This article considers the evolution of computer use in school geography, as seen through the 45 volumes of TG, to see how we have arrived where we are. The hardware and software that seem ubiquitous today has actually only been in use for a few years (see accompanying download). In 1976 the GA received one year of funding to create a library of computer-aided teaching units and to co-ordinate the activities of those creating them (Walker, 1976, 1, 3). TG encouraged teachers to register their interest, because if there was a poor response the service would be disbanded. Teachers did not disappoint: computer use in geography became, and has remained, a core topic in the journal.

Pioneering

Computers had been used in universities to analyse data since the early 1960s, at a time when teachers still tended to ‘feed’ information to their students. By the mid-1970s the quantitative revolution in geography had reached some schools whose teachers worked with computer staff at universities to write programs for students. These programs enabled school students to add data to standardised forms and make large numbers of calculations that would have been impracticable on a calculator. Such data analyses included the study of spatial distributions in fieldwork, using multiple correlations to investigate variations in social data, and a database project named RURAL for central place study, with 28 variables for settlements in a county to help classify them (Stevens, 1976, 2, 2).

A pivotal moment for computing in schools arrived with the BBC Micro at the end of 1981 (Figure 1). The BBC B model was popular; by the end of the 1980s more than 1.5 million had been sold and around 80% of UK schools had ‘Beeb’ microcomputers.

TG took a leading role in facilitating computing for school geographers. From 1983–2006 TG included a section, often quite weighty, called The TG Computer Page. It published brief evaluations of software for geography teachers. The first review was of a program called CLIMATE, involving the recognition of climate type from data or graphs, intended for demonstration purposes or individual student use with the 14–16 age group (Walton, 1983, 9, 1).

Computer-assisted learning (CAL) came of age, with commercial programs written specifically for school geography. The number of reviews increased, reaching 13 in the October 1985 edition. These covered topics from urban growth, Malthus, patterns of development and weather forecasting to locating an industry or an oil rig. The review of MICROMAP found it to be a stimulating medium for the learning and practice of map skills (Duckworth, 1985, 11, 1).

Nonetheless, despite thousands of teachers having attended computer awareness courses, surveys in individual schools and nationally showed that very few teachers had integrated microcomputers into their classroom practice (Selmes, 1984, 10, 1). Factors frustrating the use of micros in schools included problems of accessibility, fear of using a keyboard, and an erroneous belief that programming had to be mastered first. Additionally, programs were not considered a tight cycle of learning that teaches a student something by itself. Programs were generally devised for students to learn from so micros were often seen as an intrusion into the teacher-led classroom.
Teachers were encouraged to view programs and learning as problem solving exercises, identifying pertinent aspects of a program and devising instructions for students to concentrate on observing and thinking about the geographical situation. So in using the Schools Council’s Computers in the Curriculum Project program DEMOG2, instead of constructing and learning national population pyramids from a database the learning focus might be directed to answering the problem of ‘what is the effect of birth control on population structures?’. There was an opportunity for more relevant, interesting and thought-provoking teaching and learning by focusing on the how of learning (op cit., 1984).

Consolidating

Until the mid-1980s most software was published for BBC B and RML3802 micros. Then in 1984 the Apple Mac arrived (Figure 1). It was the first successful mass-market personal computer with a graphical user interface, built-in screen and mouse, and was hugely successful in education for over a decade.

A more student-centred approach to learning was given a boost by CAL developments, often led by local education authorities and their geography advisors. The Inner London Education Authority (ILEA) recognised the potential for computer use in fieldwork and encouraged groups of teachers to develop software (Lawler, 1987, 12, 2). As advanced calculator and graphics display devices, such programs enabled students to create and manipulate a variety of graphs from their own data. Using the DRAINAGE program students could input their fieldwork data on rivers, processing it to compare hydrographs with their own data. Using the DEMOG2 students were urged to create worksheets for students to trend new hypotheses.

Linking the micro to satellite systems markedly improved students’ enthusiasm for geography. The Dyfed Satellite Project enabled schools to receive images directly from NOAA satellites, cloud analysis assisted students to track weather systems and attempt to predict the weather (Hindson, 1988, 13, 2). At Slapton Ley Field Centre students collected data and used statistical programs to analyse patterns, creating hydrographs from remote sensing data loggers, and using interactive videodiscs (IV) to develop management plans for the nature reserve (Chell, 1988, 12, 2). IV stored pictures, maps and data that could be searched and manipulated at speed (Davidson, 1988, 13, 4). Topics on the Doomsday discs included weather, hydrology, the changing world, ecology and volcanoes. Teachers used these for enquiry-based learning, such as geographic decision-making exercises.

