

Real-world geographers and GIS: relevance, inspiration and developing geographical knowledge

Grace and Nicola describe how they worked with real-world geographers to demonstrate to A level students the relevance of GIS to both their geographical education and real-world situations.

The place and value of GIS in geography education is fully acknowledged (Bednarz, 2004) with a growing consensus that it can be successfully used in 'promoting spatial literacy; supplementing fieldwork and in enhancing pupils' visualisations of geographical phenomena in increasingly interactive digital environments often through geographical enquiry' (Fargher, 2017b, p. 151). The 2014 National Curriculum for Geography in England states that students should 'interpret a range of sources of geographical information, including ... using GIS to view, analyse and interpret places and data' (DfE, 2013), and examination specifications at GCSE and A level refer to the use of GIS. However, recently there has been increasing discussion as to the purpose of GIS within geography education. For example, Fargher (2017a) sets out the importance of geography teachers considering what forms of geographical thinking can be achieved through using GIS in the classroom. While Walshe (2018) emphasises the capacity for GIS to develop students' powerful geographical knowledge by drawing upon Maude's typology (2017) as shown in Figure 1. In response to this, our recent research considered the potential for GIS in these areas by exploring how integrating programmes using GIS into an A level geography course both develops students' perceptions of the nature and value of GIS and impacts on their acquisition of geographical knowledge (Healy and Walshe, in review).

This article focuses on how learning from real-world geographers about the GIS they use in their everyday jobs can engage students. The GIS programme we developed to complement the year 12 students' geography course was supported by real-world geographers, including industry experts both from local contexts and from the GeoMentors network set up by Esri UK and the Royal Geographical Society (with IBG): see Figure 2. The real-world geographers gave presentations on GIS use in real-world situations, but there was also a focus on developing students' geographical thinking and knowledge, and engaging with geographical enquiry. There were 16 students in the class and the majority were female. These students' initial perceptions of the nature and value of GIS have been more thoroughly explored in Healy and Walshe (2019).

Place studies

As part of the AQA Changing Places unit of work, students were introduced to two place studies, discussed in a previous *Teaching Geography* article (Healy, 2018). The first, based on Digbeth in Birmingham, was presented by Katie Hall from the Esri Education team who prepared a story map and set of activities to explore lived experience in Digbeth, including transferring geo-tagged walking interview responses from Dr Phil Jones' Rescue Geography Project into GIS to enable students to engage with them (Jones and Evans, 2012). Walshe (2016) provides a more detailed description of how story maps can be used in school geography. The second, an examination of social inequalities in the Mill Road area of Cambridge, was taught through an information pack and exercise presented to students by their class teacher. We used a questionnaire to find out which of these contrasting approaches to a place study students found more useful and why. Eight out of the eleven students who completed the questionnaire preferred the GIS approach, two preferred the paper-based approach and one thought they were equally useful. Students who preferred the GIS approach commented 'information [was] more direct and clearer to understand. More statistics and more maps and diagrams to manipulate and analyse' (Eva); 'it was more interactive and memorable' (Gabiella); and 'it was more visual so could clearly see data in and around the area' (Reagan). As such, it seemed that GIS made a wider range of secondary data easier for the students to access and interact with.

Figure 1: Typology of powerful geographical knowledge (after Maude, 2017).

Type of powerful geographical knowledge	Description
Type 1	Knowledge that provides students with 'new ways of thinking about the world'
Type 2	Knowledge that provides students with powerful ways of analysing, explaining, and understanding
Type 3	Knowledge that gives students some power over their own geographical knowledge
Type 4	Knowledge that enables young people to follow and participate in debates on significant local, national and global issues
Type 5	Knowledge of the world

