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The University Of Sheffield.

The Sheffield Companion To Inquiry-based Learning.

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The Sheffield Companion to Inquiry-based Learning

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‘The ecology of a university depends on a deep and abiding understanding that inquiry, investigation and discovery are at the heart of the enterprise, whether in funded research projects or in undergraduate classrooms or graduate apprenticeships. Everyone at a university should be a discoverer, a learner. That shared mission binds together all that happens on a campus.’[1]

Contents

CILASS (the Centre for Inquiry-based Learning in the Arts and Social Sciences) was a national Centre for Excellence in Teaching and Learning (CETL) awarded to The University of Sheffield in 2005 by the Higher Education Funding Council for England (HEFCE).

CILASS conducted a five-year programme of work with strands including reward and recognition for teaching, curriculum development and innovation, educational evaluation and research, enhancement of the University's physical estate for learning and teaching, and dissemination. Its main focus was on inquiry-based learning in the arts, humanities and social sciences, and on promoting integration of university learning, research and teaching. Its work also extended to supporting development of inquiry-based learning in a range of other disciplines, and in other higher education institutions across the UK. CILASS participated in the Learning Through Enquiry Alliance of CETLs at the universities of Gloucestershire, Manchester, Reading, Sheffield, Sheffield Hallam, Surrey and Warwick and hosted the 3rd annual conference of the Alliance at The University of Sheffield in 2008.

Introduction

This publication offers an overview of themes in the conceptualisation, design, practice and development of inquiry-based learning (IBL) from the perspective of work carried out through CILASS at The University of Sheffield (UoS).

The Companion is intended for those in universities who teach, or who support or develop learning and teaching, including academic staff, practitioner-tutors, librarians, educational developers and learning technologists. It also is intended for students who work in roles as tutors, learning mentors or partners with staff in educational enhancement activities.

The terms 'inquiry' and 'research' can be interpreted differently and this is a complicating factor in definitions of IBL, student research and the relation between them. In the Companion, the two terms are used in combination or interchangeably to refer inclusively to all forms of scholarly exploration and investigation carried out by students as part of their studies or in extra-curricular contexts.

International interest in enhancing the role of student inquiry and research in the experience of higher education is growing, as reflected currently in a wide range of strategic and developmental initiatives. IBL is seen to offer rich opportunities for improving student learning, linking teaching and research more effectively, and strengthening the role of universities in society. For example, senior university managers from institutions across Australia recently addressed a Communiqué to national political leaders to underline the importance of 'research-mindedness' for an innovative knowledge society and to draw attention to the need to teach 'all students, not just research students, how to engage in the production of knowledge as in its acquisition.'[2]

The Boyer Commission's critique of teaching in American research universities more than ten years ago was a key stimulus for the development of this agenda.[3] Arguing that the didactic style of much teaching in these institutions was failing their students, the Commission proposed a far-reaching blueprint for change to be based on making learning through inquiry central to the student experience from the first undergraduate year. More recently, the importance of this for all students – whether in research-intensive or teaching-intensive institutions – has been emphasized. In the UK, recent national learning and teaching enhancement initiatives have provided supportive frameworks for development, including the Research-Informed Teaching Initiative and the CETL programme, both funded by HEFCE, and the Scottish Higher Education Enhancement Themes programme steered by the Scottish Higher Education Enhancement Committee. Increasingly, a commitment to student inquiry and research is visible in institution-level strategic documentation and development activities for learning and teaching in universities, and in more joined-up approaches to teaching and research enhancement.

The Sheffield Companion to IBL is informed by the work of the many participants – students and staff – in CILASS initiatives at UoS and beyond. Combining practical resources and guidance with pointers to the CILASS evidence-base on IBL, it aims to provide a springboard for exploration of further resources that can be accessed via www.shef.ac.uk/ibl. CILASS evaluation data and reports that are drawn on for the Companion, and CILASS-related published research, are identified in the Notes and References section of the Companion.

What is IBL?

'IBL' describes a cluster of strongly student-centred learning and teaching approaches in which students' inquiry or research drives the learning experience. Students conduct small- or large-scale inquiries that enable them to engage actively with disciplinary or interdisciplinary questions and problems. Learning takes place through an emergent process of exploration and discovery. Guided by subject specialists and those with specialist roles in learning support, students use the scholarly and research practices of their disciplines to move towards autonomy in creating and sharing knowledge.

IBL is an empowering, engaging approach with benefits for subject learning as well as for the development of a wide range of important higher-order attributes and skills. Successful IBL flows from enthusiastic, questioning, purposeful, imaginative engagement with well-designed inquiry tasks, in a challenging but supportive learning environment. The starting-point might, among other possibilities, be an intriguing fieldwork or design problem, a complex case scenario, or an important research question. Students may be encouraged to share the results of their inquiries with each other and wider audiences, including through peer-reviewed publication where appropriate. Reflecting increasing interest in student participation in the research communities of their disciplines, there is a growing trend for outlets such as *Reinvention*[4] and *Diffusion*,[5] both of which are multi-disciplinary journals for undergraduate research.

Sometimes the term IBL is used to refer specifically to teacher-guided investigations of student-generated questions. In this Companion, we take it to include approaches in which academic staff set the questions and offer a great deal of guidance on the inquiry process as well as those in which students have a larger degree of freedom and control in relation to both inquiry questions and inquiry processes and procedures.

IBL is a flexible approach that can take a variety of forms. It can be used to foster acquisition of clearly-defined, 'certain' knowledge such as the conceptual foundations of a scientific discipline. Alternatively it can be used to engage students with uncertainty, multiple perspectives and contestation through exploration of open-ended questions and problems to which single right answers do not exist. From one perspective, IBL can be seen as a form of active learning in which students carry out research-like activities to explore and master an existing knowledge-base. From another perspective, IBL extends student learning towards and well into the realms of real research, positioning students as engaged producers or authors of knowledge participating in generating original intellectual and creative outcomes of value to their wider academic, professional or social communities. The Companion puts forward a view of IBL that is inclusive of both these perspectives.

This view of IBL also sees it as encompassing related approaches such as problem-based learning (PBL), project-based learning, case-based learning and problem-solving. The terms IBL and PBL sometimes are used synonymously. However, 'IBL' often is used in particular to describe approaches that offer students considerable freedom in defining and directing their inquiries, are oriented towards open-endedness of questions and problems, and have a clear focus on teaching students the research approaches and techniques of their disciplines.

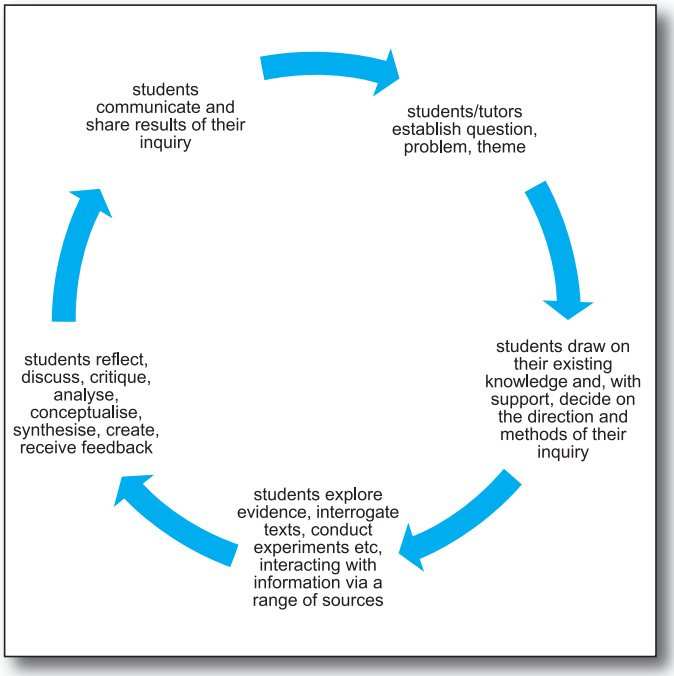

Figure 1: An IBL Cycle

IBL and the research-teaching relationship

IBL is an especially student-centred approach to research-led teaching, being based on students doing research rather than on the communication of research knowledge by staff to students. In making the connection between learning and research explicit, IBL opens up possibilities for strengthening the links between research and teaching in universities, inviting students to participate in the knowledge-building communities of their academic or professional disciplines and allowing for productive staff-student partnerships.[6] IBL that is oriented towards open-ended questions and problems offers particular potential for close integration between the teaching and disciplinary research activity of an institution,[7] for example where students get involved in working on questions that relate to the research and scholarship of their academic tutors.

What's different about IBL?

Is IBL unnecessary jargon for fairly standard educational practice in university teaching? After all, inquiry and research are aspects of many university students' experiences in the UK and elsewhere. Students are expected to develop initiative as learners and an independent, critical approach; at more advanced levels especially, research projects are common. However, on many courses student inquiry and research play a secondary role, and learning and teaching is organized around the communication of curriculum subject-matter as the stimulus for student activity. In contrast, IBL organizes learning and teaching around questions and problems, and all teaching strategies are designed to support the inquiry process. This process is firmly to the fore.