With computers revolutionising the workplace, the BBC and the government had developed the BBC microcomputer for schools, and the Technical and Vocational Education Initiative (TVEI) channelled funds and training into schools for equipment and using micros in lessons.

Then came the National Curriculum and GCSE, consolidating computer use in the curriculum. This gave students an entitlement to computer experiences across the curriculum to develop their transferable Information Technology (IT) skills. Despite all the excellent software available, many geography teachers still lacked the skills and confidence to use computers as a teaching tool (Heinrich, 1989, 14, 4). Another limitation was the availability of hardware: each classroom needed a number of micros, preferably networked, and all schools needed bookable computer rooms.

Mainstreaming

With the 1990s the innovative TG Computer Page(s) morphed into substantive articles in an Information Technology section, and software evaluation moved to the Reviews section. New hardware and software developments transformed the use of computers in lessons. CD-ROM enabled large quantities of text, images and audio to be stored and searched rapidly. Searchable material could be saved, incorporated into word documents and printed, enhancing the process of geographical enquiry (Russell, 1994, 19, 2).

A wave of new CD-ROM resources included encyclopedias, atlases (e.g. the long-running World Atlas), and databases (e.g. Exploring Earth Sciences). Encarta was both geographical encyclopedia and atlas, with detailed maps, cultural and general information, over 3000 photographs and video clips from 188 countries, organised under seven themes like tourism and urban change (Luker and Hassell, 1996, 21, 3). The effective use of CD-ROM included structured search and retrieval of real-world information as well as more independent and engaging enquiry routes through the data, requiring teachers to design the key questions (Martin and Swift, 1996, 21, 1).

Access to remote sensing, using electronic instruments to continuously record weather elements and using satellite image data, also became realistic. Weather Reporter consisted of an automatic data-logging weather station mounted on the roof of a school building. When connected to a computer, weather data could be stored in spreadsheets and displayed graphically. School geographers could track real-time weather such as depressions, seeking relationships between elements and explanations for changes (Whiddon, 1992, 17, 3). The National Remote Sensing Centre (NRSC) produced packs of false-colour LANDSAT satellite images plus transparent maps of the same area, enabling students to extract real-world information to investigate hypotheses like ‘does the density of housing decrease from the centre of a settlement?’ (Selmes, 1991, 16, 4) – virtual fieldwork using a manual Geographical Information System (GIS). Software for computer-based GIS studies were also becoming available for schools, from AEGIS to ArcVIEW and IDRISI (Freeman et al., 1997, 19, 1).

The World Wide Web was becoming an important resource. To encourage students to read more widely, but avoid unstructured surfing, they could be given good resource links on a topic. Teachers were urged to create worksheets for students to find and record specific information, allowing learners to take personal control of the sequence of their research, and apply this information in answering questions (Taylor, 1997, 22, 1).
From 1996 examination syllabuses provided guidance on the use of IT in coursework. Students could submit coursework in word-processed format. Graphs, charts and maps could be produced using IT, although to prove that a student had the relevant knowledge and skill at least one had to be hand-drawn. Access, when tens of students might simultaneously require a computer each, remained a problem (Hassell, 1996, 21, 2).

By 1997, surveys of the state of geography in secondary schools undertaken by the GA’s Secondary Education Section Committee (SESC) suggested that there had been large increases in computer availability and a clear majority of geography teachers had at least one computer in their department and reasonable access to whole-school facilities. Around half had an automatic weather station (Donert and Grimwade, 1998, 23, 2). Computer use in school geography was becoming mainstream.

**Twenty-first century**

Developments since 2000 have resulted in more sophisticated devices, faster processing speeds and multimedia use. They have enabled a more personal input into computerised learning. But has computer use in geography lessons become more common?

As teachers gained confidence in using the internet, students were encouraged to use it to research topics or issues in greater depth or breadth. Some teachers created their own websites, such as GEO (Geographical Enquiry Online) allowing students to develop research and IT skills in school and at home (Cartmel, 2000, 25, 3). Some teachers began creating geographical ‘blogs’ to guide colleagues towards resources or where students might record their perceptions of places or concepts (Parkinson, 2004, 29, 3). Interactive lessons began to be integrated into sequences of learning, using on-screen instructions to complete geographical enquiries, or problem solve while learning about a topic or issue (Dixon, 2004, 29, 2). As broadband connectivity improved, departmental websites – both internet and intranet – began to offer ready access to lesson plans, and resources for new and experienced teachers, acting as an incentive for generating fresh materials, as well as supporting students’ independent learning (Mitchell, 2007, 32, 1).

