years 2020-2022 having seen A-Level results graded differently, and with 2022 being an outlier in the data (see Table 5.3), it cannot be claimed with confidence that this data is statistically significant or attributable to TSC.

5.5 Improved female attainment in STEM subjects in target schools

An analysis of TSC vs non-TSC-school learner attainment in STEM subjects by gender demonstrated no clear findings relating to the difference between male and female attainment in STEM subjects (see Tables 5.5 and 5.6). Table 5.6 sets out the difference between TSC and non-TSC schools between 2019 and 2023 for a weighted average of the A*-B category. It demonstrates very little difference between TSC and non-TSC schools.

Table 5.5: Difference in the average percentage of GCSE grades achieved in TSC and non-TSC schools, 2019-2023, females only (difference in percentage points).

	Diff in A*	Diff in A	Diff in B	Diff in C	Diff in D	Diff in E	Diff in F	Diff in G	Diff in U
TSC	2.10	-0.20	-2.14	-0.76	-0.30	-0.56	0.76	0.89	1.38
Non-TSC	3.38	-0.62	-2.59	-0.82	-0.80	-0.30	0.63	0.58	1.16
Difference	-1.28	0.42	0.45	0.06	0.50	-0.26	0.13	0.32	0.22

Source: Welsh Government all-Wales GCSE attainment data

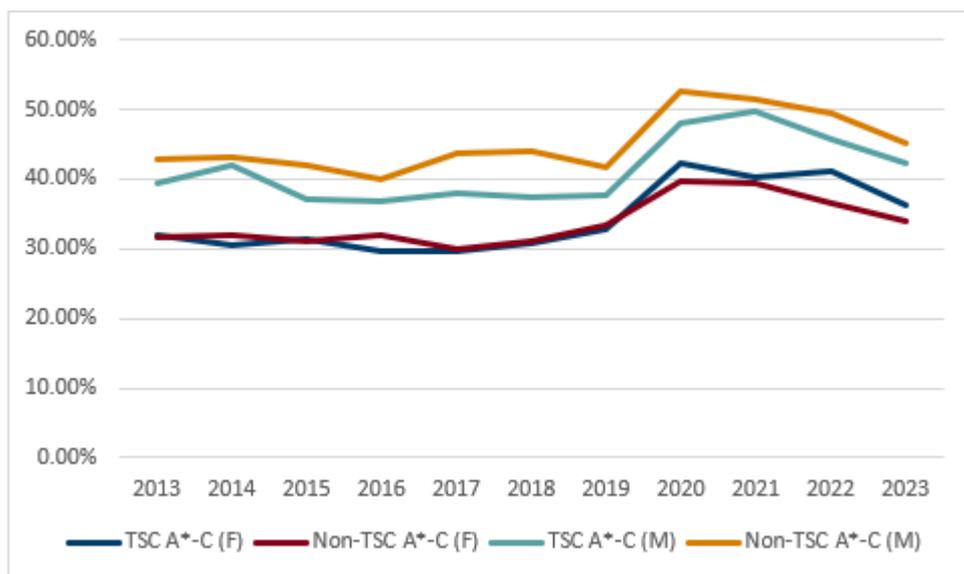
Table 5.6: Weighted Average GCSE A* to B results for TSC and non-TSC schools, 2019 and 2023, females only (difference in percentage points).

	A*-B, 2019	A*-B, 2023	Difference
TSC	14.444	13.054	-1.390
Non TSC	15.810	14.506	-1.303

Source: Welsh Government all-Wales GCSE attainment data

When looking at year-on-year data for higher grades (A*-C), as shown in Figure 5.2 below, attainment data for A-Levels between TSC and non-TSC schools for females demonstrates some improvement against non-TSC school for the year 2020 onwards. The greatest improvement occurred in 2022, the first year in which TSC students would have been able to enrol for A-levels. Female A*-C attainment in 2022 in TSC schools trended upwards, from 40.27% in 2021 to 41.05% in 2022, whereas the attainment for females in non-TSC schools, and males in both TSC and non-TSC schools fell. However, it is not known to what extent this is attributable to TSC, or if the data is an outlier.