Academic staff perspectives

Perspectives on IBL vary. Research carried out by CILASS[8] showed that academic staff may see IBL as closely aligned with formal, discipline-based research practice or with a systematic, problem-solving process. Alternatively, they may see the research process engaged through IBL as a more general one of critical questioning and exploration, with IBL defined broadly as encouraging 'inquiring' students to set their own learning goals, plan and direct their learning, and reflect on outcomes. Academic staff described flexible approaches to IBL, saying that they would adopt different strategies in different contexts, for example according to level of study. While emphasizing the aim to foster student autonomy, some strategies described were more strongly teacher-led whereas others were more strongly student-led. Some saw the 'purest' and most powerful forms of IBL as those in which students both devise their own research questions and direct the development of their inquiries with guidance and support.

Characteristics of IBL[9]

In IBL, students:

- Learn through a process of inquiry, often co-operatively with peers and using digital information and technologies,
- Apply principles and practices of academic or professional inquiry, scholarship or research,
- Engage with questions and problems that often are open-ended,
- Explore a knowledge-base actively, critically and creatively,
- Participate in building new meaning and knowledge,
- Develop process knowledge and skills in inquiry methods and in other areas including information literacy, reflection and group-work,
- Gain opportunities to share their results of their inquiries with each other and with wider audiences.

IBL: a framework

This framework[10] for conceptualising different modes of IBL extends work on different ways of linking research and teaching in the student experience[11] and offers a tool for IBL design and evaluation. Key dimensions of undergraduates' experiences of inquiry and research, as these emerged from CILASS research,[12] are represented as a matrix.

Two broadly contrasting ways in which students experience the status of inquiry are represented on the vertical axis. When viewed through the lens of 'learning', students experience inquiry as a matter of exploring and acquiring existing knowledge. When viewed through the lens of open-ended 'knowledge-building', they experience inquiry as bringing something personal or new to an area of study, thereby contributing potentially to the development of ideas in a domain.

The horizontal axis adds a second dimension, representing where primary responsibility lies for establishing the inquiry question or theme. The amount of process support (guidance, direction and structure) that students experience is a third dimension. In this way, four ideal-type modes of IBL are identified, labelled *Identifying, Pursuing, Producing* and *Authoring:* in each of these the nature and amount of support will differ according to context. Questions in *Producing* and *Authoring* modes may be entirely new to the discipline or simply new to the student, but in either case are authentically open in the sense that definitive answers have not yet been, or cannot be, found.

The matrix offers a framework onto which the orientation of different IBL experiences and designs can be mapped, either fitting neatly into just one of the quadrants or extending across two or more. The dimensions are continua and, for example, over the course of a given inquiry the dynamic of students' activity may include both exploration of existing knowledge and a move towards the creation of genuinely new meaning or the making of new discoveries (not only new to the student). Similarly, in an extended inquiry process, students may move from a more to a less structured and supported experience as they gain in confidence and skills.

In Figure 3, IBL is represented as inclusive of both PBL and student research, including research at a more advanced level as typified by the research dissertation. PBL is mapped here on the 'tutor-framed' and more 'strongly-supported' dimension of the matrix. However, some approaches to PBL invite students to devise problem scenarios themselves or offer looser structure and direction.

A 3-D version

This framework has been re-created in 3-D in the virtual world, *Second Life.*[13]

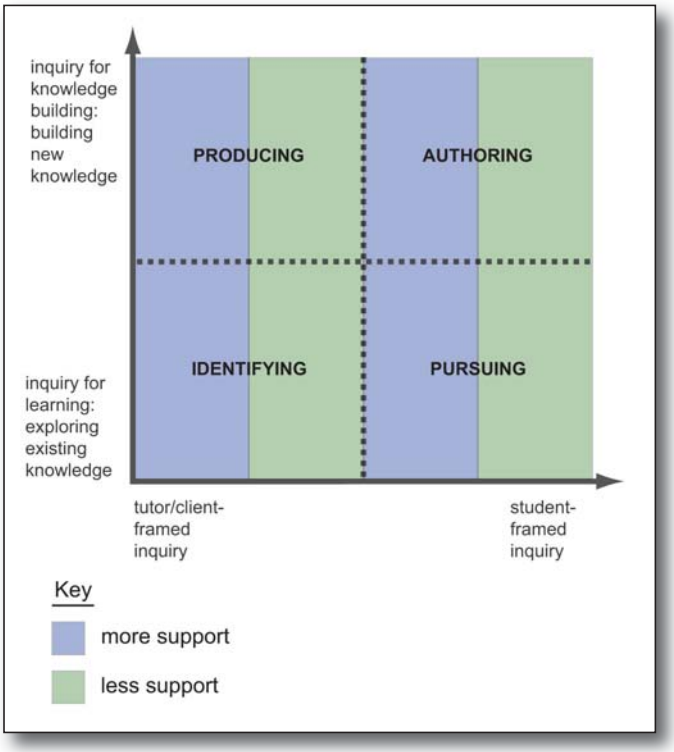

Figure 2: Modes of IBL[10]

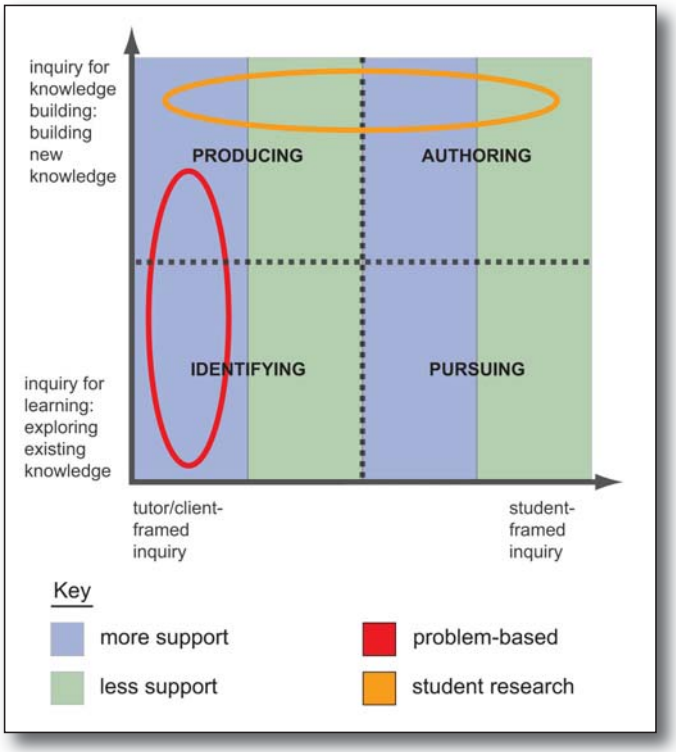

Figure 3: Modes of IBL and relation with PBL and more advanced research[10]

Authoring: Students explore their own open questions, problems, scenarios or lines of inquiry, in interaction with a knowledge-base ('how can I answer my open question?').

Producing: Students explore open questions, problems, scenarios or lines of inquiry, framed by teachers or others such as an external 'client', in interaction with a knowledge base ('how can I answer this open question?').

Pursuing: Students explore a knowledge-base actively by pursuing their own questions, problems, scenarios or lines of inquiry ('what is the existing answer/response to my question?').

Identifying: Students explore a knowledge-base actively in response to questions, problems, scenarios or lines of inquiry framed by teachers ('what is the existing answer/response to this question?').

IBL purposes and the student experience

IBL educators aim to inspire a questioning, open stance in students and to foster development of higher-order dispositions and capabilities – in areas such as initiative, self-belief, responsibility, independence of mind, critical judgment, problem-solving, creativity, self-management, collaboration, communication – that are essential for life and work in a highly complex and challenging world. IBL can be seen as a powerful means of developing skills that are prized by employers and that are central to an enterprising and entrepreneurial outlook. From another perspective, IBL and the closer integration of research and teaching can be seen as a fundamental challenge to the idea of students as consumers of university education and a move toward re-positioning them as producers in a radically reinvented model of the academy.[14]

The Sheffield Graduate[15]

At UoS, the 2005-2010 Learning Teaching and Assessment Strategy set an objective for students in all disciplines to experience an IBL-infused approach to learning and knowledge-building. The approaches, knowledge and skills that characterize learning in IBL mode are embedded in the University's articulation of the attributes of The Sheffield Graduate.

Purposes

CILASS conducted an analysis of the educational aims expressed by IBL curriculum development project leaders at UoS.[16] Staff wanted to improve students' experiences in these areas:

- Engagement with academic subject-matter and the learning process,
- Enjoyment of learning,
- Autonomy and responsibility in learning,
- Academic performance and grades,
- Awareness of the real-world relevance and value of studies in non-vocational as well as vocational subjects, and of inquiry itself,
- Reflexivity in learning and inquiry, and awareness of process issues,
- Strengthened identification with their discipline or with professional practice and communities in vocational subjects,
- Inquiry and 'transferable' skills in a wide range of areas, of relevance to lifelong learning,
- Participation in open-ended debate with no definitively right answers,
- A more holistic, integrated sense of curriculum or inter-disciplinary subject connections,
- Recognition of the transferability of knowledge processes across subjects and disciplines,
- Preparation for higher levels of study.

