

# COLLABORATING IN GISCIENCE EDUCATION: PAST TRENDS, FUTURE POSSIBILITIES

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## 1. Introduction

This paper is concerned with exploring various types of collaboration among tertiary-level teachers of Geographic Information Science (GISc). Whether or not you consider teaching a collaborative or competitive activity might depend on whether you associate more with the 'acquisition' or 'participation' metaphors of learning (Sfard, 1998), but the chances are that it will involve elements of both competition and collaboration. We compete to attract 'good' students, to earn their respect, and to drive our particular academic agendas, which increasingly are motivated by numeric targets (whether in terms of numbers of students or financial returns). Yet we also collaborate when we participate in departmental teaching, and participate in the pedagogic research process outside of our departments, for example by sharing results through the literature, refereeing papers, and participating in joint projects. From time-to-time such collaboration extends to the development and/or delivery of teaching materials with individuals beyond the department, perhaps from across a number of Higher Education Institutions (HEIs). A mix of collaboration and competition - what management theorists call 'transcompetition' (see for example Robbins and Finley, 1998) - is not necessarily a bad thing and may in fact be an optimal strategy in certain situations.

The community of practice (CoP) has been lauded as the 'epitome of interpersonal collaboration' (Gajda and Koliba, 2007: 1) and a scaffold for both tertiary-level education staff learning and development (Bathmaker and Avis, 2005; Javitz, 2007; Trowler and Knight, 2000). CoP theory (originally introduced by Lave and Wenger, 1991) is a social theory of largely informal, organic, practice-based situated learning which has its roots in the sociocultural theory introduced by Vygotsky (1978). Although the definition of a CoP has been modified over time (Cox, 2005), Wenger (2004: 2) has described the essence of CoPs as social structures comprising:

Groups of people who share a passion for something that they know how to do, and who interact regularly in order to learn how to do it better.

The emphasis here is upon the generation of largely *tacit* (Polanyi, 1967), *soft* (Hildreth *et al.*, 2000) *procedural* knowledge gained as an individual becomes socialised within a particular workplace community engaged in a particular practice. In the parlance of Duguid (2005) (after Ryle, 1949) the emphasis is upon learning to know *how* rooted in practice, rather than learning to know *that*. Lave and Wenger (1991) originally conceptualised CoPs in the context of the novice/apprentice learning the 'tools of the trade' under the guidance of 'old hands'. As such, CoPs have direct application in the facilitation of induction / initial professional development of new staff, the continued professional development of existing staff – both in a tertiary context, and perhaps as one route to the integration of teaching and research at department level (Healey, 2005).

## 2. The Contingent Nature of GISc Pedagogy

Although it had been out on the fringes for many years, when GISc eventually surfaced into the collective academic geographical conscience in the 1980s it had a number of characteristics relevant to the how, when and why of its being taught. The arrival of a 'new' subject meant that there was little collective experience of (1) what constituted its subject matter and in particular (2) how it should be taught. The parallel emergence of a rapidly growing industry based on and around geographic information meant that we had for the first time to introduce elements of 'professional' education and practice into our courses (Dale and Unwin, 1990). Lastly, we also had to find the hardware, software, and data resources to support the teaching and learning of GISc. There is an extended, if dated, account of these contextual factors in Unwin (1991; updated in Forer and Unwin, 1999).

An immediate collaborative response to these problems was to talk about them. GISc educators have a twenty-year history of meetings for which educational issues have been the concern. In the USA these were initiated by Duane Marble at OSU and continued by Jay Morgan in Florida. In UK and under the auspices of the national Centre for Computer Assisted Learning in Geography, David Maguire and David Unwin organized a similar meeting, taking the somewhat unusual step of inviting Alan Jenkins, a past editor of JGHE but at the time a determined technophobe, to sit in on the discussions. Alan's slightly bemused reactions can be found in Jenkins (1992), where he notes with what was probably guarded approval how unusual such meetings were in other branches of the subject. In the USA the University Consortium for Geographic Information science<sup>1</sup> has continued this tradition of educational meetings since 1996. In Europe we have the biennial European GIS in Education Seminar<sup>2</sup> (EUGISES) that has met in the Netherlands (1998), Hungary (2000), Spain (2002), Austria (2004), Poland (2006), and England (2008).

There are two important consequences of these early developments. First, it will be evident that GISc teaching has always had a strong international flavour and, second, that these meetings have laid the foundations of friendship and trust that has underpinned subsequent both formal and informal collaborative teaching activities.

