Authentic learning through place-based education

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REFRAMING SPACE FOR LEARNING

Excellence and innovation in university teaching

EXTRACT: CHAPTER 2

Edited by Tim Bilham, Claire Hamshire, Mary Hartog with Martina A.Doolan

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Chapter 2

Authentic learning through place-based education

Derek France, Alice Mauchline, Brian Whalley, Martina A. Doolan and Tim Bilham

This chapter continues our exploration of the importance of space and place in facilitating the creation of authentic learning opportunities.

Authentic learning is rooted in learning that is both situated and experiential (Herrington and Herrington, 2006), seeking to provide authentic contexts for active learning and authentic activities that reflect the 'real-life' practice for which students are preparing. Authentic learning requires the application of relevant knowledge and technical and interpersonal skills to the solution of real problems. As such, it lies on one end of the continuum from deductive and prescriptive learning to inductive and investigative learning (Renzulli *et al.*, 2004). Lombardi (2007) argues that authentic learning experiences enable our learners to appreciate the subtle, unwritten and interpersonal knowledge that communities of practice unconsciously utilize on a daily basis. As such, learning becomes social, concrete and requiring judgement 'just as it is in the actual workplace' (ibid.: 2). Consequently, authentic learning is closely associated with both problems and places.

Place-based education

Place-based education creates authentic learning experiences and places them beyond the walls of the classroom. David Sobel (2004) defines place-based education as an approach that uses aspects of a local environment, including cultural and historical information, in addition to the natural and built environments, as the integrating context for learning.

In fact, place-based education is both an old and a new pedagogy (Gruenewald and Smith, 2014). John Dewey (1938) contended that truly authentic learning required the involvement of students in real-world activities, solving real-world problems. A survey of the literature reveals that many place-based learning projects originate from within the science disciplines (Sobel, 2004) or are environmentally based, thus drawing in aspects of the social sciences (Resor, 2010). They are usually multidisciplinary and interdisciplinary and frequently deploy problem-based and active learning approaches in striving to create authenticity. Students become active, participatory and collaborative learners co-creating knowledge through learning communities and professional communities of practice (Wenger, 1998) and reflecting the pedagogic spaces outlined by Barnett (2011). Problem-based learning (PBL) is a common methodology along with, for instance, role play, case studies and participation in actual and virtual communities of practice that are employed to ensure authenticity in learning (Lombardi, 2007).

In exploring authentic learning on university courses, Stein *et al.* (2004), using a perspective of legitimate, peripheral participation (Lave and Wenger, 1991), see authentic learning as requiring participation within communities of practice (CoP). They propose that academic input is through facilitation and mentorship, which allows students to participate in the CoP, engaging in real-world activities and using the real language of that community without full participation, thus providing students with the space to make sense of the community.

Why is authenticity important in learning?

We are living in a world of immense social and technological change, affecting the ways we work, the ways we communicate and the ways we live. Implicit in this is an unprecedented level of uncertainty and rapid change. Our students need to be knowledgeable about a wider range of concepts and are required to be able to apply them to a wider range of contexts than at any time before. As teachers we need to enable this learning and that requires a fundamental examination of universities' reliance upon decontextualized and abstract forms of learning (Herrington *et al.*, 2010).

What characterizes authentic learning?

Authentic learning requires students to engage in realistic tasks that provide complex activities and that are necessarily collaborative in some form. Many of our HE colleagues provide these without labelling them as authentic, but in doing so, HE teachers must take risks and be prepared to offer high levels of support, guidance and resources. Herrington and Herrington (2006) inextricably link the move towards authentic learning, assessments and tasks with moves from instructivist to constructivist approaches: from bounded sequential learning designs to open and flexible contents, from support provided solely by the tutor to the creation of communities of learners and from standardized tests and academic exercises to assessment via production of authentic artefacts and completion of authentic tasks. In terms of space they see a parallel shift, from learning fixed in institutions to distributed and contextual learning, and objective, predetermined knowledge replaced by knowledge built by, and shared within, the community.