Most CILASS project leaders highlighted their intention to use IBL to engage students with an existing knowledge-base and its modes of analysis and representation. Some also highlighted their aim to encourage students' development as knowledge-builders, in the sense of working towards contributing to creating new disciplinary and interdisciplinary knowledge.

The student experience

CILASS gathered extensive evidence on the experience of IBL that shows highly positive impacts on students' intellectual, personal and professional development. Benefits reported included: greater enthusiasm, interest, confidence, initiative, ownership and responsibility in learning; deeper engagement with subject-matter and improved subject knowledge; a sense of intellectual freedom and of 'growing up'; strengthened identification with an academic or professional discipline; more advanced conceptions of inquiry and of the role and potential of students in knowledge-building; improved skills in areas such as information literacy, communication, use of ICT; greater group cohesion in class and closer relations between staff and students; recognition of the relevance of IBL to for employability and continued learning after university. A large majority of respondents to the longitudinal CILASS Graduating Student Survey (2006-10) reported valuing IBL highly.

These findings are broadly consistent with those reported in the growing research literature on IBL. A large-scale quantitative study of the student experience in the USA concluded that student inquiry and research in the undergraduate curriculum can be described as 'high impact' in relation to several indicators of intellectual and personal development.[17] Evidence from a variety of sources[18] highlights themes such as improved student grades, development of a range of meta-cognitive and academic skills, transfer of inquiry skills across courses, enhanced student engagement, changes in students' understandings of learning, teaching and research; improved transition from secondary education and retention in higher education. Some research suggests that many students prefer learning through inquiry and research over other methods.[19]

CILASS evaluation and research also served to highlight student concerns and difficulties relating to IBL. IBL can unsettle students' expectations and beliefs about learning and teaching and it is an approach that, in asking students to play a role in directing their own learning, can pose significant intellectual and practical challenges. Provision of appropriate support, as well as challenge, is essential for successful IBL.

What students value

'I found this method of learning helped me further immerse myself in the subject.'

'Having been engaged in a research assignment has boosted my confidence and self-worth as I endeavour to continue finding answers to issues and problems plaguing [my professional area].'

"Although helpful IBL has been a little bit of a shock for me as for the previous decade of my education I had got used to a far more passive learning style. I can see that this type of IBL is more useful for the workplace and so particularly suited to my vocational degree course.'

As a student wanting to go into research in my field IBL has helped enormously and before even graduating I can already think of myself as an active researcher in my field.'

'It developed my interest in the subject. It made me 'hungry for knowledge'.'

'What I liked about [IBL] was that I was freer in a way. I didn't know that you as a first year, or a student at all, could refute arguments put forward by academics. I encountered a theory that I really disagreed with and I had brilliant examples of it not being true at all, and I got to do that by myself. I built my own arguments, and that was really, really good for me. I really enjoyed that, because it was free. I don't think that you can do that to the same extent in an essay because that mode often is a set question – of course you can say if you agree or not agree to what it states, but the question often is based on certain concepts or certain theories, while in this [inquiry] project we could choose our approach by ourselves. That was really good.'

'I think doing something that, this is your project, do what you want with it, it's scary but I feel like a grown-up person, going into [the professional field], I like being able to do your own thing. And that reminds you that you're not just a student, the more you go into [the field] the more it reminds you you're becoming that role.'

inquiry

I think IBL will be hugely beneficial in my future career and has considerable benefits besides academic enhancement.'

'IBL has not just been an integral part of the teaching on my degree course but has in fact changed my thinking about knowledge: how I gain it, how I extend it, how it is created. The reflective element of IBL has proved extremely useful and as a result has improved marks. The reflective element has also impacted on my way of thinking and going about applying for graduate jobs.'

'I felt that researching as part of a group and as an individual during the sessions made me aware of issues which otherwise in a teacher-focused session is not possible. I interacted with some very interesting people. It actually inculcated a stimulus to ask more and question a lot and then to find the answers by researching thoroughly and gave a very self-satisfied feeling.'

'Having the opportunity to devise research questions has helped me to think independently and follow my own research interests.'

'As a scientist, I feel that IBL is essential for the development of scientific skills. During my course I felt as though I was part of the community of researchers and scholars that is my department and was very much enthused by this.'

'IBL has greatly improved my learning process. In [the country] I come from learning for me has been more of a one-sidedness where the tutor dictates but here I have been able to participate and inquire by myself.'

'Instead of feeling separated from academia, you are part of it.'

Designing for IBL

IBL encourages students to become self-directing inquirers while providing tasks, resources, guidance, feedback and assessments to support the inquiry process. Designing for IBL involves establishing conditions in which students' inquiries are stimulated and can flourish, and in which a productive balance is struck between the level of challenge and support they experience. IBL does not hand over full responsibility for learning to students: instead, this is shared between students and staff. At the level of specific courses and activities, this may involve students taking on the role of designers (or co-designers) of their own learning, for example in taking the lead in framing the focus of their inquiries, and in deciding on methods and tools. Students also may be involved in designing for IBL at programme or departmental level. For example, a CILASS-supported project involved students in the Institute for Lifelong Learning at UoS working collaboratively with academic staff to develop IBL across several courses.[20]

Design for IBL: this refers to the planning (and documentation) of tasks, and preparation of associated content-resources, for an IBL event of any scale.

CILASS evaluation and research consistently confirmed the value and importance of guidance and feedback in a range of areas including initial orientation to IBL, question-formulation, direction-setting for inquiries, information literacy, and group-work. Without support, students can struggle.

'IBL does seem to have advantages, however it is my experience that students can be quite unsure and even uncomfortable with the independence.'

'I have enjoyed IBL as it has made me individually and personally responsible for my learning. The confidence and independence this has given me is priceless. However, there is a need for skilled tutor input in order to ensure that the work progresses.'

IBL can be used as the design principle for whole teaching units (modules) or degree programmes. Alternatively, as a hybrid and smaller-scale approach, IBL can be incorporated into more traditional curriculum designs, for example as part of seminar, laboratory or fieldwork activities.

Theoretical perspectives

There is no one way to do IBL and CILASS did not impose any specific theory or model on the development of practice. However, a number of theories of student learning were found useful in informing the work of the CETL. In particular, constructivism in its various guises offers support for educational approaches based on inquiry, in taking learning to be an active intellectual and social process of knowledge-creation and in indicating that students are more likely to adopt 'deep' learning strategies when engaged with tasks that are authentic to their field, using its techniques and tools. The American tradition of constructive-developmental research into students' intellectual and personal development offered a useful point of reference for the CETL[21] as did the practice model of constructive alignment.[22] CILASS also drew on theory and research evidence relating to students' information literacy development and technology-enhanced learning.[23]

Elements of IBL design

CILASS developed a simple hub-and-spokes representation of key elements in design for IBL.

Student inquiry The two inter-related elements of a student inquiry – its topic and its process – both are central to IBL design.

Inquiries often engage students with real world issues and problems in applied subject areas, exploring the relation between theory and practice. CILASS supported a number of projects that involved students working on research questions generated through interaction with organisations beyond UoS in the local community or further afield. These included Sociology undergraduates conducting research on issues of social importance for clients such as the Citizen's Advice Bureau, or working collaboratively with service users. Dentistry students researched issues arising during their professional placements. Town and Regional Planning students explored the impact of the Gautrain, a new high speed rail link in Johannesburg, South Africa, which is being used to encourage economic development in the region. Drawing on real-life primary material gathered by staff, including interviews with planners and developers, digitised paper documents, photographs, and video footage of sites and life in the surrounding communities, students had to come up with a plan for just, sustainable and financially viable development around one of the new train stations. Similar examples also from UoS include third-year Computer Science undergraduates working on real-life software development projects for external clients, first-year Architecture students creating pieces of public art for a local urban regeneration initiative and Journalism students researching local and national elections in 'real-time'.[26]

In many of the IBL initiatives taken forward through CILASS there was a strong, explicit focus on process in the intended learning outcomes, with the aim of enabling students to develop process, as well as subject, knowledge and skills.

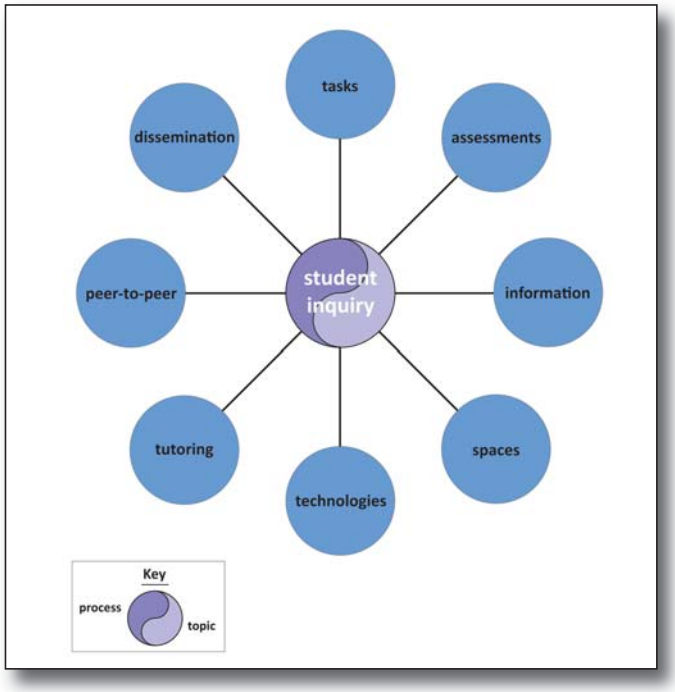

Figure 4: Elements of IBL design

Tasks and task sequencing Tasks designed to stimulate and provide a framework for inquiry include problem scenarios, field-work investigations, experiential learning projects and laboratory experiments, as well as research projects of different kinds. IBL is more likely to begin with an open question or scenario, or perhaps a reflection or discussion activity, than with communication of a unit of subject content. Frameworks such as Kolb's learning cycle[24] – 'do, reflect, conceptualise, apply' – or PBL protocols[25] offer points of reference for task sequencing.