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<sup>1</sup> [www.ucgis.org](http://www.ucgis.org)

<sup>2</sup> [www.eugises.eu](http://www.eugises.eu)

## Example 1: The NCGIA Core Curriculum

The most important early collaborative venture was the US National Center for Geographic Information and Analysis (NCGIA) Core Curriculum of the late 1980s. Around that time a number of people developed model GIS 'curriculums' (see Poiker, 1985; Nyerges and Chrisman, 1989) that were essentially syllabuses that outlined suggested course *content* (see Unwin *et al.*, 1990). In the parlance identified above, this could be described as *explicit* (Polanyi, 1967) *hard* (Hildreth *et al.*, 2000) *propositional* knowledge. The NCGIA team realized that if their agenda – to promote geographic information use and analysis – was to be advanced, then teaching staff who go on to teach their students was a good way to go about it. Accordingly, Michael Goodchild and Karen Kemp coordinated the development not just of a model syllabus but a complete curriculum with individual units contributed by numerous scholars drawn from a wide range of countries and interests. The result was distributed as paper notes with OHP foils, specimen examination questions, and some ready-to-run laboratory classes using cheap GIS software. No claims were made for copyright or other intellectual property rights, and the materials were distributed more-or-less at the cost of duplication.

The result was a spectacular success (see Kemp, 1992, Kemp and Goodchild 1992a, 1992b), with the curriculum kick-starting developments at numerous educational establishments, world-wide. Perhaps less desirable was a tendency for GISc teaching to continue to be based on this product and the concepts it established, at the expense of more recent developments in both the science and technology, and pedagogy. As a not entirely irrelevant aside, readers might like to contrast the evident success of the essentially *collaborative* NCGIA especially in terms of its long-lasting influences with the relative failure of the Economic and Social Research Council in UK's Regional Research Laboratory initiative, in which the main driver was research and that set laboratories up in *competition* with each other.

Apart from the usual use of materials from texts written by others, use of the NCGIA core curriculum materials was for many university teaching staff their first experience of teaching using materials drafted by other people. In 1988 a group at Leicester University, (David Maguire, Alan Strachan, Mitch Langford and David Unwin) contracted to test the core curriculum materials, using them as the basis for a Masters level course in GIS. There is no doubt that we could have developed this course entirely from our own materials, but the fact remains that their existence made the start-up pain of a new course in an entirely new field much less than it might otherwise have been. One of the great merits of the curriculum was the simple fact that each and every unit was drafted by a recognized authority in the field. Second, although the NCGIA materials formed the core of our course, we spent time customizing their content for use in UK and in providing what we like to think of as a curriculum 'wrapper' in the form of tutorials, seminars, additional laboratory classes and research supervision. One very clear lesson from the experience is that the ability quickly and easily to customize this type of resource (the units were distributed as machine-readable text files<sup>3</sup>) is essential, as was the relaxed attitude to ownership and intellectual property rights. Interestingly, an

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<sup>3</sup> still available at <http://www.geog.ubc.ca/courses/klink/gis.notes/ncgia/toc.html>

attempt to develop a second version of the curriculum seems to have stalled around the turn of the millennium<sup>4</sup>.

This isn't to claim that the NCGIA was the first or even the only geography project to develop ready to run curriculum materials. Those with long memories will recall the AAG's Commission *on College Geography Resource Paper* series. If you are interested in introductory technical education for geographers, then *The Geographer's Craft* and *Virtual Geography Department*<sup>5</sup> at the University of Colorado at Boulder are worth a look. In UK over the same period there has been a raft of central teaching resource development projects. Almost all of them were justified and funded by an information technology interest: The Computers in Teaching Initiative, Fund for the Development of Teaching and Learning, teaching and Learning Technology programme, Joint Information Systems Technology Applications Programme and so on. With the exception of the Geography Discipline Network<sup>6</sup>, and the current work of the Higher Education Academy Subject Centre for Geography, Earth and Environmental Sciences (GEES)<sup>7</sup> and the newer HEFCE-funded SPLINT Centre of Excellence<sup>8</sup> very few seem to have created any resources that have stood the test of time.

### **Example 2: The UCGIS Body of Knowledge**

Our second example, the joint AAG and UCGIS *Geographical Information Science and Technology Body of Knowledge* (BoK)<sup>9</sup> and the book itself, which is DiBiase *et al.* (2006). This is perhaps one of the most interesting developments not only in GISc education but also in geography itself. It has a long history. Recognizing needs in GISc education to provide both academic rigor and meet the needs of a very rapidly expanding workforce, Duane Marble (then at Ohio State) organized a series of late 1990s workshops to explore the development of what were called 'model curricula'. After an influential 'straw man' report, it was decided to lay the necessary foundations for such curriculums by the specification of the 'body of knowledge' that GISc encompasses. This led to a massive, international collaborative effort. Guided by the seven editors some fifteen contributors working in turn with over fifty advisors and reviewers, this has resulted in a genuinely community developed inventory of the knowledge and skills that define the field.

