

What enables Scottish mathematics teachers to embed global citizenship themes in their classrooms?

Corinne Angier

University of Stirling

This paper reports on the engagement of a small number of Scottish secondary mathematics teachers, with an online subject specific professional learning module, offered by a Development Education Centre. The responses suggest the teachers had to reconcile their activity with the hegemonic priorities of teaching the standard curriculum and of preparing learners to be tested. The teachers drew on limited professional and pedagogic courage and further work is needed to identify how these resources might be developed and activated. These early findings from the project point to implications for initial and continuing teacher education if Scotland is to achieve its aspirations for ‘Learning for Sustainability.’

Keywords: global citizenship; pedagogic courage; professional courage; learning for sustainability.

Introduction

This paper reports on part of an ongoing PhD project which is exploring the contours of possibility for teaching global awareness in mathematics lessons. The project is based in Scotland where many aspects of national policy including education are aligned to the United Nations Sustainable Development Goals (Scottish Government, 2020). There are approximately 4500 secondary mathematics teachers in Scotland and interest in professional learning is high with over 900 at this year’s Scottish Mathematics Council conference. A number of national initiatives such as ‘maths week Scotland’ and ‘making maths count’ alongside significant funding for mathematics¹ add support to an active mathematics education community. Few mathematics teachers however choose to engage with the free professional learning opportunities offered by development education centres (DECs) in Scotland. I am not aware of any extended treatment in policy or research of the specific contribution that mathematics might make to the education of “responsible citizens” who are able to “develop knowledge and understanding of the world and Scotland’s place in it.” (Education Scotland, 2019). Working alongside a DEC I devised and then acted as a mentor in an online subject specific professional learning module. The responses reported here suggest that mathematics teachers need pedagogic and/or professional courage to resist the normative expectations of their role.

Characteristics of the Scottish context

Scottish education policy strongly encourages teachers to engage with ‘learning for sustainability’ (LFS) which is a portmanteau term incorporating global citizenship,

¹ Education Scotland has announced £400,000 of funding to support STEM teaching with 200,000 ring fenced for mathematics. <https://education.gov.scot/media/cefdve2u/stem-grant-guidance-round-3-2021-23.pdf>

sustainable development education and outdoor learning. Scottish teachers are also accountable to the General Teaching Council of Scotland with whom they are required to remain registered.

Learning for sustainability themes and approaches, using local and global real-world and outdoor contexts, **are expected to be embedded in the design of all curriculum areas and subjects** (GTCS, 2021, p.3, my emphasis).

Secondary mathematics teachers might feel empowered or constrained by this requirement to bring the outside world into their classrooms. My research findings suggest that LfS is largely ignored by mathematics teachers because of the competing demands of other government policy and typical school practice which focus strongly on raising attainment in core subjects. As one mathematics teacher said in an online survey:

Although these goals are to be admired, often in secondary education, exam success is deemed more important and national curriculums do not often lend themselves well to investigating key themes especially further up the curriculum [secondary mathematics teacher]

Global learning advisors at three of the DEC's have told me that they struggle to recruit mathematics teachers for projects even where there is money to cover absence from school.

Through the ... project which was obviously secondary focused ... we probably had a hundred and fifty secondary teachers come to different parts of training... we literally have had one well I guess one and a half maths teachers choose to engage with the project. [Global learning advisor B]

The very small number of mathematics teachers who are attempting to adapt their curriculum report that they are neither supported nor blocked but that their development of global citizenship themes is carried out in their own time. This distinctive Scottish policy of LfS can therefore be said to be permissive at best.

This study

I report here on five mathematics teachers who engaged with a subject specific module that was part of an online training course provided by a DEC. I developed the mathematics specific module content and acted as a mentor by responding to postings. One of the activities is shown below (see fig 1). The intention was to provoke thinking about the different ways in which mathematics teachers might develop their practice to align with the aims and values of a critical Global Citizenship education (de Andreotti, 2014). In the sections below I discuss the responses of the teachers to each of the four options. I have also drawn on other material from the project in the form of oral and written responses in workshops and webinars for mathematics teachers, online surveys and interviews with global learning advisors.

Teaching standard curriculum content with different resources

Teaching standard curriculum content with different resources has the most potential as it would be welcomed by all and would benefit pupils both within their existing curriculum and their numerate literacy for real life. [Teacher B]

1 is definitely the easiest of the options available as it is something I try to do anyway. [Teacher D]

Wherever possible I have always included real life examples to ensure that pupils can make connections with the course topic and see the value in their learning. As

someone who often supports in class I have witnessed some good practice, which is reassuring. [Teacher E]

What might teaching for Global Citizenship mean in a mathematics classroom? Read the descriptions of three different approaches below. Do any of them reflect your own practice or aspirations? Which are most challenging? Which have the most potential to impact on young people's lives?