A wide range of tasks can be designed to help students engage with relevant theory and subject matter.

IBL curriculum development projects supported by CILASS also designed 'process support' tasks aimed at fostering the development of students' process knowledge and skills, including in areas such as orientation to IBL, formulating research questions, inquiry methods, information literacy, reflection and ICT use.

Assessments Assessment plays a critical role in student learning, with research evidence suggesting that students are likely to engage most with what they think they will be tested on.[27] Aligning the assessment of student achievement with the intended learning outcomes of student inquiries in IBL means that process, as well as subject knowledge and skills, may become the focus for assessment. At the same time, traditional forms of assessment such as essays or exams are not always appropriate, or may be supplemented with other forms. In CILASS curriculum development projects often an essay or exam was replaced by a portfolio with a number of components. Podcasts, wikis, blogs, posters, mindmaps, animations, films, portfolios, diaries and research reports were among the assessed outputs of student inquiry used in projects. Peer and self-assessment were features of many projects and in some cases, students themselves established the criteria by which the outputs of their inquiries were assessed, in negotiation with academic staff.

Information Designing IBL involves making decisions about which, how much, and when information will be provided to students, as compared with students gathering and evaluating information by themselves. CILASS supported a number of projects that developed rich digital information resource banks – typically accessed via a virtual learning environment – for students to explore. Other projects placed emphasis on students using information search tools to access information from the wider digital environment. A number of projects demonstrated that lectures can be integrated effectively into IBL as a means of communicating both subject and process information, and that a variety of activities can be used to inject an element of student inquiry into these sessions.

'The areas of my course which involved learning through inquiry were some of its most enjoyable aspects. It provided me with a greater understanding of how the theory we had been learning was applied outside the classroom and gave me experience that will invaluable for my career.'

Technology In some subject areas, IBL involves the use of specialist technology and equipment. More generally, digital technologies are changing research practices within and across disciplines and professional domains, and offer new possibilities for learning and teaching in either blended or fully on-line modes. For both these reasons digital resources and tools – including archives and datasets, Web 2.0 tools and platforms, virtual simulations, mobile technologies – are commonly an embedded feature of IBL, supporting interactions amongst peers and tutors, access to information, experimentation, and the production and sharing of inquiry outputs. Examples from UoS include the use of an on-line discussion board for students to post reflections on readings in preparation for inquiry activities undertaken in class, and Access Grid Videoconferencing to facilitate collaborative inquiry between groups of students from UoS and another institution.[28] Technology also was used by some CILASS projects to help support IBL with large student numbers.

There is perhaps a special affinity between the ethos and practices of IBL and Web 2.0, and a number of CILASS projects experimented successfully with tools including blogs, wikis and the virtual world, Second Life. For example, second year History students generated research questions and then used Diigo, an open access research and knowledge sharing tool, to create an on-line information base to support their own and each others' inquiries.[29] Similarly, as part of a Legal History module, groups of Level 3 students collaborated to research and create entries for a wiki shared with other groups.[30]

Research carried out by CILASS student ambassadors[31] suggests that many students may be less proficient and independent users of digital technologies for the purposes of conducting inquiry and research than might be assumed of 'digital natives'. This is consistent with the findings of the wider evidence-base on students' use of digital technologies for academic learning[32] and points to the likely value of including tasks and guidance focused specifically on effective technology use in IBL design where technology plays an important role. This research also suggested that students are not enthusiastic about technology use in IBL where the purpose is unclear.

Inquiry in Second Life[33]

Sheila Webber; School of Information, UoS

Second Life, the 3D virtual world, was found to be a fruitful environment for IBL by a CILASS project leader. Working in groups, first-year students of Information Management conduct small-scale inquiries into the information needs and practices of users of Second Life. They carry out a research interview in Second Life with a Second Life resident exploring an incident when the person needed information to carry out an activity in the virtual world. They compare their results with findings from information behaviour research in 'real life' to which they have been introduced earlier in the module. They then reflect critically on the process of their inquiry and the development of their research understanding and skills. Support includes remote Second-Life-only tutoring by librarians.

Tutoring IBL challenges both staff and students to rethink and reconfigure conventional relations of power and control in the classroom and to find new forms of interaction that fit with values and goals relating to development of student autonomy in learning and knowledge-building. Academic staff at UoS describe the role of the IBL tutor variously as facilitator, guide, resource, or partner with students in a relation of co-inquiry. Several IBL development projects supported by CILASS included student tutors or mentors working alongside academic staff. For example, on a first-year History of English Language project to create an annotated bibliography, research proposal and a short research paper, higher-year students assisted first-years with information search and evaluation tasks, and ideas development.[34]

'To encourage students to reflect both on the project itself and on how they're working as a group, I get them to submit interim pieces of work three times during the semester. This work is not assessed – the point of it is to form a focus for reflection and feedback. They also submit a form which they've filled in together with categories relating to the collaborative process: 'reaching consensus', 'allocating workload', and 'getting the work completed'. This is quite helpful a useful starting point for discussion.'[35]

Spaces Traditional physical learning and teaching spaces in universities place constraints on the development and practice of IBL. CILASS explored the value of classrooms designed specifically for IBL in the arts, humanities and social sciences and the impact that space can have on changing the ways in which academic staff and students think about learning and teaching.

Peer-to-peer Group-work and peer co-operation are features of much IBL and some approaches aim to foster the development of inquiry communities within or across student year-groups, for example in professional education contexts. Feedback from CILASS projects indicated that group-work often was an especially challenging aspect of IBL for students. Productive approaches to supporting group-work in IBL included encouraging students to define group 'contracts' at the outset – establishing where and how often they will meet, who will take which roles, how non-participation will be tackled and so on – and holding half-way tutorial meetings with groups focusing specifically on group process.

'Students are becoming much more involved in peer-review – they're talking to each other much more and so they're less nervous about moving around the [academic department] and going into spaces where perhaps they previously felt they didn't have a place. So what they're doing is they're engaging in cross-year conversation.'

Dissemination Sharing and dissemination of students' inquiry outputs, within or beyond the immediate student peer group, was a feature of several CILASS project designs for IBL. For example, Masters students in Architecture at UoS developed individual action research projects to investigate creative risk-taking in professional practice. Their projects were to be of a standard suitable for journal publication and part of the assessment took the form of draft journal papers.[36] Other approaches included creating conference-style events with students presenting their work to each other and other interested parties using research posters or slide presentations.

Key points for effective practice

- Make inquiry or research central to students' experience,
- Ensure teacher-led communication of subject information plays a supporting, not a leading, role,
- Sequence tasks and activities in a way that fits with an emergent process of discovery,
- Engage students' prior knowledge,
- Align assessments to intended learning outcomes,
- Build in opportunities for reflection, assimilation, dialogue and feedback,
- Provide explicit support (tasks as well as information) for students to develop 'process' awareness and skills.

Progression in IBL

IBL initiatives supported by CILASS illustrated the value of introducing IBL as early as Level 0 (Foundation) and at induction for new first-years. For example, a week-long group-based IBL induction project was designed for students of Human Communication Science involving higher-year students supporting new entrants. In Psychology, CETL funding was used to support enhanced support for progression in IBL through successive levels of study.[37] Figures 5 and 6[38] offer broad frameworks for planning progression in IBL. More tightly structured and guided forms of IBL are appropriate at less advanced levels of study. Undergraduate degree programmes might therefore be structured to lead students in a broadly step-by-step (or snake-like) progression through *Identifying, Pursuing, Producing* and *Authoring* (Figure 5). However, it also is possible to design spiral, rather than linear, models of progression through an inquiry curriculum (Figure 6). Research carried out by CILASS[39] suggests that opportunities for first-years in arts, humanities and social sciences disciplines to engage in tightly-structured, small-scale, open-ended inquiries that are explicitly oriented toward knowledge-building may powerfully support development in areas such as identity-formation, personal epistemology and self-belief. The study also suggests that opportunities for first-year students to develop skills in framing their own inquiry questions may have particularly strong impact in terms of engagement and confidence.