Figure 5.2: A-Level STEM attainment rates for the A*-C range between TSC and non-TSC schools, male and female learners.



Source: Welsh Government all-Wales data on A-Level attainment

5.6 Increased levels of ‘Science Capital’ from learners engaged in the TSC operation

TSC aimed to improve the Science Capital of learners participating in STEM subjects by exposing learners to the opportunities that STEM subjects provide.

The concept of Science Capital was developed by the STEM Participation and Social Justice research group based in University College London. It derives from research with young people to understand how access to science-related resources, such as parents with scientific hobbies or careers, affected the likelihood of learners pursuing science as a career. [The research found](#) that children from families with more science-related resources were more likely to pursue science at school and as a career. Broadening the scope out to include Technology, Engineering and Mathematics, a STEM capital approach can be used to assess the improvements to learners’ exposure to STEM subjects.

For the purposes of the evaluation, STEM Capital was articulated as the following elements:

- STEM literacy – the learners’ knowledge and understanding of STEM and the confidence they have in feeling that they know about STEM
- STEM-related attitudes, values, and dispositions – interest in STEM and the extent to which learners see STEM as relevant to everyday life
- STEM media consumption;

- participation in out-of-school STEM learning contexts
- family STEM skills, knowledge, and qualifications – the extent to which learners' family have skills, qualifications, jobs, and interests in STEM
- engagement with people in STEM roles – the extent of meaningful engagement with people in STEM
- talking about STEM in everyday life – how often learners talk about STEM with key people in their lives, including friends and family members

One of the aims of the STEM enrichment operation is to increase levels of Science Capital among learners engaged in the operation. By enhancing learners' knowledge, experiences, and connections within the field of science, the operation seeks to empower them to engage more fully with STEM subjects. This involves providing hands-on activities, exposure to role models in STEM careers, and opportunities for learners to participate in discussions and practical experiments. The goal is to create a supportive environment that not only improves learners' understanding of scientific concepts but also fosters their confidence and interest in pursuing further education and careers in science. Ultimately, by building their Science Capital, the operation aims to address inequalities in STEM participation and inspire a diverse range of learners to explore and thrive in scientific fields.

The feedback from the learner workshop and teachers indicates a mixed assessment of the STEM enrichment operation's effectiveness in increasing levels of Science Capital among learners. While many learners found the operation novel and exciting, they reported that it did not significantly impact their overall interest in STEM subjects, as their motivations to study these areas were primarily driven by existing interests, natural abilities, and awareness of STEM's relevance to their career or higher education pathways.

One teacher did observe a positive impact on Science Capital, noting that the operation sparked interest and increased engagement among learners including previously disinterested learners. Another teacher noted the impact the operation had on shifting learners' perspectives on science beyond the traditional image of 'just white coats and lab work.' However, several teachers pointed out the challenges of measuring engagement due to disruptions from COVID-19, which limited their interactions with learners and the engagement of learners with learning across the board. Overall, while there were some encouraging signs regarding the operation's influence on Science Capital, due to the COVID-19 pandemic and lack of longitudinal data collection, it is challenging to draw definitive conclusions about the operation's overall effectiveness in this area.

5.7 Relationships built with schools and improved capacity for delivering STEM enrichment in Wales

Through the TSC operation, Joint Beneficiaries developed key working relationships with a number of target schools as identified by the Welsh Government. These target schools included a mix of schools that Joint Beneficiaries had a pre-existing relationship with and new relationships with schools not previously engaged. The capacity to deliver STEM enrichment in Wales was temporarily increased over the period of the operation. Teachers appreciated the additional resources that Joint Beneficiaries were able to mobilise to deliver STEM enrichment activities. They felt that most activities delivered by Joint Beneficiaries would not have been able to be run by schools alone due to limitations on funding, resources and access to more specialised equipment. However, it is worth noting that the ability of TSC to increase STEM enrichment capacity in TSC schools was limited by the early loss of the Institute of Physics as a key Joint Beneficiary which would have enabled greater geographical flexibility in delivering STEM enrichment.