This chapter explores three specific examples of place-based education in university teaching. We start with the classic idea of learning in the field, in this instance augmented by innovative use of technology and international collaboration. We then consider the use of 'laboratory' spaces creatively designed to simulate living in an authentic house, and finally the creation of a virtual space that simulates a real place that may be inaccessible to most learners.

Bounded and unbounded spaces to promote active learning

For this project Alice Mauchline, Brian Whalley and Derek France worked with Julian Park (NTF 2008) and Rob Jackson, University of Reading

Fieldwork provides time and spaces where a range of skills can be integrated (Fuller *et al.*, 2006; Kent *et al.*, 1997) and practised through active learning with tasks designed specifically for students undertaking fieldwork and other types of 'out-of-classroom' experiences. As far as possible these tasks should be authentic and also incorporate cognitive domains. Indeed, Herrington and Herrington (2006: 2) argue that 'cognitive authenticity rather than physical authenticity' is most important in authentic learning design and that 'authenticity goes beyond mere relevance'. Consequently our tasks involve problem-solving and enquiry-based learning: fieldwork tasks are invariably based upon PBL in the context of authentic problems and questions.

Student fieldwork is a component of many undergraduate degree programmes. In science-based disciplines, such as archaeology, geography, geology, ecology and biological sciences, it invariably plays an important role and can be a (near) unique selling point for some applicants. More than half of the respondents in a survey of bioscience lecturers stated that the fieldwork component of their degree course was important for it to remain competitive against other degree programmes: 'One of the things we find in recruiting students is that the array of field courses we offer is actually a major selling point' (Mauchline *et al.*, 2013). At its best, fieldwork provides active and participatory involvement; at its most pedestrian merely a 'Cook's Tour'. In avoiding this, and to promote active learning, authentic tasks are valuable ways of engaging students in fieldwork as well as developing their competencies, skills and transferrable attributes (Whalley, 2013). By aligning the tasks (what is asked of students) and the activities (what students actually do) within a learning scheme, tutors have a structure within which scaffolding for student learning can be provided.

Students undertaking fieldwork projects experience, and utilize, multiple learning spaces, that may be out of the classroom (laboratory, library or café) or in the field (exploration site, and/or virtual exploration using tablets and smartphones and appropriate applications) that, for instance, extend and enhance data gathering, analysis and research. It is especially important that tutors use their imagination in planning student activities and relate them to the curriculum space within modules and programmes (Barnett, 2011). Traditional (non-active) approaches such as 'We always do it this way' are, we suggest, no longer tenable.

As many field courses are often residential and last several days they provide an opportunity to enhance social skills and problem- or enquiry-based learning will invariably employ group work. Thus, collaboration can extend into several learning spaces from the initial project planning, before going into the field, through laboratory or library work and post-fieldwork data analysis in reporting and publicly presenting findings. The innovative use of technology, in our case using iPads to facilitate the collaborative activities, extends the fieldwork learning spaces and is found to promote active learning (Whalley *et al.*, 2018). Asking students to undertake authentic tasks within the domains and learning outcomes as well as delivering subject-directed competencies and attributes needs careful thought. The following example shows both student collaboration and innovative use of mobile technologies combining to extend the learning spaces, both the relational space and the material space (Barnett, 2011).

Final-year undergraduates from the University of Reading, UK, and the University of Akureyri, Iceland, collaborated on a joint microbiology field-based module. Previously, students were often provided with microbial samples to work with in the lab without a real appreciation of the environment from which they were taken. Consequently this field-based module was developed to provide final-year students with an environmental understanding of microbial extremophiles and to help the students develop field-sampling skills (Jackson, 2012). A class set of iPads was used to support and engage the students in their fieldwork learning and to facilitate collaboration and communication between the students and staff in the large multi-national team (34 students and 10 staff). The students worked collaboratively, through a group work app, Geospike, to record field notes of the environmental conditions (weather, physical details of the site, habitat type) and the exact sample site location. Student groups attached representative photos of the local environment and of any specific field methods employed, as illustrated in Figure 2.1.