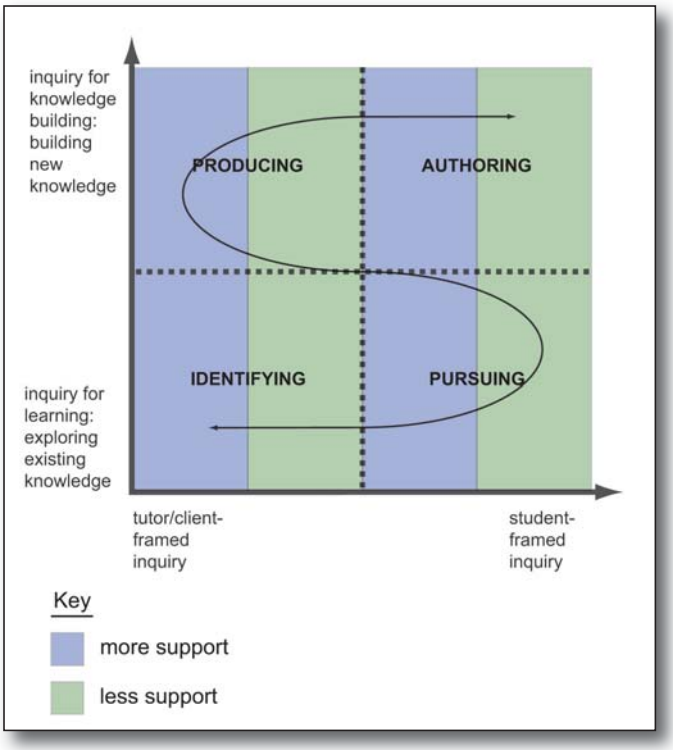

Figure 5: Step-by-step progression in IBL[38]

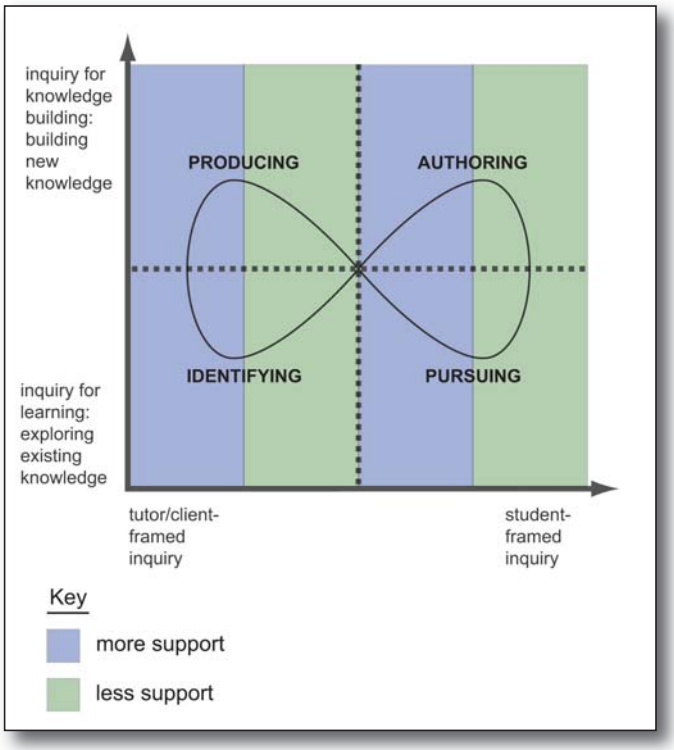

Figure 6: Spiral progression in IBL[38]

Digital design

Digital tools have been created specifically to support the creation, sharing and re-purposing of designs for learning. An example is the open source Learning Activity Management System (LAMS) which, as trialled by CILASS, was used successfully to design some approaches to IBL. LAMS aims to encourage activity-oriented design thinking and supports visualization of linked steps in a learning process. Once learning designs have been created in LAMS they can be run with students (either face-to-face or online), published to a wider community and reused by others. Students, as well as educators, can use LAMS to plan a sequence of inquiry activities.[40]

Visualising IBL design

Figure 7 offers one way of representing IBL design at the level of extended course units, illustrating the shape of one possible IBL design in relation to a number of dimensions.

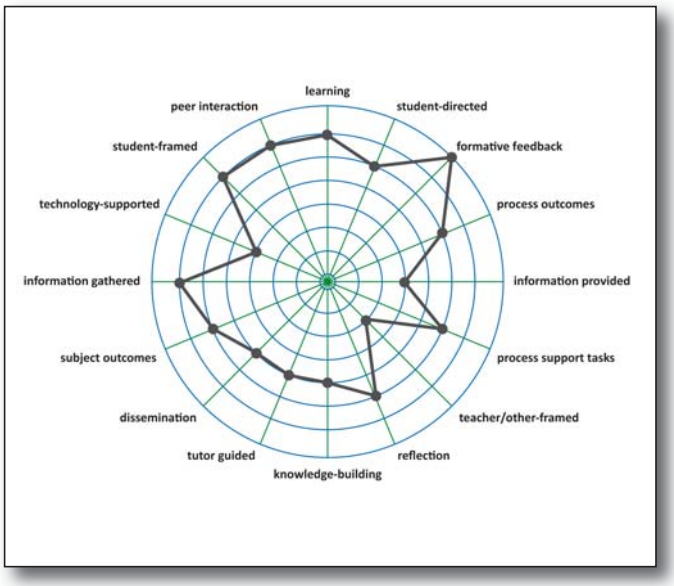

Figure 7: Dimensions of IBL[41]

IBL Planner

This Planner[42] offers a point of departure for designing IBL, and discussing and sharing IBL designs, in any academic discipline. Already-produced designs – for example, in the form of case studies or activity-sequences – can be used in conjunction with the Planner for inspiration and adaptation.

Designing for IBL	Questions to consider
Students	• What relevant subject and process knowledge and skills will students bring to the inquiry? How do they understand inquiry and research, and their own roles as student researchers? • How might IBL challenge them, e.g. in relation to their beliefs about their role in knowledge-creation, expectations about learning and teaching, self-confidence, skills? • What are their likely needs for support and guidance, in relation to the subject-matter and the inquiry process?
Intended learning outcomes	• Will the main focus be on students acquiring existing knowledge ('inquiry for learning') or on building new knowledge ('inquiry for knowledge-building')? • What will the balance be between subject and process learning outcomes? • Will students play a role in determining learning outcomes?
Inquiry theme	• What will students explore? How will their inquiries relate to the curriculum? • Who will establish the inquiry question – teacher, students, someone else? • Will there be a link between students' inquiries and their academic tutors' research interests? If so, will this be made explicit?
Inquiry process	• What is the appropriate scale and timescale of the inquiry? • Will the process be tightly or loosely structured by academic tutors? A step-by-step sequence of tasks, or a more flexible, emergent process? More strongly teacher- or student-designed? • Will students have choices in deciding how to approach the inquiry? • Will an established framework or protocol be used to structure the process? • Will it follow the pattern of research practice in the discipline?
Tasks	• What will the stimulus for the inquiry be (an open question; a scenario; a problem; an image; an artefact; a performance; a discussion; something else)? • How will the tasks be sequenced? Will a digital design tool be used? • What tasks will there be to help students engage with relevant theory/subject-matter (e.g. reflection; discussion; peer-to-peer information-sharing; lectures; practical workshops; laboratory sessions)? • What tasks will there be to help students develop process awareness and skills (e.g. in areas such as research methods, information literacy, group-work, reflective writing)?

Designing for IBL	Questions to consider
Assessments	• What will be assessed (research product; aspects of the process; reflection on the process)? What form will assessed outcomes take (poster; wiki; essay; design; report; film; other?) Will assessment be individual or collective? • What will the assessment criteria be? Will students play a role in establishing assessment criteria? • Who will assess (academic tutors; student peers; self-assessment; other)? How will summative feedback be given?
Information	• How will students access relevant information? What will the balance be between providing information to students, and requiring students to seek and select information themselves? • Will students be directed to information on process issues as well as discipline-based subject-matter?
Spaces	• Is there a need for a particular type of learning/teaching space during and outside of 'contact' time?
Technologies	• Which technologies will be needed and appropriate? Special equipment? Platforms for collaboration and content-creation; mobile technologies; the institutions' virtual learning environment; etc? • Will students play a role in deciding which technologies to use?
Tutoring	• Who will be involved in guidance and tutoring (academic staff; learning support professionals, e.g. librarians; student mentors; external tutors; other)? • How and when will formative and summative feedback be provided?
Peer-to-peer	• Will students work together? If so, in what way? Will there be a focus on developing an 'inquiry community'? • Will students work in partnership with academic staff or other researchers?
Dissemination	• Will students share the results of their inquiries with each other? More widely at department or Faculty level, or with a practitioner/research community beyond the university? • How will results be shared (on web, at an event, via presentations, posters, suitable peer-reviewed outlets; other)?

The template is available for download from www.shef.ac.uk/ibl and with acknowledgment can be freely adapted and distributed. It is based on the pedagogic planner concept and templates developed by JISC for its 'Effective Practice' programme.[43]

Examples of IBL

In this section some IBL curriculum development initiatives supported by CILASS within and beyond UoS are outlined, illustrating a spectrum of approaches across a number of disciplines.