Following the delivery of TSC, Joint Beneficiaries are looking to repurpose the resources developed through the operation to deliver further enrichment to schools which is more aligned with the new curriculum and are seeking out additional funding opportunities post TSC to do so. Joint beneficiaries have indicated that some relationships with schools they have built through TSC have been able to continue following the operation through delivery of wider operations. While some have not continued in part due to turnover of staff at the schools worked with and also due to the closure of the Chemistry department at Bangor University who had been coordinating Bangor University's TSC delivery. It was also noted by Joint Beneficiaries that their ability to build relationships with schools was severely limited by the onset of COVID-19 pandemic. One Joint Beneficiary highlighted the importance of in-person engagement with teachers to support relationship building. Teachers who were interviewed agreed with the importance of in-person engagement to support relationship building and enable Joint Beneficiaries to develop an understanding of the challenges schools were facing and the context in which delivery would take place.

The feedback from teachers on existing STEM enrichment operations in Wales indicates that while there are valuable initiatives in place, the overall capacity for delivering effective STEM enrichment is hindered by several challenges. Teachers reported feeling the level of administration associated with participation was burdensome. Particular challenges noted included registering individual participants and gathering parental consent forms to support the sharing of monitoring data. This individual monitoring data was required to be recorded to support Joint Beneficiary output claims and avoid any double counting of participants as part of ESF funding requirements. Future

initiatives that are not EU funded would not need to have the same reporting requirements to reporting could be improved and streamlined. However, any future initiative will need to balance the need to collect data to demonstrate impact and VfM more accurately, with the administrative burden on teachers.

There was also a concern raised by teachers regarding the decreasing availability of options for STEM enrichment, with high demand often leading to quick bookings and limited access. Furthermore, while some teachers noted participation in various initiatives like Technocamps, Engineering Education Scheme Wales and Equal Engineers, there is a call for more options, especially in emerging sectors like renewable energy and AI. Overall, there is a need for improved communication about available opportunities and a desire for more regular and reliable engagements that can be integrated into the school year to enhance the capacity for STEM enrichment delivery across Welsh schools

5.8 Increased skill level of workforce in Wales

Unfortunately, the data on the skill level of the workforce in Wales is not sensitive enough to pick up any changes in the skills level of learners or outcomes in terms of participant destinations such as progression to HE/FE or employment as a result of TSC. Therefore, there was not any longitudinal data available which would be able to capture the skill level of participants pre and post TSC. Data on these outcomes should be incorporated into the design of any future initiatives.

5.9 Unexpected outcomes

The feedback from teachers regarding the unintended outcomes of the operation highlights several positive impacts beyond TSC's original objectives. Firstly, teachers noted that engaging with the operation contributed to their professional development, providing new ideas and inspiration to support effective STEM curriculum delivery as well as inspiration to explore greater opportunities to integrate STEM learning opportunities with other subjects such as art and P.E. in alignment with the updated Curriculum for Wales. Other teachers also welcomed the suite of online resources that were shared with them through TSC during the pandemic and one teacher mentioned exploring opportunities to continue to integrate the resources into their curriculum delivery

One teacher pointed out that prior to the pandemic they had learned about the transmission of diseases through the TSC operation which helped make scientific concepts, related to the pandemic, more accessible for learners and help them understand what was happening. While it was felt that the pandemic had a substantially negative impact on delivery, when delivery could be resumed it supported learner wellbeing through the operation's role in facilitating enriching

experiences such as visits to the National Botanic Garden of Wales, after learners had previously been subject to restrictions during the pandemic this type of enrichment activity and 'getting out' was much welcomed by learners that would not have had the chance to have the same experience in the absence of the operation.

6. Impacts

An intervention's impacts are the long-term outcomes or changes made as a result of the operation. They represent the ultimate goals of the intervention that the operation aimed to contribute to. The logic model for TSC included the following intended impacts.