Back in the laboratory, the students (n = 23) accessed the group Geospike account and GPS Log mobile apps to produce maps at suitable scales for inclusion in their presentations and field reports. Student feedback on this was overwhelmingly positive:

> It brings together several useful applications in one place e.g. GPS, photo, video, internet, so we don't need 3 or 4 pieces of equipment.

> We can record GPS location and bring all the manuals/protocols/ photos with you easy to find and fast to obtain info. Durable iPads survive rain, mud and rips/crumpling of paper sheets.

The shared Geospike map provided the student group with a permanent record of the field locations and environmental conditions from which their microbial samples were taken (France *et al.*, 2015) and the group was able to refer to the Geospike database for data on the field locations while conducting laboratory experiments on the various field samples. Data were thus passed through several learning spaces (France *et al.*, 2013).

Figure 2.1: Example data 'spikes' of sampling techniques and field sites using the Geospike app

Image: A.L. Mauchline, 2017 (Creative Commons, CC BY-SA 3.0)

Collective use of tablet technology provided an innovative and efficient way of recording group field site data with the Geospike and GPS Log apps (see the map in France *et al.*, 2015: 50), which facilitated sharing and display during, and after, the fieldwork (Mauchline *et al.*, 2015). This enabled student groups to co-create a novel dataset of potentially important microbial extremophile samples with a visual and geo-tagged record of the field sampling techniques. The use of the technology on fieldwork not only exemplifies active practice for students but also shows how they might use it in research and employment.

Reality spaces: Utilizing real-world research and development spaces

For this project Martina A. Doolan worked with Mick Walters and the research team at the Robot House, University of Hertfordshire

This case study illustrates how students experience a real research and development (R&D) facility – the Robot House at the University of Hertfordshire – as a learning space within a Master's in computer science programme.

Designing the learning space

The Robot House is a three-bedroom semi-detached house occupied by a number of robots used for human–robot interaction (HRI) research in adaptive systems. HRI is defined as 'a field of study dedicated to understanding, designing, and evaluating robotic systems for use by or with humans. Interaction, by definition, requires communication between robots and humans' (Goodrich and Schultz, 2007: 204). Situated off campus in a residential area alongside other dwellings, the house is fully wired with sensors and cameras, but otherwise is a typical British semi-detached house providing an ecologically valid domestic environment for conducting HRI studies. Within these spaces, students are given the opportunity to engage in a rich R&D experience, developing their subject knowledge, research and analysis skills.

To develop a usable interface, computer scientists first need to understand the problem space for which they are designing. This includes understanding who are the users, how they will use the system and importantly the environment in which the system will be used. Students were tasked with conceptualizing the problem space by designing and analysing various models to understand essential or unnecessary attributes and functions. This iterative process begins with undertaking user and usage research, which is a key component in HRI and human–computer interaction (HCI). HCI is defined as 'a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them' (Hewett *et al.*, 1992). The user research was made authentic by providing access to PhD and postdoctoral researchers in our Adaptive Systems Research group – the resulting discourse between designers and users engaged and supported our students in more creative thinking and the use of design sketching. This is a unique opportunity as these spaces tend to be closed and are generally not accessible to students studying on taught programmes.

Incorporating the space within the curriculum

International students studying on the HCI programme at the University of Hertfordshire collaboratively design a user interface, based upon authentic research processes within HRI, as part of a group assessment project. The students choose from a range of projects, including a general-purpose domestic service robot Care-O-Bot (Fraunhofer Institute for Manufacturing Engineering and Automation, 2016) developed to provide elderly care in supporting a number of tasks around the home such as fetching and carrying (Reiser *et al.*, 2013), KASPAR, a child-sized robot used primarily by therapists and teachers for providing therapy for children with autism (Dautenhahn *et al.*, 2009), Baxter, a light industrial stationary robot designed to perform various pick and place tasks, either autonomously or co-operatively with human co-workers (see www.rethinkrobotics.com), and CHARLY (Companion Humanoid Autonomous Robot for Living with You) used as an avatar to provide a remote user with a presence at a location that may be many miles from the user's actual location (Walters *et al.*, 2012). This case study will focus upon KASPAR, exploring the affordances of the authentic physical location and the curriculum and relational spaces (Barnett, 2011) provided to students through their engagement with the project.