This Body of Knowledge is divided into ten knowledge areas, with some 73 units covering 329 topics, but it is no sense a curriculum or syllabus. What it does in each topic is to articulate a series of intended learning outcomes (ILO) appropriate for that topic and its stated aims. In total here are over 1,600 ILOs making up the BoK. This design through explicit aims and objectives is reminiscent of Chapter 10 of *Teaching Geography in Higher Education* (Gold *et al.*, 1991). Although at that time the advantages of this approach were noted, the full potential of such an approach was perhaps not recognized. It has taken the more recent interest in constructive alignment (Biggs, 1996) to fully realise the potential of curricular ILOs. At first sight you might think that in the BoK we have come full circle to the precursors of the NCGIA core curriculum but

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<sup>4</sup> <http://www.ncgia.ucsb.edu/gisc/>

<sup>5</sup> <http://www.colorado.edu/geography/virtdept/contents.html>

<sup>6</sup> <http://www.glos.ac.uk/ceal/qdn/index.cfm>

<sup>7</sup> <http://www.gees.ac.uk>

<sup>8</sup> <http://www.splint-cetl.ac.uk>

<sup>9</sup> <http://www.aag.org/bok/> , <http://www.ucgis.org/priorities/education/modelcurriculumproject.asp>

there are some important advantages. First and foremost, the specification by ILOs makes it a reference work for use by educators, curriculum planners, and evaluators in the design, accreditation, assessment and evaluation of programme of study. Second, they also make it useful as a basis for comparison of educational programmes by prospective students. Third, for those either outside or at best on the fringes of GISc they provide a basis for professional certification, for articulation agreements between and among higher education institutions, and for human resources professionals seeking guidance in employee recruiting, selection, and continuing professional development.

### **Example 3: eSeminars in GISc**

Whatever one thinks of the World Wide Web, there can be no doubt that it has revolutionized our ability to share materials that almost by definition are in machine-readable form. Scott *et al.* (2007a,b,c) have noted the learning opportunities of 'computer supported collaborative environments' such as synchronous videoconferencing where:

Learners can now collaborate with each other, exchange views on common activities, critique each others work; share learning material and study together in a world-wide context (Scott *et al.*, 2007c: 1)

One exciting prospect is the ability such environments provide for close international teaching collaborations. For example, the Worldwide Universities Network (WUN) is an alliance of 16 research-led Universities in Australia, China, Holland, Norway, England, Canada and USA. Within this network a variety of Masters level teaching collaborations have been established. Our third and last example concerns the collaborative provision and teaching use of graduate-level seminars organized by the WUN in collaboration with the UCGIS and the Quantitative Methods Research Group of the Royal Geographical Society (with the IBG).

The first series in 2005 looked at *Ethics for GI professionals* and was hosted out of Pennsylvania State University using their local virtual learning environment and for the most part addressing the curriculum needs of a graduate level professional course. In 2006 this was followed by a trial series with the catch-all title of *Hot topics in GISc*. The next series focussed on *Spatio-temporal modelling* and in 2007 with presentations by ten graduate students on *Graduate research in GISc*. Building on the knowledge acquired in these initial series, during the Autumn of 2007 Dr Tim Nyerges (Washington) and one of us (David Unwin) organised a series of six presentations on the theme of *Public Participation GIS*. These seminars were run much as the usual university seminar but with some important differences:

- Through the WUN and its collaborators we were able to arrange for presentations from some of the world's leading authorities in the chosen field, certainly more than might be assembled by any one of the participating institutions for face-to-face presentations;
- The Marratech™ extended desk-top video conferencing system video and audio-conferencing environment enabled synchronous participation from almost

- anywhere with an appropriate computer and broadband internet link. To date, it has proved a remarkably versatile and stable platform;
- In consequence the seminars can be attended by as many participants as our server can accommodate. To date, our 'record' has been upwards of 60 client machines seen by perhaps 80 individuals;
  - Geographically, attendance was possible during the working day for most of the planet. In practice, the audience was usually made up of staff and students from universities in Norway, the Netherlands, England and the USA;
  - Because the presentations were digital, we were able archive not only the slides used, but also a complete, re-playable video and audio recording and a log of the questions asked by the audience as the seminars proceeded. Together, these form an important and rapidly growing resource that via the internet can be drawn upon and re-used by instructors in their advanced teaching;
  - The general unfamiliarity of this environment, meant that we found it necessary to set up short practice sessions in which presenters tested out their equipment and understanding of the interface ahead of their talks;
  - Finally, we were able to pool and distribute relevant resources such as bibliographies, ideas for student follow up work, and suggested intended learning objectives. The economies of scale in this should be evident.