1. Teaching standard curriculum content with different resources.

- Devising questions that have a “real world” context such as public spending for a ratio task rather than flavours of sweets in a bag.
- Using resources from e.g. OXFAM that present mathematics within global contexts or tackle an issue such as voting systems.
- Devising modelling tasks that connect directly to pupils' lives e.g. costs of travel or phones.

2. Challenging views of mathematics.

- Using the history of maths (maths is humanly constructed).
- Welcoming mistakes (maths does not need to intimidate).
- Connecting to news stories (maths is an applied as well as a pure subject).
- Decorating the classroom (maths is aesthetic and not all about number).

3. Incorporating “ethnomathematics.”

- Using tasks that show different approaches to the same concept e.g. base 60 counting in the Babylonian civilisation or the use of quipu to record numbers.
- Using tasks that show mathematical thinking in cultural contexts e.g. Celtic knots, weaving patterns, Islamic symmetry etc.
- Using tasks that demonstrate mathematical thinking that is less usual in the algebraic global north e.g., proof by diagram in Chinese and Arabic mathematics.

4. Working to achieve a democratic and inclusive maths classroom.

- Establishing a dialogic classroom with strategies for talk, discussion and collaborative group work.
- Giving space for pupils to make choices and ask questions.
- Listening to pupils' feedback (Pupil voice/ P4C practices).
- Challenging setting and fixed “ability” language in your department.

Fig 1: Extract from online module

This approach is considered to be possible perhaps because it is only a small and easily imaginable adaptation of typical teaching practice. There is no threat to ‘covering’ the curriculum. Many teachers in Scotland will teach for the qualification ‘applications of maths’ which is all in context albeit sometimes rather contrived or inappropriate ones. Discussions in workshops and webinars suggest the constraints that might deter teachers are a lack of up to date materials and some reticence to discuss topics outwith mathematics. The issue of opening up space in the mathematics classroom to discuss ‘non-maths’ issues has been a recurrent one throughout my research. Some teachers feel it is professionally inappropriate because these are not topics they have been trained to teach and they would be better dealt with by colleagues with specialist knowledge. All mathematics teachers are concerned about losing time. In both cases the culture of ‘usual school mathematics’ (Boylan 2010) is

being threatened. Teachers need professional and pedagogic courage to spend time developing dialogic ways of working and to make space for the complexity of authentic contexts.

Challenging views of mathematics

Challenging mistakes – love this, pupils find it uncomfortable to make mistakes (particularly pupils who achieve near 100%) but it is such a **great tool for discussion**, to learn by and most importantly to understand why it did not work and go on to spot this again in future examples...**In order for our learners to become confident enough to admit they make mistakes in class we have to work hard to ensure the class climate is one that we do encourage open and honest discussions.** [Teacher E, my emphasis]

There is one E and 0^2 that everyone dreaded covering and assessing, which fits with number... The history of mathematics is **fascinating once you get over your fear of it**, and kids love it! [Teacher D, my emphasis]

Only the two most experienced teachers saw potential in this suggestion and their responses demonstrate their pedagogic understanding. They are both in promoted positions, one has a background in primary, and they both have roles where they engage with teachers from other subject disciplines. I conjecture that this has broadened their conceptions of classroom practices. Interdisciplinary conversation was suggested by a global learning advisor as the most important action mathematics teachers could take:

I'd just love them to talk to their colleagues across departments ... to start to see maths as less of a silo subject. And I think good maths teachers do that naturally. [Global learning advisor A]

Mathematics teachers in workshops and webinars have described not wanting to spoil the silent classrooms they have worked hard to achieve and this again suggests that courage is needed because discussion and collaborative working are not typical. Teachers D and E have a depth of pedagogic understanding that gives them the confidence to see possibilities where others might see potential difficulties.

Incorporating ethnomathematics

One of the challenges of teaching mathematics, in comparison to other curricular areas is the **sheer volume of content** which is required to be covered. However, these more “fun” topics lend themselves nicely to holidays, rather than watching Elf again. [Teacher A]

I believe this would be great to challenge and engage pupils, however **time in class is limited** and this may be challenging to fit into the curriculum. [Teacher B]

Ethnomathematics – I have never really delved into this area consciously, I have used different number systems to challenge pupils in ‘fun maths’ activities. This is an area **I would like to explore** and develop more resources for my classroom. [Teacher E]

This suggestion triggered responses which I think indicate this is the boundary of what is possible. These tasks would have to be left for unusual days when that boundary could stretch, such as the end of term. There is clear agreement that exploring mathematics across the globe and through history is worthwhile and regret that it is not possible, again because of a lack of time. The prioritisation of preparation

² The maths curriculum in Scotland is described as a set of Experiences and Outcomes.

for national qualifications is absolute in spite of national policy backed up by an inspection focus that the first two years of secondary school should be a ‘Broad General Education’. There seems to be no belief that any of the agreed positive outcomes from this wider experience of mathematics would support attainment and so they have to be forgone. The Scottish government is currently paying for an initiative aiming at “transforming Scotland into a maths positive nation” (Scottish Government, 2016) yet there seems to be no investigation into where a negative perception might have arisen from.