In addition to the material and environmental space of the Robot House, our design concept considered how we might optimize the curriculum and relational spaces experienced by our students. Barnett (2011) describes curriculum spaces as those that are intentionally opened up to student learning and the relational spaces as the, often resulting, pedagogical spaces between the tutor and students and within the students' community. By establishing the group project as part of an authentic 'real-world' task, we aimed to open our students' eyes to the practical and applied nature of their study, and, through encouraging student–researcher dialogue, to the way knowledge can be co-constructed within collaborative relationships.

Outcomes

Student outcomes include storyboarding the user relationships with KASPAR and demonstrating an understanding of the tasks of the therapist in operating KASPAR to support children on the autistic spectrum in developing their social interaction skills (Figures 2.2 and 2.3). Given that students do not have access to the therapist and the children, working within an authentic space setting offered by the Robot House enabled them to understand the challenges of bringing research to practical outcomes.

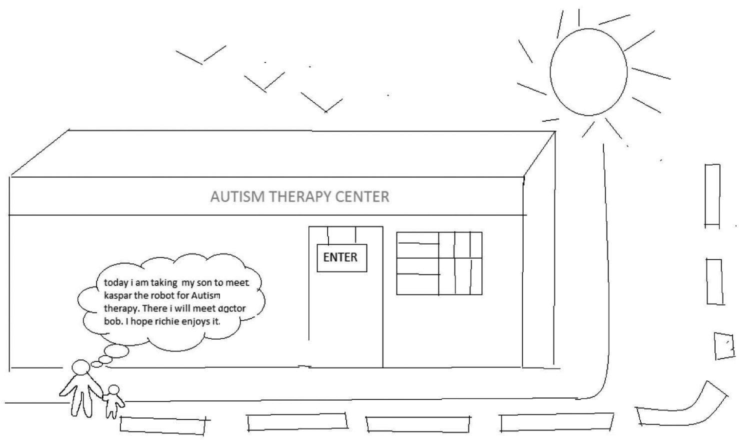


Figure 2.2: The context of use for KASPAR the robot (created by student group 2)

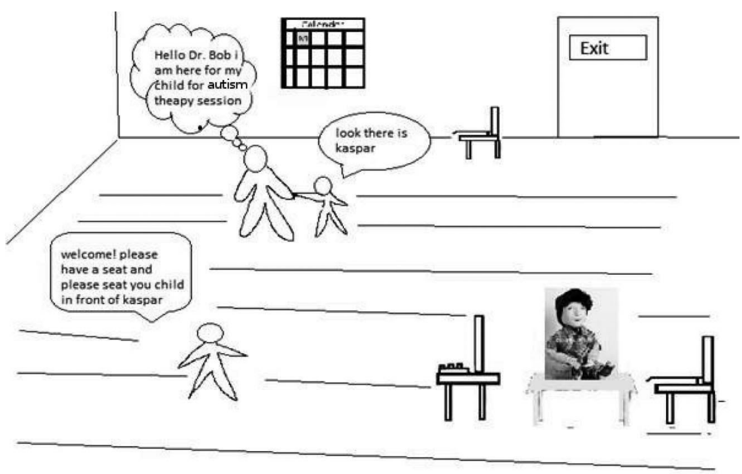


Figure 2.3: Scenario of parent, child and therapist: KASPAR the robot (created by student group 2)

Figure 2.4 shows an interface design completed by one student group to be used by a therapist when operating KASPAR. This was originally sketched and revised based on feedback from the tutor and peers in the class (relational space).