IBL induction for engineers

Linda Gray; Dr Anthony Rossiter; Department of Automatic Control and System Engineering, UoS

An undergraduate induction programme aims to engage new students with IBL, orient their expectations of university study and assist transition from school. The previous lecture-based induction format is replaced with: a pre-arrival individual research task about the role of a systems engineer, with students' work uploaded to the Virtual Learning Environment for future use; a 'Robot Challenge' team competition in which students investigate how to program a Lego Mindstorms™ robot to achieve a number of tasks, using information drawn from a range of different sources; and, a group-based information-seeking task (learning trail, focused on induction information relating to their course and the University). These activities are supported by resource packs, an introductory lecture and practical sessions on the use of the Virtual Learning Environment and University portal. The Robot Challenge involves randomly selected teams carrying out tasks devised by second-year students. Feedback indicates that new undergraduates find the activities 'very challenging but great fun' (student) and beneficial in aiding transition to university study, enabling them to develop friendships with peers and giving a sense of identification with their new department. Staff comment on students' appreciation of the time spent in their department during 'intro week'.

Understanding law

Dr Mark Taylor and Dr Natasha Semmens; Dr Clare McGourlay and Dr Jonathan Doak; School of Law, UoS

This approach aims to meet the challenges of facilitating IBL with a group of over 400 students by means of a blended learning approach making use of a virtual learning environment. Key aims are to introduce first year Law students to the nature of legal problems and to develop their skills in legal inquiry. Inquiry-oriented tasks are supported with lectures and seminars. Students use an electronic workbook that, with a series of structured weekly inquiry exercises and scenarios, guides them through activities including legal information-seeking and analysis. They come together to discuss their research (what they find and how they find it) in colloquia led by second and third year student tutors. Students produce a series of individual, reflective learning diary entries plus a case critique for assessment. Feedback indicates that students find the IBL approach intensive compared with that of more traditional approaches but value the inquiry, information literacy and other transferable skills they develop. A second-semester module adopts a similar electronic inquiry workbook and learning diary approach, with 250 students working in groups to research topics they are interested in and producing a digital resource (video, podcast, slide presentation) to present to others at a 'celebration of learning' event.

Biblical studies fieldwork

Dr Diana Edelman; Department of Biblical Studies, UoS

As part of three weeks of archaeological fieldwork in Israel, pairs of third-year students in Biblical Studies work together to make video recordings of aspects of the archaeological dig process and interview specialists about other aspects in which they are not directly involved. Students are given support and guidance on filmmaking and the use of technology and they edit their footage to create films in the first few weeks of the autumn semester. The films are assessed by the lecturer and peers. Through this project, students need to do independent research about the archaeological process, from the initial conception and approval of a project, through implementation, and on to publication of findings. They need to decide which images to capture on site during the excavation process and which topics to cover during interviews or in other creative ways. They develop a range of technical and transferable skills while producing usable resources for future cohorts of students. Students involved find the IBL approach hard work but motivating, appreciating the extra responsibilities afforded to them by the filmmaking and peer assessment processes. One student said: 'I thought I was going there to do some work but I actually grew very much as a person from the experience'.[44]

Inquiry in information management[45]

Dr Andrew Cox; Peter Stordy; Professor Philippa Levy; Sheila Webber; School of Information, UoS

'Inquiry in Information Management' is a first-year, second-semester core module with an enrolment of about 30. A key aim is to encourage the participation of students at an early stage in the research culture of

their department and university. Students work in groups on small-scale research projects, from generating their own worthwhile research questions within the broad theme of 'the university as an information environment', through ethics approval processes, to presenting findings at a research 'mini-conference'. Development of students' understanding of, and skills in, the inquiry process is supported through participatory workshops and online resources. Work on projects starts in the fourth week of twelve, following a series of preparatory workshops that include exploring students' conceptions of research and how to pose and investigate research questions. In the final week, guests at the mini-conference include PhD students, lecturers and researchers. All guests contribute to assessment of research posters, using criteria that the students on the module have established previously in negotiation with their academic tutors. The module features input from practitioners in the field, who share their experience of Information Management and of the relevance of research and inquiry in practice settings, and comment from their perspective on students' research proposals and work.

Exploring an on-line edition

Dr Rhian Davies; School of Modern Languages and Literature, UoS

This module for around 30 second year students in Hispanic Studies aims to maximize the opportunities offered by research-led teaching using the interactive electronic edition of Benito Pérez Galdós's novel *Torquemada en la Hoguera* (1889) created by the module leader. The intention is to stimulate students to work like researchers and develop new ways of reading literary texts, while improving their skills in information literacy and collaborative learning. Inquiry exercises are provided in electronic form, designed to complement the electronic edition and to pose increasing challenging research questions as the module progresses. Students work in groups in workshops where they have access to the on-line edition and other resources, tackling tasks such as: analysing character by using the edition's character indexes; or the significance of particular words by using the edition's search mechanism. Students critically appraise the work of other groups and keep reflective diaries. Their work is assessed by individual essay or other forms of assessment such as character studies. Students emphasise that the approach encourages independent investigation. One comments that: 'I think this text has stuck out because I've got a lot more involved with the text. Skills I have learnt from studying this text will help with other books'.

IBL for international healthcare policy

Graham Jones; Dr Sarah Barnes; School of Health and Related Research, UoS

A cohort of 34 Masters students from 17 different countries with diverse subject-backgrounds explore factors driving health policy and system changes across the globe. A full module (twelve 2-hour classes) is designed around students working in small groups to carry out a sequence of 3 different inquiries based on real-life policy dilemmas. The starting-point for each is a question to be addressed and suggested lines of investigation. Support includes a set of information resources, including newspapers, grey literature and video clips, prepared by academic tutors and made available via a virtual learning environment, plus a lecture session introducing relevant conceptual and contextual material. Students work together during contact hours with tutors available for questions and advice in a CILASS inquiry collaboratory space that is designed to support flexible group-work with access to digital technologies. Assessment is by group presentations. Evaluation of the first iteration of the module highlights the value of physical space that combines 'pods' for small groups each gathered around a large computer screen, with ease of movement from small-group to whole-class mode and vice versa. It also indicates how working in this way with people from other cultures at an early stage in the programme stimulates valuable friendships and networks among students.

Medicine in the media

Philip Chan, Sheffield Vascular Unit; Professor Jackie Harrison; Journalism Studies, UoS

Why are the media so concerned about MRSA (methicillin-resistant staphylococcus aureus)? Does their coverage actually correspond to the scientific evidence? Second year students from the UoS Medical School are helped by staff from the Department of Journalism Studies to answer these questions. Students spend seven weeks investigating the ways in which the depiction of MRSA has changed over the past decade in newspapers ranging from the Sun to the Times via the Yorkshire Post. Students receive support in information literacy skills development, content analysis and production analysis. As well as analysing articles, students design and conduct interviews with journalists. Research is recorded using blog-based learning diaries. This interdisciplinary project is a pilot for a broader programme to develop the Medical School's problem-based learning curriculum in order to improve higher level learning skills in Medical students. Students present their findings formally in a conference-style

oral presentation at which an external expert acts as a moderator to assess and give feedback. In first year of running this module, the findings of the student group were developed for publication as a scholarly peer-reviewed article.

Contemporary visual arts in France

Dr Amanda Crawley-Jackson; School of Modern Languages and Literature, UoS

This project enables final year undergraduate students from the Department of French to engage with the work of contemporary artists from France. Working in small groups, students research artists and key themes in French contemporary fine art practice, making presentations about their findings and expressing their opinions on the artists' work. Each of the small groups decide on an exhibition theme and, using the work of the artists they discover in the course of their research, prepare a virtual exhibition using Google SketchUp™ and accompanying contextual learning materials for exhibition visitors, including brochures, podcast audio guides and worksheets for young people. Each of the exhibitions is then reviewed by student peers, using criteria they have developed while designing their own exhibition. Over the course of the module, students keep a learning journal, which they present as part of their assessment. As well as learning about contemporary visual arts in France, students develop a variety of other skills, not least in independent research, critical thinking and group working. The Leverhulme Trust supported the artist Nicolas Moulin's three-month residency in Sheffield in the first year of this approach, so that students were able to talk to a well-known practising artist about his work, getting advice about their exhibitions and learning about the real life processes of the art world.

An IBL approach to statistics

Stephen Wise; Department of Geography, UoS

A core statistics module for first year Geographers is modified to incorporate IBL. Students explore a geographical question, which is stimulating, open-ended and for which a quantitative approach provides useful insights – for example, relating to evidence for and against a North/South divide in Britain, or the extent to which climate and climate change varies across the UK. Students have a role in deciding how to explore the question, thus engaging their interest and developing their skills in undertaking research. Initial instruction in statistical methods provides sufficient information for their application by students working in groups, which is further supported by regular lectures and practical sessions. In this way the selection and application of statistical techniques is the key focus of their learning. At a final consolidation stage the full range of statistical methods is reviewed. In providing the explanation after students have had a chance to explore and apply the methods themselves, the links between theory and practice are more comprehensible and easier to re-apply for future use. Students' feedback indicates that the approach noticeably improves their interest in, and engagement with, statistics, and there is an improvement in marks and attendance.