Type of GIS input	Details of the GIS input
Using GIS to develop knowledge of place	<ul style="list-style-type: none"> • Story map task on a chosen place (with focus on location, locale and sense of place) (Autumn 1) • Using GIS to explore socio-economic characteristics in Digbeth (Autumn 2) • Using GIS to explore lived experience in Digbeth with Katie Hall (Esri) drawing on data from Dr Phil Jones' Rescue Geography project (Jones and Evans, 2012) (Autumn 2)
Learning from real-world geographers about GIS use	<ul style="list-style-type: none"> • Presentation by Elly Greenway (Rivers Trust) (Autumn 2) • Presentation by Lance Corporal Smith (pseudonym) from the 42 Engineer Regiment (Geographic) and Daran Scarlett (Esri – Defence, National Security and Public Safety) (Autumn 2)
Using GIS as part of a fieldwork enquiry	<ul style="list-style-type: none"> • Esri Education support for preparation for field trip exploring whether there is a positive place attachment to Mill Road (virtual lesson by Katie Hall) (Spring 1) • Use of Survey 123 as part of data collection (Spring 1) • Esri Education support for exploration and analysis of data (virtual stimulus and support session by Katie Hall) (Spring 1)
Using GIS to learn about storm hazards	<ul style="list-style-type: none"> • Developing students' understanding of the spatial distribution, frequency, and predictability of storm hazards using GIS with support from Lance Corporal Smith and Daran Scarlett (Spring 2) • First-hand accounts of how GIS supported the Forces' response to Hurricane Irma and examples of the software designed to aid decision-making by governments/NGOs (Spring 2)

Figure 2: GIS input programme.

Later in the term, when they began planning their fieldwork enquiry, students also seemed to find exploring and analysing secondary data easier using ArcGIS Online in the initial phases of their fieldwork enquiry. For example, in her final interview, Heather suggested that access to data within ArcGIS guided the questions she was able to ask: 'it was being able to visually see, say, the crime data for example or the IMD data and then starting to think [and] ask questions about that once you'd seen it'.

A fieldwork enquiry

Later in the academic year, Katie Hall supported the class via Skype with interactive pre- and post-fieldwork GIS training sessions. This enabled the class to engage with secondary data whilst planning their data collection, and to use Survey123 for their data collection and data presentation. Figure 3 shows examples from the Survey123 web form builder and Survey123 graphs of the collected data from the students' fieldwork enquiry exploring whether there is a positive place attachment to Mill Road in Cambridge. This illustrates how students can easily access their geo-tagged data and visualisation of their results, as soon as they return from collecting their data. The training sessions and fieldwork enquiry are discussed in more detail in Healy *et al.* (2018).

GIS in real-world geography

The students also learnt about how GIS is used in real-world situations. Firstly, Elly Greenway's presentation explained how the Rivers Trust uses GIS to protect and promote river environments in the UK; secondly, Lance Corporal Smith and Daran Scarlett held a seminar on the different ways the military use GIS. Questionnaires (Figure 4) after the sessions explored student perceptions.