Working to achieve a democratic and inclusive maths classroom.

I believe this would be challenging as it would be conflicting to the rest of the department. Whilst group work is very important for future careers, it may not benefit all pupils to obtain their potential grades in qualifications and could be difficult to monitor and measure. [Teacher B]

This response from a probationer teacher articulates the strong neoliberal discourse (Angier, 2020) that the most important role of schools is to ensure that each individual achieves maximum certification. Activity that might detract from this, even though it could have other positive benefits, must once again be foregone. I sent each teacher a copy of their postings with my initial responses and invited comment:

What stands out for me here is the tension between expectations in terms of individual attainment and wider purposes of maths education which are not certified. There is only so far an individual teacher can go perhaps before being constrained by department/school/national policy. [Corinne]

It may be worth noting somewhere in your notes that I was a probationer when completing the activities. I do believe these effect my responses. (Limited experience – trying best to fit into department etc) [Teacher B]

The precarity of this probationer contrasts with the professional autonomy of teachers D and E above. It also demonstrates that nothing has been brought from initial teacher education which is strong enough to challenge the prevailing culture. This suggests to me that whilst work in ITE and with probationers may sow the seeds of critical stances, the contours of possibility for beginning teaches enclose a very restricted and highly monitored area.

Discussion

The participants in this study are all teachers who have chosen to spend time engaging with professional learning about global citizenship in mathematics. Their response, and lack of response to possible approaches for bringing the world into their classrooms suggest different ways in which they have accommodated the hegemonic purpose of school mathematics to achieve individual certification based on a narrow curriculum. They need professional and pedagogic courage to do anything which appears to take time away from this. There is only a glimpse in this material of what might lie behind that courage and this analysis has led me to question the structure of the task I devised for the online module. I plan to pursue three themes in my ongoing collaboration with a DEC: challenging views of mathematics, widening pedagogic practice and critical reflection on the purposes of learning mathematics. Engaging with a broader and deeper definition of mathematics is a threat to the strongly guarded and rationed resource of time. Even when activities are acknowledged to be beneficial, and even when education policy is permissive it is almost impossible to justify any deviation from preparation for national testing. It takes tremendous

personal authority and may be professionally risky. There will always be tensions with respect to time and purpose but the lack of response to the fourth suggestion draws attention to subject pedagogy. I think it will be very difficult for mathematics teachers to mediate discussion about complex global issues unless they are already used to mediating discussion about mathematical concepts. I don't think that some of the suggestions in the task can make sense within the paradigm of a mathematics classroom where the teacher is the authority who models procedures from the front and the learners' behaviour is mostly that of quiet repetition. These mathematics teachers are engaging with possible other purposes beyond acquiring certification and I hope to pursue this issue in conversations with teachers as the next stage of this research project.

This small study suggests that when teachers aspire to bring the world into their classroom they can begin to do so straight away if they are supported with appropriate resources that explicitly align with the curriculum. The DEC's have an ongoing role in providing such material and crafting professional learning that supports its use. Any activity that draws on a broader conception of mathematics or mathematics pedagogy requires courage. I am not yet able to say how this courage is developed or what mobilises it, but I conjecture that there are many different stories connected by "learning to mind" (Griffiths & Muray, 2017) and a willingness to resist dominant discourses (Angier, 2020). I believe such differences are evident in a small way here and choose to read this as deeply heartening because it suggests a wide community of mathematics teachers might ultimately feel empowered and confident to bring the world into their classrooms.

References

- de Andreotti, V. O. (2014). Soft versus critical global citizenship education. In S. McCloskey (Ed.) *Development education in policy and practice* (pp. 21-31). Palgrave Macmillan, London.
- Angier, C. (2020). Scotland's education policy of Learning for Sustainability, the Anthropocene and learning to resist. *Spark: Stirling International Journal of Postgraduate Research*, (5).
- Boylan, M. (2010). Ecologies of participation in school classrooms. *Teaching and teacher education*, 26(1), 61-70.
- Education Scotland (2019). Curriculum for excellence a refreshed narrative. <https://scotlandscurriculum.scot/>
- General Teaching Council Scotland. (2021). Learning for sustainability - a professional guide for teachers. <https://www.gtcs.org.uk/professional-standards/learning-for-sustainability.aspx>
- Griffiths, M. and Murray, R. (2017). Love and social justice in learning for sustainability. *Ethics and Education*, 12 (1), pp. 39-50.
- Scottish Government. (2016). Transforming Scotland into a maths positive nation: final report of the Making Maths Count Group. <https://www.gov.scot/publications/transforming-scotland-maths-positive-nation-final-report-making-maths-count/>
- Scottish Government. (2020). Scotland and the sustainable development goals: a national review to drive action. <https://www.gov.scot/publications/scotland-sustainable-development-goals-national-review-drive-action/pages/20/>