The Young STEM Leader Programme: inspiring and developing young people through STEM

Graeme Rough, Alastair MacGregor and Jamie Menzies

Abstract The Young STEM Leader Programme (YSLP) is an important feature of the Scottish Government's STEM Strategy. YSLP creates culture change through developing peer role models who challenge stereotypes and improve awareness and attitudes towards STEM. YSLP is having a major impact on the quality and extent of peer support available across primary and secondary schools in Scotland. Over 1200 Tutor Assessors, representing over 600 educational centres, have been trained and certificated to run YSLP with representation from all Scottish local authorities. Some 4000 Young STEM Leaders are working towards non-formal and formal awards. By 2022, YSLP will be available to all school pupils in Scotland.

The Scottish Government recently published a STEM Education and Training Strategy for Scotland (Scottish Government, 2017) in which the development of STEM is identified as being pivotal to economic and social development in Scotland. Among the ambitious targets set by government are that by 2022, there should be:

- *increases in the proportion of people undertaking STEM-related learning, engagement, study and training across all sectors including in school-level qualifications and awards, and participation in apprenticeship programmes.*
- *increased numbers of people who understand the benefits and value of STEM for themselves, their families and their communities.* (p. 10)

In the STEM Strategy the role of STEM Ambassadors is highlighted and the Government also recognises the benefit to young people of peer support in the following outcome:

- *We will establish a new Young STEM Leaders programme to stimulate and strengthen the development of peer mentoring and inspiration in STEM **for** children and young people **by** children and young people. The programme will start in early 2018 and be fully operational by 2020.* (p. 28)

SSERC, as a local authority shared service (see www.sserc.org.uk/about/), is the lead organisation for the development and delivery of the Young STEM Leader Programme (YSLP). YSLP is available to students from primary, early and upper secondary, FE sectors, as well as a range of community groups.

Completing YSLP will be of great value to Scotland's young people by increasing their access to the many experiences that STEM offers and building their key skills. It is hoped that that Young STEM Leaders (YSLs)

will be inspired to become STEM Ambassadors once they complete the upper levels of the YSLP.

Once fully operational, by the end of 2022, YSLP will allow all young people across Scotland to engage in a national programme to support their peers in learning about STEM, and to receive recognition for their efforts. A key feature is the opportunity for pupils to become involved at primary, should they so wish, and then to progress through continued involvement with the possibility of gaining credit at SCQF (https://scqf.org.uk/) levels 4, 5 and 6. SCQF level 2 equates to pupils operating at the upper end of primary education in Scotland (typically aged 10–12). Broadly speaking, SCQF levels 5 and 6 correspond to GCSE and AS levels in other parts of the UK.

SSERC was appointed as the lead organisation to create and deliver the YSLP. In this article we will:

- report on the structure and aims of the YSLP;
- discuss how the YSLP operates in relation to the science curriculum in Scotland;
- explore how the YSLP model might be rolled out across the UK and beyond.

Aims of YSLP

In its STEM Strategy the Scottish Government (p. 28) set out the case for the establishment of YSLP. In doing so it took the view that:

- mobilising the enthusiasm of young people themselves will help grow the number of role model and mentoring opportunities for other young people;
- being a YSL could, in turn, help motivate that young person to follow STEM study or careers and

to become a STEM Ambassador in the future. It will also help them develop 'soft' skills that are in demand from employers;

- YSLs will help to address stereotypes that act as barriers to participation in STEM and this will include making sure that there is a good gender balance among the YSLs.

YSLP allows young people to develop their personal skills and qualities in a STEM context. Through delivering STEM activities, events and interactions in their schools, communities and beyond, a YSL consolidates their existing knowledge and understanding of the STEM concepts being delivered. It is intended that YSLP will lead to development of leadership qualities and mentoring skills, and an increase in STEM capital, with improved retention in STEM subjects in both leaders and participants. Through YSLP, SSERC and its partners seek to create culture change through developing peer role models who actively challenge stereotypes and improve awareness and attitudes towards STEM. Our efforts are encapsulated in a series of aims:

- developing skills for the 21st century;
- building confidence through a leadership role;

- developing employability and career-management skills;
- increasing STEM literacy, awareness and appreciation;
- preparing young people for an ever-changing world.