Table 5.7: Intended Impacts from the TSC Logic Model

No.	Impact
IM.1	Developing a sustainable supply of a suitably qualified workforce in STEM
IM.2	Increase the representation of women in areas traditionally considered male industries
IM.3	Improved skill base to meet demand for STEM skills from employers
IM.4	More young people in Wales working in STEM
IM.5	Positive economic impact (growth) from improved local employment
IM.6	Improved future employability of young people in Wales
IM.7	Making Wales a more attractive place for STEM companies to invest in.

Source: Miller Research TSC Logic Model

Achieving intended impacts is reliant on successfully achieving the intended outcomes, as impacts are long-term changes that result from outcomes.

TSC had mixed results in achieving outcomes. While it had notable successes in increasing short-term engagement with STEM subjects and fostering interest among previously disengaged learners, its ability to improve take-up of STEM subjects and improve attainment in STEM subjects cannot be robustly evidenced. Evidence for having increased learners' Science Capital, and particularly to encourage the participation of girls in STEM is limited.

With the data available to the evaluation team, it is not possible to evidence contribution to the intended impacts, with the exception of evidence of possibly:

- improved A* achievement in STEM subjects in TSC schools at GCSE
- improved A-Level participation in STEM by females post 2022

If this is attributable to TSC, then it would indicate that TSC has made a positive contribution to the following intended impacts:

- improved skill base to meet demand for STEM skills from employers
- improved future employability of young people in Wales

6.1 Value for money

At a cost of £6.2m, TSC had a per-learner cost of £1,017 (for all learners engaged) or £1,628 per learner if the output figure for WEFO-approved learners is used.

TSC can be compared with similar STEM-enrichment interventions in Wales. STEM Gogledd, which delivered extracurricular activities and mentoring for learners in Gwynedd, Ynys Môn, and Conwy provided 3+ engagements to 599 learners for a total cost of £1,859,516, a cost of £3,104 per learner engaged through its core delivery.

Despite a lack of data to claim additional economic benefits with certainty, TSC has likely resulted in positive impacts. As noted above, there is evidence of improved A* attainment in TSC schools and an indication that female A-Level enrolment in STEM subjects has increased. Furthermore, strengthened by the move to online delivery during the Covid-19 pandemic, TSC has produced a repository of online STEM resources that are now available to schools and learners. While these benefits cannot be calculated, they nonetheless have delivered value from the investment in TSC.

7. Lessons learned

7.1 Conclusions

7.1.1 Management and governance

Feedback from Joint Beneficiaries and wider stakeholders indicated that it was felt that the role of the Lead Beneficiary was substantially limited by the insufficient resources allocated internally to the operation due to a Welsh Government moratorium on recruitment during the COVID-19 pandemic and staff turnover. This meant that the Lead Beneficiary role was not fully resourced as set out in the initial WEFO application, which set out an expected six FTE staff to be employed to lead on the operation and manage the relationships with Joint Beneficiaries. Whilst Joint Beneficiaries did hold some joint meetings as a consortium to check in with each other and share best practise, they felt that the lack of Lead Beneficiary capacity affected communication with the Welsh Government. This included the ability to receive a timely response to queries raised, and led to Joint Beneficiaries making decisions regarding their delivery largely independently based on their experience of what had worked previously for similar operations. While one Joint Beneficiary highlighted attempts to work collaboratively as part of a wider consortium of Joint Beneficiaries, another Joint Beneficiary did not feel that the collaboration was sufficient and described often more 'siloes' ways of working.

7.1.2 Differences in models of delivery

Joint Beneficiaries welcomed the ability to develop their own delivery work streams based on their institution's research expertise, strengths and prior experience. Most Joint Beneficiaries had experience delivering STEM enrichment previously and were able to build on these established approaches and best ways of working in order to deliver an approach that would work with their schools in the individual contexts in which they operate. This led to considerable variation among Joint Beneficiaries in terms of the mode of delivery, whether learners were engaged at their schools or brought onto university campus, as well as whether delivery would be delivered through general classroom approaches or smaller group interventions. However, one Joint Beneficiary expressed concern over the ability to evaluate the relative merits of the different approaches taken and expressed a desire to have seen more steer from the Welsh Government on approaches taken.