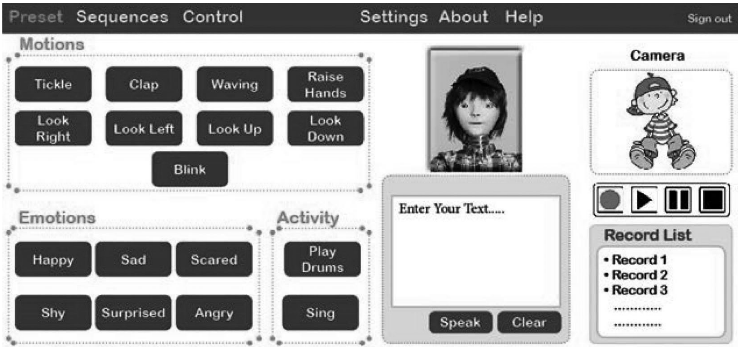


Figure 2.4: An interface design to operate KASPAR the robot produced by a student group (created by student group 6)

Evaluation

Our evaluation of the programme identified student benefits related to location in the physical, curriculum and relational spaces as follows:

> Access to the robots in the robotic laboratory supported my study greatly as it let me have hands on practical experience in robotics.
>
> Usually we spend the entire semester coming to class and listening to the teacher, in this class we give and can get feedback, can discuss ideas and make corrections to confusions and mistakes, we get a chance to have our say.

In this relational space, the students expressed how they were empowered to engage in lively discussions around the mini-project outputs, which were designed to be shared, nurture interactivity within and between student groups, and engage in dialogue with their peers and tutor. Within the relational space, students were keen to share their discovered knowledge:

> The mini-project activities are very helpful and provide us postgraduates with the opportunity to expand our knowledge and skills by presenting to the group as well as seeing what ideas and concepts other groups have come up with.
>
> Looking at other students' work presentations helped me understand better.

> It is a chance for the groups to assess their work as it progresses; by getting feedback thusly, they can correct any mistake.

With this in mind, the acquisition of knowledge and its application was encouraged through the assessment design and access to real research spaces, which included opportunities to meet with the PhD and postdoctoral researchers and exposure to state-of-the-art robots *in situ* in the Robot House and in the Robotic Laboratory based at the university. This supported students in ascertaining the requirements of the user interface, understanding the likely users and how the robot would be used. Additionally, access to authentic research infrastructure and processes immersed students in a more realistic research context, helping them to gain insights into the robot's environment necessary to develop a suitable interface design.

> Being in the Robot Laboratory helped me to be clearer and understand how to design better.

Observations

The concepts of research-informed learning, authentic assessment, active and collaborative learning are transferable and applicable to any discipline. Making explicit the links between research, learning and teaching in curriculum design promotes collaboration and interactivity and benefits student learning (Brew, 2006; Doolan and Walters, 2016). Pushing the boundaries of space by utilizing research spaces beyond those timetabled and not ordinarily accessible is valuable to student learning and raising student awareness that they are part of a research-informed learning culture through access to 'forbidden' research spaces has a positive impact on their student experience.

Acknowledgements

Thanks to Professor Kerstin Dautenhahn, the Adaptive Research Systems Group Lead, the staff and research students within the group and to the students who participated on the course and agreed to share their experiences.

Virtual clinics: Online learning spaces

For this project Tim Bilham worked collaboratively with clinical and educational-technology colleagues at the University of Bath. This case is discussed in Savin-Baden (2007) and a summary can also be found in Jones et al. (2006).

Our final case study also uses technology, but not as a way of extending the learning space of classical fieldwork, or of being the primary mechanism for delivering adaptive systems, but rather as a way of simulating places and locations that are normally inaccessible to most students.

Virtual clinics were conceived as a mechanism to bring authentic, practice-based learning opportunities to doctors studying an online postgraduate programme in sport and exercise medicine (SEM). The learners were remote, typically time-poor and unable to directly experience the location. Evaluation of the students' assessment results had identified the need for more direct clinical experience, a frequent challenge for online programmes.