It is useful here to consider an example of the type of activity that YSLs have undertaken. Across ten primary schools and one secondary school in North Ayrshire Council, the local authority's Family Learning Team has been working with select groups of young people to achieve a YSL award. In completing the award, YSLs were supported to deliver STEM activities, events and interactions to their household groups. By delivering video career profiles, guided sensory nature walks, kitchen science experiments and more, YSLs were able to actively involve their family groups in their leadership journey while together engaging more deeply with STEM. Over 100 YSLs have now been certificated.

Structure of the Young STEM Leader Programme

The team leading the YSLP was established in January 2019. The Programme operates as a partnership that includes the four Science Centres in Scotland (the

INSPIRE Others in STEM
- Learn and develop skills, qualities and behaviours of inspirational leaders
- Produce inspirational STEM experiences for others
- Encourage others to consider a future in STEM
- Champion the potential that STEM offers to everyone
- Learn to inspire others

CREATE Plan and design STEM activities, events or interactions
- Exciting and engaging STEM opportunities for others
- Plan and organise safe STEM learning experiences
- Build self-confidence and resilience
- Develop knowledge, understanding and skills in STEM
- Choose and explore personal areas of interest or expertise

LEAD Engaging and inspiring STEM activities, events or interactions
- Be a positive role model
- Build presentation, communication and social skills
- Develop essential leadership skills
- Promote and display equality, equity and inclusion
- Deliver STEM activities, events or interactions

DISCOVER The meaning, importance and impact of STEM
- Opportunities, pathways and futures in STEM
- The YSL's own potential in STEM
- The limitless context and applications of STEM
- The positive impact STEM has on people and society
- Challenges and issues in STEM

YOUNG STEM LEADER

Figure 1 Programme elements YSL1–YSL4 (SSERC, 2020)

Aberdeen Science Centre, the Dundee Science Centre, Dynamic Earth and the Glasgow Science Centre), the three STEM Ambassador Hubs in Scotland (SAE@ SSERC (East of Scotland); Science Connects (West of Scotland), and Aberdeen Science Centre (North of Scotland)), the Dundee, Edinburgh and Glasgow Science Festivals, The Awards Network, Young Scot, YouthLink Scotland, The Science Skills Academy, Education Scotland and the Scottish Mentoring Network.

YSLP is offered in two versions:

- a non-formal version, which is digitally badged or certified and aligned to Curriculum for Excellence Second, Third and Fourth levels (designated as YSL2, YSL3 and YSL4) (see Education Scotland (2019))
- a formal version, which is awarded and certified by SSERC, Scottish Curriculum Qualifications Framework (SCQF) credit rated and levelled by SQA.

Both the non-formal and formal versions of the Programme are underpinned by a framework that identifies the skills, knowledge and behaviours expected of a YSL at each curricular level.

The formal version of the Programme is offered at SCQF levels 4, 5 and 6 (YSL4, YSL5 and YSL6) and is underpinned by learning outcomes and assessment criteria at each level. SCQF credits are included within the formal version of the Programme.

Programme content

In the non-formal version of the Programme there are four elements, linked directly to the four digital badges completed by YSLs: Discover; Create; Inspire; and Lead (see Figure 1 for more detail).

In the non-formal version of the YSLP, digital badges are awarded by a Tutor Assessor (TA) when YSLs have met the required standards and they have evidenced this in their log. Completing all four elements and gaining the digital badges at each level of the Programme earns the YSLs their Young STEM Leader Awards at the appropriate level. Further detail on the nature of the evidence that is gathered is available in the YSLP Handbook (SSERC, 2020).

As YSLs progress to the formal version of the Programme, digital badges are replaced with formally assessed learning outcomes and the award of credit. On completion of the formal version of the YSLP, the YSL will be able to plan, lead and evaluate STEM activities, events and interactions that promote opportunities in STEM. The approximate completion time is 30 hours for YSL4 and YSL5, and 40 hours for YSL6. YSLs will gain 3 SCQF credits upon completion of YSL4 and YSL5. Completion of YSL6 leads to the award of 4 SCQF credits.