Additionally, there was variation in the topics covered, with some Joint Beneficiaries only being able to offer activities on select science subjects and having to pair up with another Joint Beneficiary to offer options across the sciences. Where it was provided, teachers welcomed the ability to select from a range of topics, however, would have liked to have been able to select activities from all three science subjects. Although one stakeholder noted some challenges with Joint Beneficiaries being able to provide enrichment across Biology, Chemistry and Physics given the limitations on their institutional expertise and capacity.

There was some disagreement between Joint Beneficiaries as whether TSC should have been delivering STEM enrichment opportunities in addition to the curriculum, or whether the topics covered should aim to align more with core curriculum content. It was noted by Joint Beneficiaries and teachers that while teachers valued the ability of TSC to deliver activities that were more 'novel' and 'hands-on', they also appreciated and were more likely to take up delivery which aligned with the curriculum.

7.1.3 COVID-19 pandemic adaptations

Joint Beneficiaries highlighted a need to adapt their delivery models 'overnight' to the COVID-19 pandemic which significantly disrupted the delivery of the operation, particularly in engaging schools and promoting STEM uptake among learners. Prolonged school closures and restrictions hindered in-person relationship-building and the ability to embed STEM enrichment through TSC within school timetables, as priorities shifted to delivering the core curriculum. Despite these challenges, Joint Beneficiaries adapted by pivoting to online delivery models, offering virtual workshops and accessible resources. This shift enabled a broader reach beyond the original target group but introduced complexities in evidencing impact. Adaptation varied among Joint

Beneficiaries, with some leveraging pre-existing digital capabilities, while others, such as Swansea University, trialled innovative solutions like home experiment kits to maintain engagement. However, the fully online approach struggled to replicate the hands-on nature of STEM learning and learners expressed a strong preference for in-person delivery. A positive legacy of this transition is the digital STEM resources created through the project, which one Joint Beneficiary is seeking to update align with the new Curriculum for Wales and continue to support STEM enrichment delivery.

7.1.4 Impact of operation

TSC has demonstrated some successes in some of its intended outcomes, particularly in increasing short-term engagement with STEM subjects and fostering interest among previously disengaged learners. Teachers highlighted the operation's ability to make STEM subjects more engaging through hands-on, practical activities that encouraged discussions and strengthened home-school links. Evidence from GCSE attainment data further indicates that it may have had an impact, with TSC schools showing a statistically significant increase in A* grades compared to non-TSC schools between 2019 and 2023. However, this improvement was not consistently reflected across other higher grade categories (e.g., A and B grades), where TSC schools saw less favourable outcomes than their non-TSC counterparts.

There is some evidence to indicate that TSC's efforts to incorporate female role models and challenge gender stereotypes in STEM were appreciated, with data demonstrating some improvement in the attainment and uptake of STEM A-Levels by females in TSC schools from 2022 onwards.

Despite its achievements, TSC faced significant challenges in achieving its broader objectives. The operation struggled to demonstrate a measurable impact on sustained participation in STEM subjects or increased uptake of triple science GCSEs, partly due to the disruption caused by the COVID-19 pandemic, which limited both learner engagement and partly due to the lack of baseline monitoring data being captured^[footnote27] consistently across interventions monitoring data not supporting assessment of TSC's impact.

Teachers expressed uncertainty regarding the operation's long-term influence on outcomes like STEM achievement and progression, and qualitative feedback suggested mixed results in building Science Capital among learners. Furthermore, while some schools benefited from strengthened relationships with TSC Joint Beneficiaries and access to resources, the operation's capacity to

²⁷ Due to delays in appointing an evaluator until after TSC was delivered.

deliver widespread STEM enrichment across Wales was hindered by logistical challenges, such as the early loss of a key Joint Beneficiary and the impact of pandemic-related restrictions.

Due to limitations in capturing systematic data on the impact that TSC interventions had on learners, it was determined that there is insufficient data to undertake the initially planned comparison of cost effectiveness between different approaches adopted by Joint Beneficiaries. The overall value for money assessment is also limited beyond a calculation of the cost per pupil for TSC overall. This means that no firm conclusions can be reached regarding the value for money of the TSC operation compared to other STEM enrichment programmes or the relative cost effectiveness of the different models Joint Beneficiaries undertook as part of the operation.