Conceptualizing the learning space

The use of e-learning was critical to the delivery of the programme. All of our students were geographically distant, many of them working across the world. They were working full-time as clinicians, studying part-time and needed to access the course at times convenient for themselves, rather than at scheduled times.

The virtual clinics were situated within an MSc, for which we had universally adopted a constructivist approach (Lave and Wenger, 1991), recognizing that our students had much to offer through their extensive and collective professional experiences. Herrington *et al.* (2010) argue that single perspectives are inadequate and that complexity can enhance student learning. Instead of exposure to a single expert view, students are immersed in complex and contested perspectives and experiences, and provide differences of opinion that characterize all authentic settings (Sandberg and Wielinga, 1992). In this way, we had sought to avoid the criticism levelled at faculty who are content with converting courses to online formats without pedagogical change (Herrington *et al.*, 2010):

> Great being online approaching clinical problems together … everyone has different ways of looking at problems. (Student evaluation)

Designing the learning space

We extended the use of PBL by adapting a model originally proposed by Barrows and Tamblyn (1980), developing it to encourage epistemological competence (Savin-Baden, 2000). Learners saw the resulting co-creation of knowledge positively:

> Working in a group is beneficial, making you feel involved in a case.

> It was interesting to get other people's thoughts and respond to them. (Focus group evaluation)

This concept of situated cognition, which contends that knowledge cannot be separated from its situational context (Choi and Hannafin, 1995), was used throughout with the design of deploying technology as a cognitive tool, rather than only as an alternative form of delivery (Herrington *et al.*, 2010), in which students learn with the technology. One example of a scenario provided through the virtual clinics placed each student as the team doctor to a junior (under 18) national sports team on tour at an international team championship, in unfamiliar surroundings and in an unfamiliar culture. The students had to use and manage a body of knowledge about sports physiology, psychology, nutrition, injury diagnosis and management, and ethics as applied to a sport's team doctor scenario. They were faced with the competing demands of coaches, team management and the welfare of the athletes, reflecting authentic and complex challenges found in real-world learning.

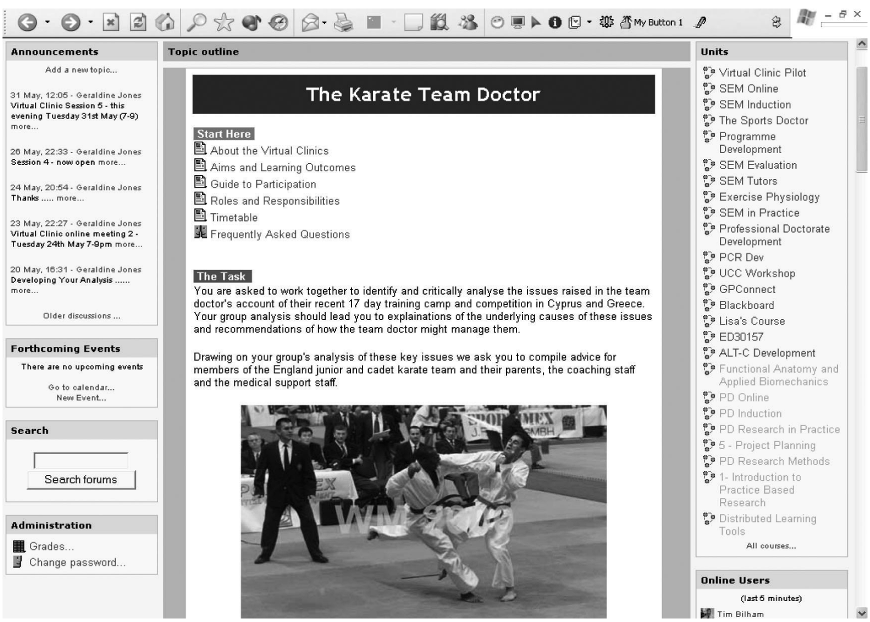


Figure 2.5: Screenshot showing the introduction to the virtual clinic scenario

Image: G. Jones

They engaged in asynchronous activities, e-tivities (Salmon, 2002) and online discussion. This allowed us to accommodate different time zones and different work schedules, but we also experimented with some synchronous and mediated discussions to facilitate immediacy and foster a group identity.