IBL and international students in computing

Briony Oates; School of Computing, Teesside University

Most students on a core Masters-level Computing module on Project Research and Development are international (non-EU). They often are not accustomed to UK higher education teaching and learning approaches, including IBL and group-work. The IBL design uses a scaffolded approach to enable them to learn about and adapt to IBL. Inquiry tasks are designed to build up in terms of academic challenge throughout the module. They begin with a group photograph task aimed at getting students to know each other, and they continue to work together on a systematic review of research literature on a topic of their choice, selecting and properly referencing a given number of relevant papers, and analysing and evaluating three of these. Built into the module is an explicit exploration of the IBL process and the SCONUL Seven Pillars of Information Literacy.[46] Students also develop a website using a structured process, with a team contract and action minutes for each meeting. The outputs of their research and information literacy activities form the content of the website, making up one part of the assessment for the module. Other assessed outputs include staged group hand-ins relating to the research activity, a group presentation, and an individual essay reflecting on students' understanding of the research and information literacy activities undertaken and the skills they have developed.

Dramatising slavery and emancipating students

Dr Alan Rice; School of Journalism, Media and Communication, University of Central Lancashire

Students too often believe that their lecturers own the knowledge imparted to them and that they are passive recipients of it. This module is designed to enable students to see how their own individual and collaborative research and ideas can feed into the on-going development of a resource put together over the years by one of their lecturers. This resource is a performance-based tableau that has been taken into schools and museums and had particular purchase in 2007 when, with the commemorations of the bicentenary of the abolition of slavery, school teachers and educational officers were looking for

novel ideas to impart information about the transatlantic slave trade. Students from the second and third year of an American Studies degree experience a live project to develop the tableau (e.g. its characters, scenes and background materials) by conducting their own primary research in archives and other contexts. The project enables students to develop flexibility and independent learning skills, confidence in using primary and secondary resources and team-working skills to build individual research projects into a collaborative resource. They immerse themselves in the study of slavery over an eight month period and ultimately produce resources to make what had been an underdeveloped learning tool into a much more user-friendly and attractive multi-media event.

IBL in management accounting

Sue Davey-Evans; Ian Toon; Department of Accounting and Finance, University of Portsmouth

The traditional text book and lecture approach in teaching management accounting does little to bring the subject to life or encourage students to see the relevance in adapting techniques to real world scenarios. This second-year module aims to help students to apply concepts and techniques to business problems as they learn about them. Students' activity centres, for a full year, on simulation exercises in combination with a case study. Students are provided with the case at the beginning of the year and participate in a series of management board meeting simulations over the year, giving presentations on different issues of relevance to the case study company. For each board meeting, working in groups, students research a different business issue, and they rotate board roles over this period. During weekly classes time is allocated for student groups to analyse the case study and discuss their findings with the academic tutor. This is an important part of the learning process as tutors are able to utilise directed questioning techniques and refer groups to relevant resources. In addition to forming the basis for group-work, the case studies are the basis of a final closed book exam at the end of the year.

Exploring literary inquiry[47]

Dr Duco van Oostrum; Dr Richard Steadman-Jones; School of English Literature, Language and Linguistics, UoS

During a 12 week module, around 20 second-year students of English Literature, Language and Linguistics conduct a multi-dimensional inquiry into one literary text (Alex Haley's *Roots*). The approach is intended to heighten their awareness of the inquiry process in its different forms, to encourage them to develop more independence and initiative as inquirers, and to stimulate increased confidence and pleasure in working with texts. Interactive seminars organised around collaborative inquiry tasks explore 8 modes of inquiry and the interconnections between them: history, theory, close reading, writing, technology, sources, science and performance. For example, in 'science' students explore questions relating to the representations of speech in the novel and in 'writing' they write a short poem or link a theme into their own autobiography. Students' inquiries are supported by a rich range of multimedia resources accessed via a Virtual Learning Environment and weekly lectures. Assessment is by eight short postings to the Virtual Learning Environment bulletin board and three written pieces. Academic tutoring includes a reflective blog maintained by tutors and extensive use is made of the facilities of a collaboratory (research classroom) space in which students can access on-line resources, capture off-line work digitally, present to others using plasma screens, and configure the room to suit their activities. Students are enthusiastic about the different modes of exploration and the transferability of the inquiry skills they develop.

IBL in cognitive neuroscience[48]

Dr Tom Stafford; Department of Psychology, UoS

A Masters module in Psychology is based on the idea of 'teaching questions rather than answers'. Learning is organized in thematic blocks around four questions that reflect debates within the discipline. These are genuinely open questions, in that while theories exist as to the answers, they are contested. The questions are chosen because they link with research conducted by module tutors. Support for students' inquiries is in the form of a 50:50 mix of staff-led and student-led sessions. Staff-led sessions include lectures and seminars while student-led sessions are run in the way students decide, typically as round-table discussions in which information is presented and aspects of the questions debated. A feature of the module is a strong focus on fostering students' own question-formulating skills, with marks awarded for posing relevant questions via on-line discussion board after the four introductory lectures. Other assessed components are: peer-review by students of contributions to student-led sessions; individual written coursework consisting of two responses to a free choice of two out of the four topic questions. The module creates an extremely positive atmosphere with a high level of student engagement and achievement.

See www.shef.ac.uk/ibl for further information about these cases and more examples of IBL at UoS and other institutions.

Information literacy and IBL

Information literacy (IL) can be defined broadly as the ability to find and use information effectively in any given context, through any medium whether digital or other. It encompasses higher-order capabilities including critical evaluation, synthesis, ethical judgment and communication as well as technical skills in information searching and the use of technology. It can be seen as fundamental to successful inquiry and is identified as a core attribute of The Sheffield Graduate.[49] For these reasons, working in close partnership with the University Library, CILASS adopted a special thematic focus on integrating IL development explicitly into IBL. The CETL also aimed to support the development of new, inquiry-based approaches to IL education.

Academic staff leading CILASS-supported development projects gave a range of reasons for wanting to embed a stronger focus on information literacy in IBL. These included recognition that often:

- Students lack IL awareness and skills of relevance to IBL in their disciplines,
- The importance of IL is not always communicated effectively by academic staff,
- IL does not feature explicitly in stated learning outcomes for modules, and is not assessed,
- IL support across whole curricula is patchy and there is no commonly agreed framework for it across degree programmes as a whole,
- Students need to be able to transfer information literacy skills developed at university to work and life beyond the academy.

CILASS-supported information literacy projects

The CETL supported development projects in a range of areas including:

- Departmental or degree programme IL 'audits' and strategic development,
- Design of new IL tasks for IBL modules,
- Tailoring of 'generic' IL guidance resources to specific subject areas,
- Creation of new IL resources for specific purposes, e.g. subject information portals,
- Training of student IL mentors for peer support approaches,
- Creation of videos/audios about IL in workplace.

Examples of Information Literacy Tasks

Students construct an annotated bibliography to a specified brief

Students trace the research source of a specified news item

Students search for a journal article of interest and write a review

Students reflect on their personal IL using prompts and learning journals

Students interview a student peer about their information needs, carry out a literature search on their behalf, and create a bibliography

Students select terms from a piece of writing and explore different online reference sources' explanations

Students develop research questions from a given stimulus and search for and evaluate resources to support their inquiry

Students use social bookmarking or other Web 2.0 technologies such as wikis to create a peer-reviewed, shared information resource

Students research a Wikipedia entry for accuracy and re-draft it, with the possibility of uploading their changes to Wikipedia itself

CILASS strategies for developing information literacy in IBL

The CETL adopted a number strategies specifically focusing on the development of IL in IBL. A 'blended' educational developer post was created, with expertise in information literacy teaching and a specific remit to support this aspect of IBL development. A CETL Liaison Librarian role also was established to facilitate close partnership working between educational development and the Library. An Information Literacy Network group brought together information specialists from the Library with others from the University's School of Information to run events aimed at stimulating discussion and development of IL, and under the auspices of this group the CETL's student ambassador network produced a film on IL from the student perspective. The CETL also provided support for further development of the Library's role in IBL, including projects focusing on IL learning resource development and professional development for librarians on the theme of IBL.

'Having taught information literacy and skills for more than thirty years, I engaged with CILASS to try to refocus my teaching. Immediately, I realised the potential for using IBL and quickly revised my whole approach to teaching. Straight away I was absorbed with the excitement of this new challenge. Typically, I will use IBL to encourage students to revise and develop their internet searching skills to solve information problems. They will be shown new search products and alternative methods as they are challenged to find quality information.'

'In a short time, I have developed new programmes of teaching. One result is that I have embedded information literacy into three teaching Departments at both undergraduate and post-graduate levels. The other result is that my work excites me again and I have increased my annual total of contact hours significantly to meet demand from Departments.'[51]

Some ideas for information literacy in IBL

- Establish clear IL learning outcomes,
- Introduce IL explicitly to students and communicate its relevance to IBL assessments,
- Consider using an existing model to plan an IL curriculum (e.g. 7 Pillars),
- Relate IL development tasks directly to students' inquiries and research,
- Use IBL principles to design IL tasks and support (avoid approaches based solely on informing students about IL concepts and practices),
- Working in partnership (academic and library staff), integrate IL tutorial resources of the Library and create opportunities for librarians to use active, inquiry-oriented learning approaches,
- Time IL interventions right, to support students' inquiry in an integrated way,
- Assess students' IL development outcomes.