Overall, while TSC has achieved some important short-term successes, its ability to deliver sustained and systemic changes in STEM participation, attainment, and gender balance remains uncertain.

8. Recommendations

8.1 Lessons learned for similar operations in Wales.

8.1.1 Recommendation 1

Based on feedback from Joint Beneficiaries, it was felt that the lack of collection of baseline data prior to interventions with learners as well as longitudinal data collection of learner outcomes made it more challenging to evaluate the impact that the TSC operation had on learners as a whole, as well as the ability to assess the relative merits of the different approaches employed by Joint Beneficiaries to engage learners with STEM. It is recommended that future initiatives build in a standardised plan for data collection on learner progress prior to the start of the operation to enable a more robust assessment of the impact of TSC on the learner's baseline.

For example, this could include tracking a sample of learners throughout their learning journey over a number of years, with surveys being conducted periodically to assess factors relating to STEM Capital. Additionally, a baseline survey could have been used with all or a sample of participants at the start of their engagement with TSC, again collecting data relating to STEM Capital. Such data can provide baseline information on learners' interest in STEM subjects, their understanding of subjects' value to or role in their own lives, career aspirations, and general awareness of the links between STEM subjects and career opportunities. The use of anonymised data can also capture the relative impact of external factors, such as the quality of STEM teaching in schools, the availability of STEM options, and the impact of wider social and economic trends on the appreciation of STEM.

8.1.2 Recommendation 2

Feedback from the Lead Beneficiary, Joint Beneficiaries, and WEFO indicated a shared understanding that the Lead Beneficiary role was consistently under resourced throughout the operation due to a Welsh Government moratorium on recruitment and staff turnover. It is recommended going forward that similar initiatives ensure that there is a Lead Beneficiary which is sufficiently resourced to enable a more rapid mobilisation of Joint Beneficiaries, providing sufficient steer for

delivery and facilitation of opportunities for Joint Beneficiaries to collaborate and share best practise.

8.1.3 Recommendation 3

Based on feedback from learners and teachers it was felt that years 7-9 was generally felt to be the right age group to target to avoid the drop off in learners engagement with STEM between primary and secondary school. It was felt to be important to engage learners prior to years 10-11 where learners would be making key decisions about their subject choices going forward, and teachers would struggle to timetable wider STEM enrichment activities alongside core curriculum delivery in years 10-11 where learners would be working towards their GCSEs. Wider stakeholders, however, did note the importance of complementing STEM enrichment at years 7-9 with wider engagement throughout the learner pathway, noting how early young people begin to form perceptions around whether certain subjects and jobs are for them, as well as noting the challenges of keeping learners engaged with STEM through the year 6-7 transition. It is therefore recommended that future initiatives continue to target this age group but also seek to tie in with wider STEM enrichment initiatives which target STEM engagement earlier in the learner pathways to ensure continuity of engagement.

8.2 Lessons learned for Joint Beneficiaries

8.2.1 Recommendation 4

Teachers and learners expressed an appreciation of more practical 'hands-on' activities through TSC. Teachers noted that they were often unable to deliver similar activities due predominantly to lack of resources and specialised equipment but also due to curriculum limitations and having insufficient staffing to manage more involved activities. It was felt that a more hands-on approach to delivery was welcomed by all learners, but particularly learners who had previously been disengaged by more traditional STEM lessons by enabling access to STEM through more 'novel' experiences and using accessible entry points to STEM topics which learners would be familiar with. Therefore, it is recommended that future STEM enrichment initiatives continue to engage learners in STEM through more hands-on activities, as

well as facilitating access to STEM engagement through novel experiences which schools often struggle to facilitate due to a lack of resource and specialised equipment.