For the formal version of YSLP (YSL4, YSL5 and YSL6) there is a set of assessment tasks, and the evidence that must be gathered to meet the assessment criteria (using YSL5 as an example) is shown in Figures 2 and 3.

Participation

YSLP is open to all young people in Scotland and can be delivered by Centres that may be a school, college, community or youth group. The YSLP can be integrated with existing awards and programmes that a candidate may hold or towards which they are working. Centres are encouraged to decide the most appropriate level of the YSLP to offer their young people.

In order to run the Programme, Centres need to have appropriately trained personnel. Currently, Centres wishing to offer the Programme will typically be located in Scotland. Any organisation that works with young people and has staff or volunteers who are members of the Protecting Vulnerable Groups (PVG) Scheme (www.mygov.scot/pvg-scheme/) can become a YSLP delivering Centre. The PVG scheme is managed and delivered by Disclosure Scotland.

Centres are encouraged to have a minimum of two or more trained Tutor Assessors (TAs) one to deliver the Programme and another to act as an Internal Verifier. Training for these roles is provided by SSERC. To maximise the support on offer for YSLs, Centres are encouraged to train more staff since this shows a commitment to meet the aims of the STEM Strategy. Trained TAs and YSLP delivering centres are approved and certificated by SSERC.

Outputs

YSL2 and YSL6 were piloted during the 2019/2020 academic year with the following outputs:

- 75 Centres (including school and community/youth groups) participated.
- 23 of the 32 local authorities in Scotland took part in the pilot with representation from all of the Regional Improvement Collaboratives. In 2017 the Scottish Government announced plans to encourage councils to cooperate more closely, so the councils were organised into six discrete Regional Improvement Collaboratives – see www.gov.scot/publications/regional-improvement-collaboratives-rics-interim-review/pages/4/ for more detailed information.
- 100 Tutor Assessors completed the training offered by SSERC.
- 600 young people took part in the Programme with 146 SCQF Level 6 Awards being made.

Examples of case studies from the Pilot Year are available on the Young STEM Leader website (www.youngstemleader.scot/case-studies).

Discussion

A key aspect of YSLP is the peer-assisted support that is offered by YSLs to others (principally, although not exclusively, pupils) in their setting. Examples of activities recorded during the pilot phase of the Programme include:

- running science workshops, clubs and challenges;
- Numeracy Captains supporting the learning of younger peers;
- co-delivery (across YSLP levels) of health, fashion and other creative industry-linked initiatives;
- digital transition programmes led between primary and secondary YSLs;
- YSLs supporting the digital development and learning of peers and staff in their centre;
- YSLs are supporting local uniformed youth groups, for example helping Girl Guides achieve STEM-related badges.

Peer support is offered in a range of primary, secondary and higher education settings (Beasley, 1997; Franklin Scholars, 2017; Karcher, 2013; McDonald, 2016; Smith, May and Burke, 2007). In many cases, secondary school pupils are involved with support programmes for primary pupils and often such interactions focus on improving the transition between schools. For example, many YSLs in a high school setting are preparing and distributing 'cook-along' STEM activities for learners in their associated primary schools (see www.youtube.com/watch?v=M-BK7TEoQjA)

The benefits for both 'mentor' and 'mentee' are well-described in the literature. In our judgement, the YSLP has a number of unique features:

- The emphasis on STEM-related activities, in part driven by the requirements of the STEM Strategy, gives a focus that other programmes often cannot match.

Evidence - what tasks do you need to do?	Done?
Authenticity Statement To be completed by both the Young STEM Leader and the Tutor Assessor at the end of the programme	
Task 1 The skills, qualities and behaviours required for STEM leadership	
Task 2 Set an action plan to develop STEM leadership skills, qualities and behaviours	
Task 3 Identify the challenges involved with promoting opportunities in STEM	
Task 4 Duty of care in STEM activities, events or interactions	
Task 5 Identifying risks in STEM activities, events or interactions	
Task 6 Plan, lead and evaluate STEM activities, events or interactions	
Leadership Log Complete at least 4 hours of STEM leadership activities	
All done?	