Although the series carried no activities for which a formal assessment was appropriate, our hope was that graduate student classes would build on them by creating some formal, assessed activity that enabled the series to be 'hard wired' into research training programmes. The series was used in this way for advanced credit-bearing work in three different US Universities, but as yet no UK institutions have made use of them in assessed teaching and the great majority of the participants seem to have been located in the USA. It might be that 'not invented here' plays a part, but it has also been suggested that this reflects the difficulty and delays that educators in UK have of getting a course, or course module 'onto the books' in the face of various institutional quality assurance hurdles. For further details and to access the archive, see <http://www.wun.ac.uk/ggisa/seminars.html>. The potentials in this development should be obvious, but to a very large extent it relies on the willingness of individuals and institutions to collaborate rather than compete in their graduate level teaching. As yet we have only scratched the surface of what may well prove to be a very significant additional teaching approach.

### **3. Towards a Community of Practice for Teachers of GISc**

Our treatment of various collaboration activities between GISc educators has been deliberately historic. This reflects as much the prevailing theories of learning and teaching as it does the ICT available at the time of their development. The NCGIA core curriculum was developed at a time where the predominant approach to learning and teaching was heavily influenced by behaviorism in the form of 'direct instruction teaching' (Palinscar, 1998) with an emphasis on the teacher transmitting propositional knowledge to the student. Although this is not the place to discuss the pros and cons of the influence of constructivism on learning and teaching, it would be fair to characterize developments since the 1990s as increasing focus on the learner, and – particularly social constructivism – on social interaction. The BoK in some ways reflects the

influence of constructivism as the presiding theory of learning with its increased emphasis on learners and the statement of specific ILOs, and decreased emphasis on explicitly conveying propositional/know *that* forms of knowledge.

Scott *et al.* (2007a) have suggested that videoconferencing learning resources, once created (i.e. after 'live' transmission) can be treated as learning objects for reuse by a wider learning community, and as a focus for the 'triological' learning theory of Paavola *et al.* (2004) which was developed as an extension of Sfard's (1998) 'acquisition' and 'participation' metaphors to focus explicitly on knowledge creation. In addition, synchronous videoconferencing as exemplified by the WUN eSeminars has been suggested as a means both to support CoPs (Scott *et al.* 2007b) and to enable distributed virtual CoPs for teacher development (Hu *et al.*, 2002).

CoPs at tertiary-level education have either been observed to have a research focus (Bolander Laksov *et al.*, 2008) or to exist only tacitly in the context of teaching (Viskovic, 2006). Due to the process of discipline specialisation, many tertiary-level teaching staff can find themselves relatively isolated within their academic departments (Massy *et al.*, 1994; Viskovic, 2006) perhaps being the sole individual teaching a particular branch of the discipline. This is certainly the experience of the second author on this paper when he started as a lecturer in 1994, and is perhaps to be expected in a discipline such as Geography given the range of science and social science-based content. The absence of 'old hands' in a specific teaching context has profound implications for the isolated teacher of GISc who is effectively unable to collaborate/engage in a CoP to develop best practice in teaching.

Although the social context of CoPs were initially envisaged as being face-to-face, the development of social networking technologies (Web 2.0) has allowed the development of virtual CoPs both within an organisation (intra-organisational) or between organizations (inter-organisational). The term 'Network of Practice' (NoP) has been coined for the latter (Brown and Duguid, 2001), and there is a growing literature which documents attempts to identify, form and nurture virtual NoPs/CoPs in a variety of organizational and educational contexts. Churchill (2007) draws on Laurillard (2002) and Collis and Moonen (2005) to emphasize the importance of 'productive media' in collaboration and learning, and the potential of NoPs/CoPs to facilitate 'co-structuring' of content between students and teachers. An example of a virtual NoP/CoP is WikiVet<sup>10</sup>, a project funded by the UK JISC/HEA with a focus on Web 2.0 content development for veterinary schools. In this context Short (2007: 1) noted that:

Wikis and folksonomies offer new ways for the community to order, index, signpost and rate digital content. This content could be in the form of text written collaboratively by the partner institutions or existing resources such as CAL, video, images, documents and powerpoint.

Notwithstanding some of the serious criticisms which have been leveled at certain elements of constructivism in education recently (see Kirschner *et al.*, 2006) it would seem that a virtual NoP/CoP would appear to be a sensible means to support tertiary

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<sup>10</sup> [http://w01.rvcwiki.wf.ulcc.ac.uk/index.php/Main\\_Page](http://w01.rvcwiki.wf.ulcc.ac.uk/index.php/Main_Page)

level teachers of GISc, and would augment some of the curricular and technological developments described above.

## Conclusion

These examples all involve collaboration between institutions and academics, and in each case the product of the collaboration has the potential greatly to assist individuals in their teaching, whether or not these are in some sense also in competition. It has not escaped our attention that, although their range is potentially international, they are by and large all American in origin or uptake. We are convinced that sooner or later the sheer logic of these approaches to shared curriculum development and delivery will mean that they become commonplace, and the development of a virtual NoP/CoP to support tertiary level GISc teachers that would be international in scale would seem overdue.

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