8.2.2 Recommendation 5

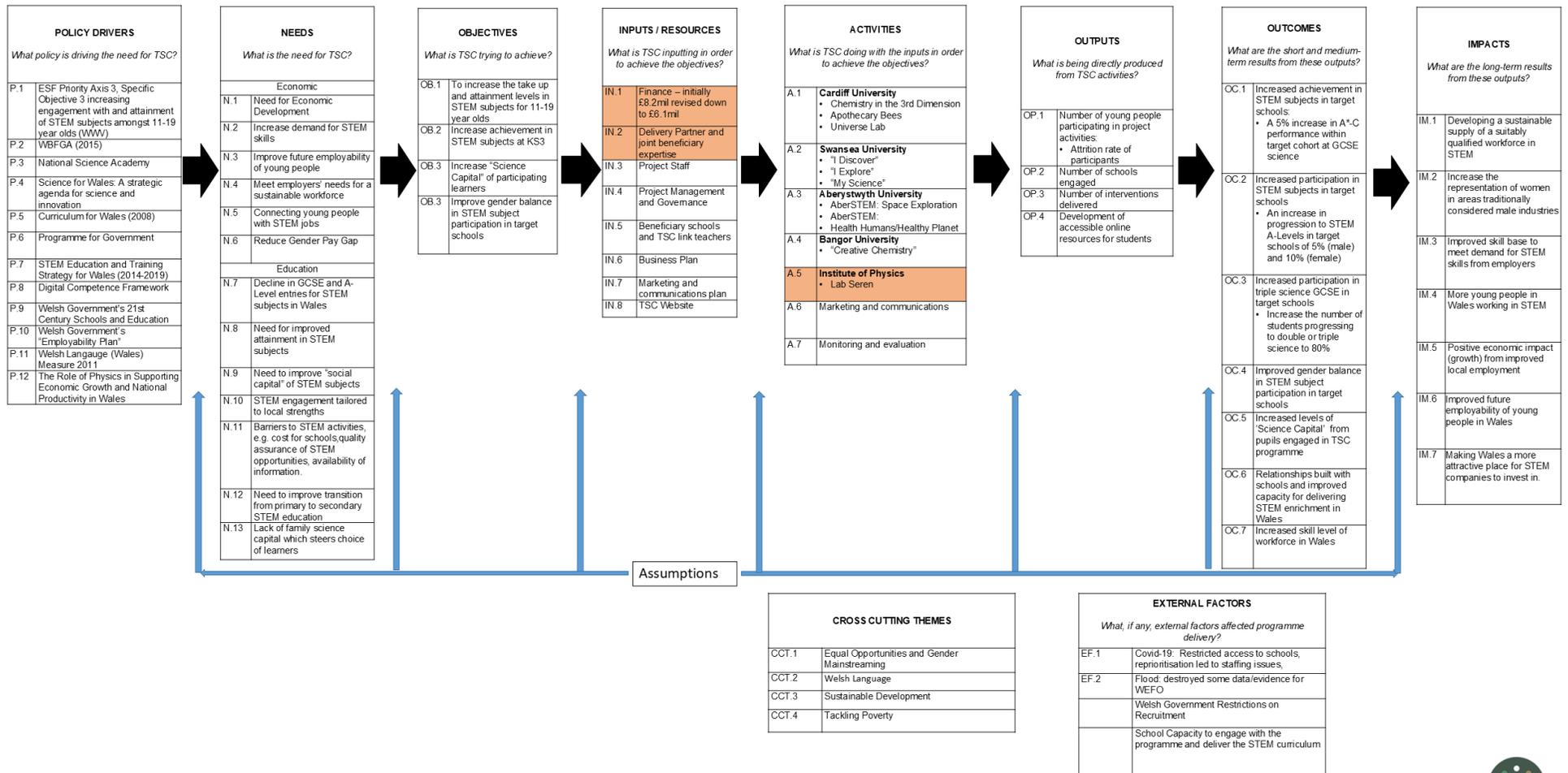
Teachers expressed positive views on their relationships with Joint Beneficiaries. They welcomed the ability of Joint Beneficiaries to build positive working relationships with their schools as well as having a firm understanding of the context in which schools are operating and their individual needs. During the COVID-19 pandemic in particular teachers felt that the Joint Beneficiaries were responsive to the needs of teachers and were able to adapt their provision to address the particular barriers schools were facing to engage with the operation. Rural schools also welcomed the extra effort taken by Joint beneficiaries to enable school visits. Therefore, this evaluation recommends that STEM enrichment initiatives build on this success, and be developed in a way which is responsive to the needs of schools and teachers, by for example offering a greater menu of topic options or offering more tailored delivery options to schools depending on their needs.