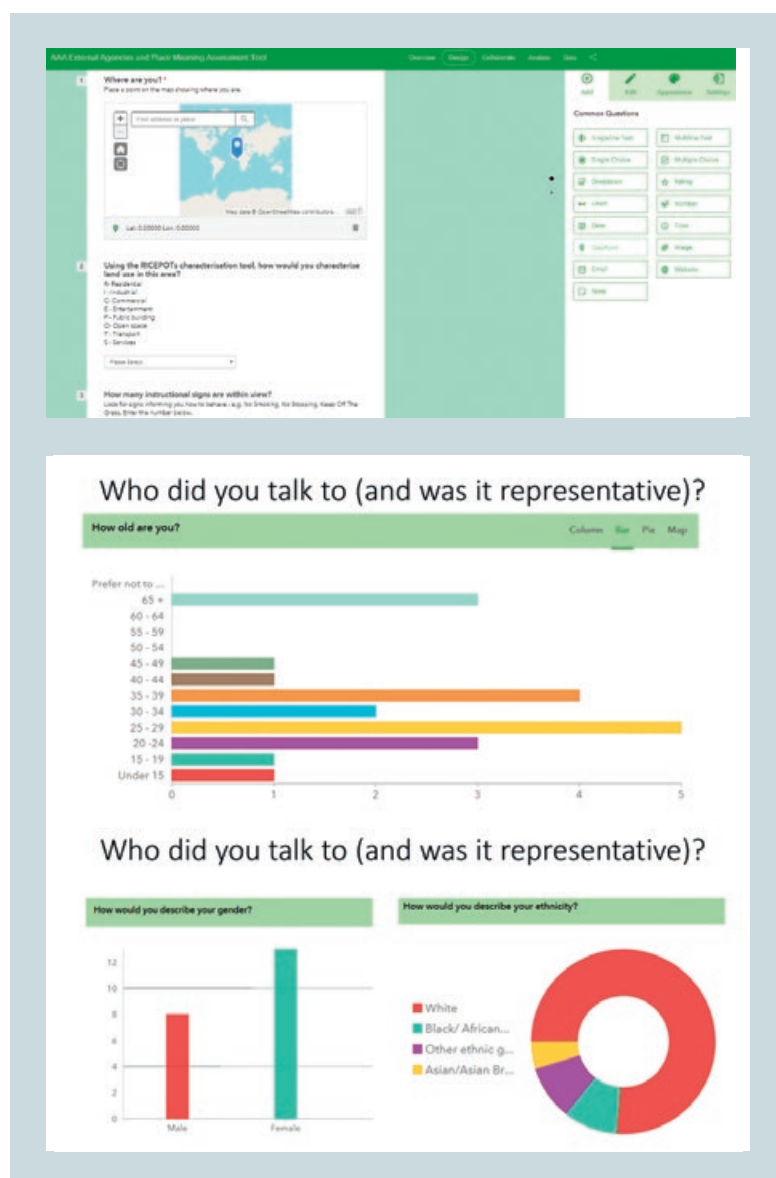


Figure 3: Examples from a student's fieldwork enquiry: (a) the Survey123 web form builder; (b) Survey123 graphs of the collected data. Source: Healy *et al.*, 2018.

Figure 4: Excerpt from Questionnaire 4 exploring student perceptions of the wider relevance of GIS.

6. You have recently had two talks from industry experts of GIS:

- one from Miss Greenway about the Rivers Trust; and
- one from [redacted] and Daran Scarlett which talked about how [redacted] uses GIS through the army.

Put a tick in one of the following boxes for each talk:

	Miss Greenway				[redacted] and Daran Scarlett		
	Not at all	A little	A lot		Not at all	A little	A lot
To what extent do you think these helped you to understand real-world applications of GIS?							
To what extent do you think these helped you to understand how GIS might be relevant to your life or future career?							
To what extent have these supported your learning geographical knowledge?							

7. How do you think working with real-world GIS experts has helped you to understand the applications of GIS?

8. Can you give an example as to how hearing from these real-world GIS experts has supported your learning about geography?

All students thought the sessions had helped them understand real-world applications of GIS and supported their geographical learning (Figure 5). The majority also felt that the real-world geographers contributed to their understanding of how GIS might be relevant to their lives and future careers.