The clinical scenario (Figure 2.5) was developed based on the direct personal experience of one of the design team, a clinician tutor and elite sports doctor. The scenario was analysed and deconstructed into a range of learning issues and presented to students as a text narrative (Greenhalgh, 1999), together with a series of supporting resources utilizing a variety of media forms. Activities that scaffolded engagement with learning were designed and framed as e-tivities.

Evaluation

Our evaluation looked at participation, the appropriateness of the e-tivities and scaffolding for online PBL, the creation of communities of learners and the drivers of and barriers to student and tutor participation. The main benefits were:

- very high levels of participation, especially in synchronous events – about 100 posts and 2,500 accesses from 17 students over two hours (see Figure 2.6)
- scheduling and scaffolding meant that the group did not spend time self-managing
- those with little online experience were able to participate
- synchronous meetings seemed to create a 'virtual proximity', which enabled socialization
- the authentic nature of the scenario stimulated great interest.

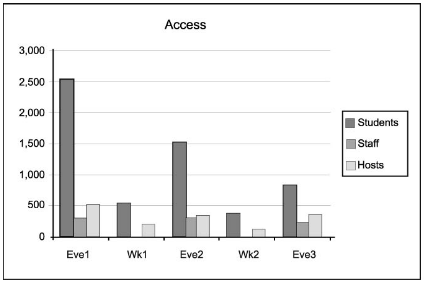
Overall 70 per cent of students would recommend this form of learning to clinical colleagues.

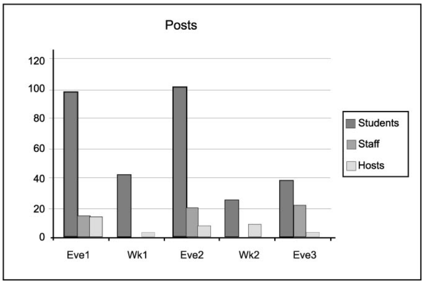
> It is hard work working this way though particularly helpful.

> Quite fun. Need to be able to think clearly despite distractions – so a bit like life really!

Challenges identified included that:

- synchronous meetings seem to create expectations of high tutor involvement, and tutors naturally adopted a leadership, rather than a facilitative role, limiting the opportunities for the co-creation of knowledge
- synchronous meetings were only suitable for small groups (< 15) as it was difficult to keep track of posted comments.





Key: 'Eve' specifies two-hour synchronous session; 'Wk' specifies asynchronous activity over seven days

Figure 2.6: Participation in virtual clinics from students (n = 17), two tutors and one facilitator.

Image: G. Jones

Virtual spaces are well suited to providing exposure to cases, places and contexts that are rare, occurring infrequently, inaccessible or occur in dangerous situations. Simulating these events provides students with experiences that might otherwise be denied them.

Lessons learnt

The examples in this chapter demonstrate that successful authentic learning is more than merely about relevance. It is about connecting students through communities of practice, moving them from the periphery towards the centre of this community by engaging them in the solving and analysis of credible problems and locating their learning in real or simulated situations. The philosophical shift from a behaviourist to a constructivist learning paradigm supports such initiatives, with authentic learning being principally based upon situated learning theory. The case studies presented here demonstrate that authentic learning can be located in any number of places – we illustrate a field location, a laboratory, an R&D facility and a virtual environment. Such places can be situated either on or off campus and are given authenticity through their context, cognitive challenges and legitimate participation from students. Each of our examples stretch the student experience beyond what is merely relevant, to provide and promote learning that requires student engagement in authentic problem-solving, moving the learners from observers to engaged and fully functioning participants and giving them access to areas of experience and communities of mature practice.

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