Map skills received a boost from internet mapping. With growing realisation of the Mercator projection’s exaggeration of higher latitude countries, new cartograms called Worldmapper, using the new area-accurate Peters’ projection, changed perceptions of the world (Barford and Dorling, 2006, 43, 2). It gave access to historical maps from 1890s and 1950s and to 5.5 million grid-referenced images, including aerial images. Content could be added to maps in textboxes or as symbols or photos, distance and area could be measured, data on spreadsheets could be uploaded onto maps. Enquiry learning was in real time and real places.

The use of GIS in lessons was further encouraged by its inclusion in the National Curriculum from 2008. Some teachers sought opportunities not only to develop students’ software skills but also their understanding of GIS principles (O’Connor, 2007, 32, 3). Three conceptual levels were suggested for a progressive curriculum: presenting spatial data; data processing and display; and inputting and editing spatial data. Students could then progress from knowing where things occurred to asking questions about why things occur where they do.

Structured enquiry using Google Earth satellite imagery empowered teachers to devise lessons to study real places following a trail of content, applying student knowledge to understand and explain what they found (Mitchell, 2010, 35, 1). Students said they experienced more flexibility and fun in their learning but also claimed to have learned more than from watching a video. GIS platforms, such as ArcGIS Online, enabled teachers to readily create, view, interrogate and display a wide range of data (Walsh, 2016, 41, 3). Story maps could be accessed from the ArcGIS Online library or created by teacher or student to combine text, photographs, data and video to tell the story of a geographical place, event, issue or pattern. It was said to benefit students’ spatial awareness and geographical thinking beyond what was possible in other presentational software such as PowerPoint.

With new GCSE specifications emphasising effective use of Information and Communications Technology (ICT), geography coursework changed. Secondary data to support primary data had become easier to access. Most teachers noticed a sustained positive impact on student motivation (Taylor et al., 2007, 28, 2).
Interactive whiteboards (IWBs) enabled students to interact with images and data, appealing in different ways to visual, kinaesthetic and auditory learners, and so enhancing teaching and learning. One resource could be used with a whole class. IWBs allowed interaction with video or images and internet content; PowerPoint worksheets or quizzes could be completed, storyboards created and annotated and sound added. In early iterations, advice to teachers concerned choosing appropriate size and robustness, as well as the need for good training with the software (Todd and Jackson, 2003, 28, 4). As the multimedia impact of IWBs became more widely appreciated thoughtful teachers used them to plan dynamic lessons and materials for student-centred learning (Bayliss and Collins, 2006, 31, 3).

As smartphones and tablets became ubiquitous their downloadable apps became a means of enhancing learning (Shipman, 2014, 39, 1). Content apps and fieldwork apps, allowing students to collect and store data, were especially useful. Mobile digital technology opened up new opportunities for engagement-rich fieldwork. Web 2.0 technologies enabled seamless online interfaces to be created by teachers. One combined Microsoft SWAY storyboards with PADLET, a mechanism for students to add and share multisensory content, and with Google Maps, allowing students to orientate to key locations (Hazelidine and Walker, 2019, 44, 2).

Experiments with virtual fieldwork allowed students to explore environments that were inaccessible to them because of distance, financial or time constraints on actual fieldwork. For instance, using the BRITICE Glacial Mapping Project websites students gained ‘experience’ of being in a glacial environment of the Lake District, learning to visualise landforms and observe evidence of processes (Matthews, 2020, 45, 1). Students enjoyed the interactive elements and felt they gained a better understanding of a glacial environment than from a standard lesson, and that it was a challenging and rewarding geographical experience.

So where are we with computers?
In 2002, when the GA’s SESC surveyed 496 geography departments, more than 80% had their own computer and 25% had more than 15 (Thompson et al., 2002, 27, 2). Good access to whole-school ICT facilities was reported in 67% of schools with poor access in only 5%. Word processing was the most significant application, with GIS used by only 3% of departments (Figure 3). There has been no comparable survey since. However Ofsted (2011) found that most geography teachers were competent with ICT, had good access to the internet and high quality software, used digital projectors and IWB to enhance the presentation of information; but that there was little interactive use. Visual images via the internet brought immediacy to learning and satellite technology brought landscapes to life, but GIS was only experienced by a small number of students. Most teachers were reluctant to use this technology, despite curriculum requirements, and access to hardware was sometimes difficult.

These limiting factors were similar to those in the 1980s, although there have been myriad advancements in technology and practices. Computers in education may enhance, substitute for or supplement teaching methods and learning, or they can transform how we teach, changing and redesigning learning (Shipman, 2014, 39, 1). Readers will be able to reflect on their own experiences and current practices in using computers in teaching geography. Ideas might be gleaned from looking through the TG archives. Whether computers become transformational to geographical learning depends on us all.

References