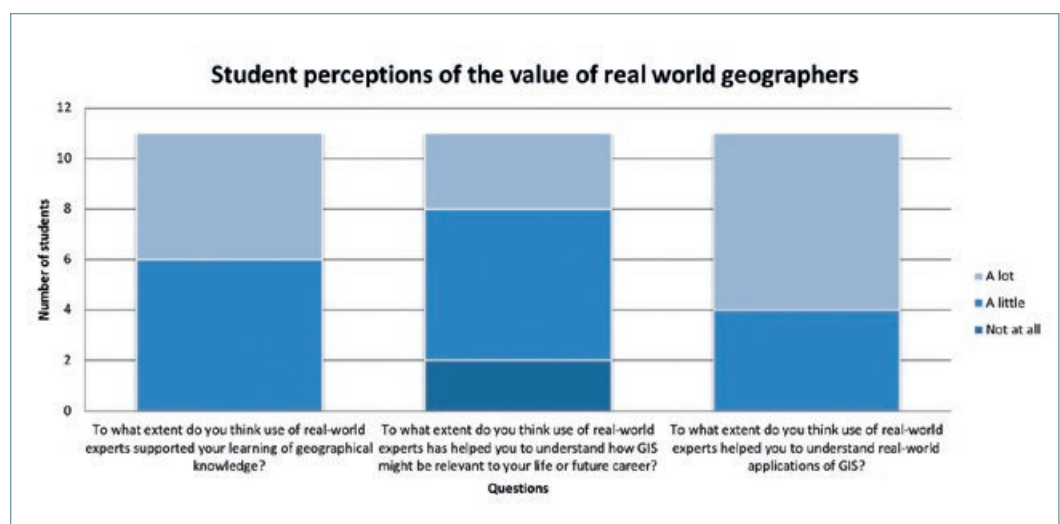
The role of GIS in the response to a storm hazard

Prior to the real-world geographers working with students, there was a significant amount of time given to preparation and planning with the GeoMentors to ensure this would complement

the students' A level geography studies.

A seminar by Lance Corporal Smith and Daran Scarlett provided the students with first-hand accounts of how GIS was used to support the Forces' response to Hurricane Irma. Weaving together learning about how GIS is used as part of a relief effort with geographical knowledge that contributed to their case study of Hurricane Irma made a valuable contribution to the students' A level geography. From a teaching perspective, this appeared to be an incredibly powerful opportunity for students to deepen their understanding of a case study in a way that would not have been possible without the engagement of the GeoMentors.

Figure 5: Bar chart of student perceptions of the value of real-world geographers based on Questionnaire 4.



Students' perceptions of real-world geographers supporting their use of GIS

At the end of the spring term, a final set of questionnaires and interviews asked students how they thought their engagement with real-world geographers supported their work with GIS. Three key themes emerged.

Illustrating the relevance of GIS

A significant number of students (24 mentions, 40% of the 60 comments) felt that real-world geographers gave them a clearer understanding of the relevance of GIS to geography and to their wider lives. For example, Gabriella commented on 'how cutting edge it is and how far it's developing, how it is used in real world situations'. The engagement with real-world geographers also enabled them to see how GIS was connected to their everyday geographies, an example of what Roberts (2017) calls 'powerful pedagogies'.

Making sense of how GIS can be used

Students started the academic year with very little knowledge of where or when GIS could be used, but by December they were all able to describe a range of applications for GIS (e.g. government analysis of census data, management of flood risk, aiding military identification of bomb targets). Beyond this, students also began to appreciate the practicalities around how GIS is used and how different stakeholders might draw upon geospatial data.

Real-world geographers as inspiration

The real-world geographers were also a source of inspiration. Reagan talked of been amazed

about how the military could use GIS to help in the aftermath of the Haiti earthquake, and how this opened her eyes to how much difference GIS could make. Even those who had seemed sceptical of GIS appeared to be engaged by the GeoMentors. For example, Raoul suggested that after hearing how GIS was used by the real-world geographers, it did seem 'cool' and 'interesting'.

Conclusions

By making different geographical sources accessible to students and providing first-hand accounts of how GIS is used in their work, real-world geographers can play a significant role in making GIS relevant both to students' lives and their geographical studies. However, any collaboration with real-world geographers requires detailed preparation and planning to ensure that the links between the GIS work of the real-world geographers and the students' A level geography course are made explicit. Furthermore, we suggest that the work of real-world geographers provides situations and contexts to show how knowledge is constructed in GIS. This goes some way to addressing Fargher's (2017b) call for teachers to engage students with how knowledge is constructed within GIS and the implications of this for the types of geographical thinking that can be achieved.

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- More details about becoming involved with the GeoMentor network are available at: <https://schools.esriuk.com/geommentor> (last accessed 25/02/19).

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