Figure 2 Evidence log for YSL5 (SSERC, 2020)

- There is no reason why mentors should be older than mentees as is often the case in school-based mentoring schemes.
- YSLP is a national programme. From August 2020, all pupils in primary, secondary and further education centres have been encouraged to enrol as potential YSLs. In our experience, the formal Programme with associated credit-rated awards offers a powerful incentive for pupil involvement.

The pilot phase of YSLP is subject to external evaluation by a team from the University of Stirling; their full report will be available via the YSL website (www.youngstemleader.scot). In the interim period, the evaluation team have recorded a series of case studies, based upon interviews with Tutor Assessors and YSLs, which offer very positive insights into the success of YSLP to date. Extracts from those case studies are reproduced here for primary, secondary and community settings:

- (Primary setting, www.youngstemleader.scot/ysls-in-the-primary-setting) The TA noted the flexibility of YSL and valued how the Programme 'fitted into the curriculum'. Recruited YSLs included previously 'completely disengaged' children, who embraced the opportunity and became passionate about their projects. All recruited YSLs were in upper primary, and they worked with the whole school on several projects, ranging from science fairs to digital newsletters. Developing leadership skills was highlighted as an important outcome of the pilot. Attitudes towards STEM were said to improve, as young people expanded their notion of STEM to include areas they were interested in, such as animation and film clubs. YSLs' understanding of scientific concepts was said to be developed through teaching and mentoring others.
- (Secondary setting, www.youngstemleader.scot/ysls-in-the-secondary-setting) Developing leadership skills was highlighted as a key element of the

Assessment Criteria/ Action required *Did the young person*:	Appr.	Date	Notes
Encourage participants to explore the range of opportunities that are available in STEM			
Use a range of verbal and non-verbal communication methods effectively on more than one occasion			
Set two ground rules effectively on one occasion			
Explain how to make a change to the level of challenge of an activity, event or interaction on at least one occasion			
Conclude a STEM activity, event or interaction effectively to include: • a recap • collecting feedback from participants			
Lead a minimum total of four hours STEM activities, events or interactions			

Figure 3 Observation Checklist for YSL5 (SSERC, 2020)

project, suggesting that young people leading the activities was a real selling point of the Programme. Awareness of STEM careers was being raised by the Programme. Challenging stereotypes was felt to be a desirable element of the project, suggesting that perhaps these stereotypes were not so deeply embedded as previously. The opportunity for the young people to gain an SCQF Level 6 Award was a significant factor.

- (Community setting, www.youngstemleader.scot/ ysls-in-the-community-setting) Most of the young people in the project were from areas of multiple deprivation, without access to digital technology at home. Their YSLP project was focused on mentoring Brownies and Guides to obtain technology-based badges. The TA and the YSLs described a core aim of their project to be increasing the STEM workforce, especially in relation to women. All talked about female 'empowerment', with one young leader articulating what she meant by female empowerment: '*They make you feel like you can do it, like, just because you are a girl doesn't mean you can't try and follow your dreams and do what you want to do*'. One young leader was aware of the impact of this opportunity to motivate and inspire others: '*They'll be inspired that you can do this and they might go on and do it*'.

Future activity

Encouraged by feedback from a range of sources, SSERC and its partners have embarked on an ambitious national roll-out of the YSLP across Scotland, beginning in the academic year 2020/2021. We aim to ensure that every young person in Scotland has access to the Programme via their school, community or youth group by the end of 2022. At the time of writing, we are well on track to meet this ambitious target. Increasing national engagement is already evident and we are delighted to report that there are:

- over 1200 trained TAs across all six levels of YSLP;
- over 600 accredited Centres across all 32 local authorities;
- an estimated 4000 active YSLs in Scotland.

There is no reason in principle why the model of the YSLP could not be extended to other parts of the UK. Formal accreditation via one or more UK Awarding Bodies would be an important consideration and we would be happy to support any groups who wished to put a similar programme in place. Indeed, colleagues outside of the UK may relish the opportunity to establish similar programmes and again we would encourage dialogue with us to see how we might help support such initiatives.

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Graeme Rough is Head of STEM Programmes at SSERC. Email: Graeme.Rough@sserc.scot
Alastair MacGregor is the CEO of SSERC.
Jamie Menzies is Programme Manager, Young STEM Leader Programme at SSERC.