8.2.3 Recommendation 6

While TSC was predominantly pitched as an enrichment operation to offer novel hands-on opportunity above and beyond core curriculum delivery, teachers expressed an interest in future STEM enrichment operations having a greater alignment with the Curriculum for Wales. They recommended that this be done through developing a clearer careers message through delivery, and enabling linkages between STEM subjects and wider subjects on the curriculum, such as Physical Education, the Arts, as well as the Digital Competency framework through greater embedding of tech into delivery. There were some positive examples of a more cross-disciplinary approach enabled through Joint Beneficiary delivery, however it was felt that these could be expanded further.

Annex A: Trio Sci Cymru Logic Model

Logic Model: Trio Sci Cymru



Annex B: Stakeholders Engaged

Stakeholders
WG Operation team (x2)
WEFO (x2)
Aberystwyth University (x2)
Cardiff University (x2)
Swansea University (x2)
Teachers (x5) from schools which had received interventions from Aberystwyth University, Cardiff University and Swansea University
Learners (x14) from one school which had received an intervention from Cardiff University
Engineering Education Scheme Wales (x1)

Annex C: TSC Operation Logic Table

Which Specific Objective within the programmes would the proposed operation deliver against?	What change will the proposed operation seek to achieve?	How will the proposed operation achieve the changes sought?	Programme output indicators and targets
<p>WWV PA3 SO3 - To increase the take up of and attainment levels in STEM subjects amongst 11-19 year olds</p>	<p>WWV PA3 SO3</p> <p>Increase achievement in STEM subjects at KS3 in target schools in WWV</p> <p>Increase participation in triple science GCSE in target schools in WWV</p> <p>Improve gender balance in STEM subject participation in target schools in WWV</p>	<p>Increase achievement in STEM subjects at KS3 in WWV</p> <p>Provide a coherent programme of science enhancement and experiential learning activities to targeted cohorts during their whole KS3 cycle (y 7-9)</p> <p>Increase participation in triple science GCSE in WWV</p> <p>Science engagement activities will improve learner confidence in science subjects, overcoming perceived barriers to participation</p> <p>Science enhancement activities will link curriculum science elements to diverse careers, improving perception of science as an enabling subject and building aspirations to STEM careers</p> <p>Improve gender balance in STEM subject participation in WWV</p> <p>Address cultural gender projections (such as physics as a masculine subject, biology as feminine) through intervention and careful presentation (and thorough training) of volunteer scientists. Encourage a culture of challenging stereotypes among learners</p> <p>Provide take-home activities for learners to take part in with their family to engage guardians and build science capital</p>	<p>Young People 11-19 who continue to study a Maths, Science, Engineering and Technology subject post 16 - male</p> <p>Within target schools increase the number of male students progressing to double or triple science. Target 80% entries to these qualifications. A 5% increase in A*- C performance within the target cohort at GCSE science</p> <p>A 5% increase in progression to STEM A-Levels in target schools</p> <p>Young People 11-19 who continue to study a Maths, Science, Engineering and Technology subject post 16 - female</p> <p>Within target schools increase the number of female students progressing to double or triple science. Target 80% entries to these qualifications. A 5% increase in A*- C performance within the target cohort at GCSE science</p> <p>A 10% increase in progression to STEM A-Levels in target schools</p> <p>Young people 11-19 years of age - male</p> <p>Based on working with 30 target schools, and assuming average cohort size of 100 pupils, we anticipate reaching 1500 male learners with this project.</p> <p>Young people 11-19 years of age - female</p> <p>Based on working with 30 target schools, and assuming average cohort size of 100 pupils, we anticipate reaching 1500 female learners with this project.</p>