Two information literacy case studies

Critical appraisal of the public presentation of psychology

Dr Myles Jones; Department of Psychology, UoS

An inquiry-based approach to information literacy development is adopted in a first-year undergraduate Psychology module, which is taken by over 200 students. The module aims to introduce students to the way in which knowledge is created and disseminated in Psychology and to the kinds of questions and problems that attract scientific inquiry and controversy. As part of this there is a focus on developing students' skills in following up and locating scientific research sources, and their understanding of problems of interpretation that can arise in the dissemination of research knowledge by the popular media. Working in groups with the support of postgraduate tutors, students first search the *Newsbank* database and the BBC News website to select a story claiming to be based on an original research source in Psychology. They then trace the original research by searching the *Web of Knowledge* database and build on this by locating further research material relating to the topic. An information skills tutorial created by the University Library and tailored to the needs of Psychology students is used to support this work. With the help of academic staff, students then review the material they have found and produce a critical reflection on the process in the form of a collaborative presentation that carries 20% of the module marks.

A 'stepped' approach to information literacy development at a distance

Dr Sabine Little, School of Education and CILASS, UoS.

Information literacy development is embedded into a Research Methods module on an IBL distance-learning programme in Education for students from the Caribbean, as part of the support provided for them to develop their own research projects. The module is taken by over 70 students. An online component is designed around four structured discussion tasks with a step-by-step approach to encouraging increasing expertise and independence in digital information access and searching, a process with which the students are likely to be unfamiliar. For the first discussion, a journal article is supplied online by the academic tutor. For the second, students are given a list of bibliographic references and locate journal articles themselves by searching the University Library's online sources. For the third, students are given suggested search terms for locating material of relevance to the topic. For the fourth, students locate relevant literature independently and receive feedback from the academic tutor and peers on the quality and their evaluation of items identified.

An information literacy model

The Society of College National and University Libraries 'Seven Pillars' model offers a framework for planning IL development tasks and progression.[50] Tasks can be designed specifically to foster skills development in relation to one or more Pillars.

The SCONUL 7 Pillars model was offered to CILASS IBL curriculum development projects as a tool for planning IL development in IBL. Academic staff tended to place less emphasis in IBL on Pillars 1 and 6 than on others. Pillar 5, the ability to evaluate sources of information, frequently was considered by academic staff to be an especially important focus for embedded IL tasks in IBL.

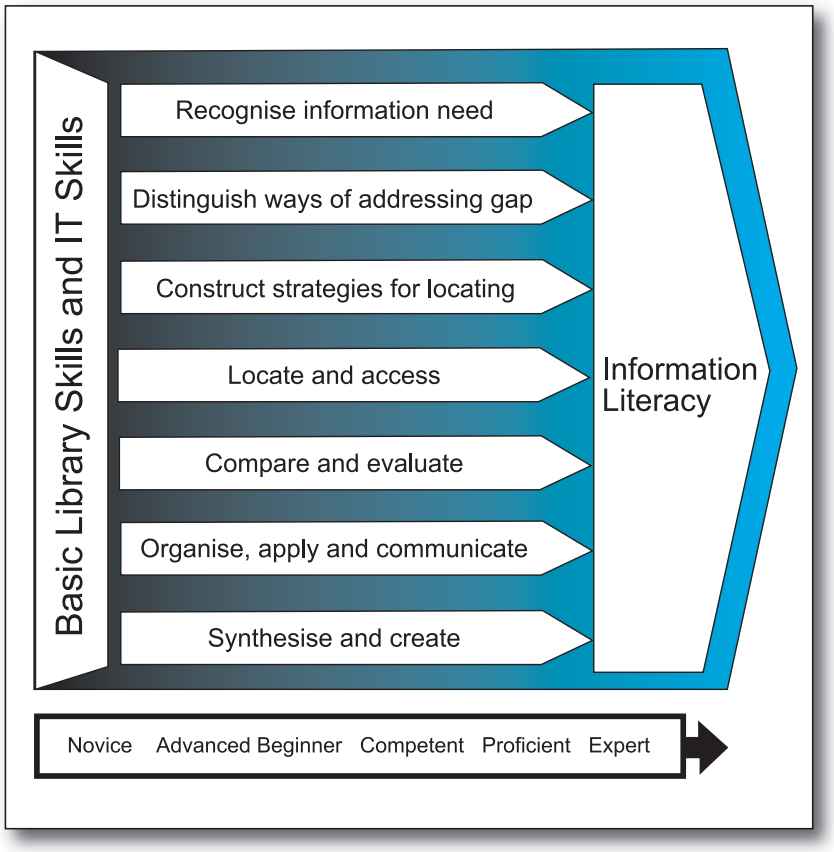

Figure 8: The SCONUL 7 Pillars of Information Literacy
Adapted and reproduced with permission

Learning spaces for IBL

Learning spaces can be designed specifically to inspire and support innovative IBL, helping to make good teaching better and to enhance the learning experience. CILASS received capital funding from the national CETL programme to create new spaces for IBL in the new Information Commons (IC) building at UoS and in another central University location. Evaluation indicated that accommodating inquiry collaboratories in the IC is seen to have raised the profile of IBL in the institution and to have made a fruitful explicit connection between library services and student-centred educational innovation.

Three inquiry collaboratories – classrooms conceived as research environments – were designed to support collaborative student inquiry in arts, humanities and social sciences disciplines. The aim was to create flexible, information-rich spaces. The collaboratories offer access to a wide variety of technologies as an integral part of the learning and teaching experience but aim to avoid being technology-dominated in feel. The first one to be created was selected by JISC as an exemplar of good practice in technology-rich learning space design.[52] The use and impact of CILASS spaces indicates that while cutting-edge technologies add value, high impact features – such as flexible furniture and collaborative access to ICT – need not necessarily be expensive.

Information Commons (IC)

Collaboratory 1

Collaboratory 2

IBL spaces in the IC

Collaboratory 1

- 40 students
- fixed collaborative workstations (clusters of up to 4 students, desktop PCs with large screens)
- touch-screen display connectivity (lectern computer or DVD to desktop PCs and vice versa)
- lightweight portable whiteboards with image capturing system (digital images saved to web)
- interactive whiteboard
- 3 breakout rooms (glass room dividers)
- seamless access to informal soft-seating spaces and wider resources of the IC

Collaboratory 2

- 36 students
- flexible tables (tip-up table-tops and wheels)
- laptops and tablets
- touch-screen display connectivity (lectern computer to laptops)
- lightweight portable whiteboards with image capturing system (digital image saved to web)
- interactive whiteboard
- videoconferencing (Access Grid Node)
- 'write-on' wallpaper with magnetic wall surface
- seamless access to informal soft-seating spaces and wider resources of the IC

'Things to do in an inquiry collaboratory'[53]

- get organised
- tête-à-tête (work in pairs)
- use big floor (for performance, or other movement-based activity)
- log on (to University virtual learning environment and beyond)
- music and voice
- get in a huddle (around whiteboards and image-capture system)
- go to the movies
- go to the IC (e.g. to find books or other resources)
- create (digital artefacts, 'traditional' artefacts)
- hold the main event (e.g. a culminating presentation or mini-conference)

What students and staff value

- Flexibility
- Technology
- Informality
- Intimacy
- Openness
- Movement
- Freedom
- Intensity
- Flow

'CILASS room fantastic – technology here was really great, made it far more interesting than other seminars.'

'Learning has finally come into the 21st century! The new technology has opened my eyes to exciting new ways to examine literary texts.'

What staff observe about students

- More participative
- More confident
- More relaxed
- More independent
- More in control
- More engaged
- More equal with staff
- Developing skills

'It's the perfect opportunity to get students working with research materials.'

'It's certainly encouraged the students to take on a hands-on, frontline role in the learning process and made me take a step back.'

'The students are much more confident, I think, with me. It changed the nature of the relationship between myself and the students, I'm much more one of the group and they treat me much more as one of the group rather than the lecturer. In these new spaces, I'm a researcher like them.'

'It's enabled me to really get to see what the students are doing when they're doing their inquiry, rather than it's sort of happening all outside the classroom when you're just not aware of what they're finding difficult or finding easy. So I could see how effective their information searching was, I could do something about making it better.'

'It's made me think about IBL, the spaces allow you to think flexibly so I've been doing teaching that I never would have done in a normal seminar room.'

Enthusiastic student feedback about the collaboratories shows that space design and technology, when used creatively, can powerfully enhance the learning experience. Technology can quickly become a transparent feature effectively facilitating a variety of modes of inquiry, interaction and presentation, and can change the way students think about learning and knowledge-building in their discipline.

Academic staff feedback to CILASS showed that space design can stimulate fresh thinking about educational design, encourage experimentation with new IBL practices, and make for closer, research-based partnerships between student peers and between students and staff. Staff reported that the collaboratories could help to promote students' responsibility for learning and enable students to make the learning and teaching environment their own, varying seating arrangements and using different facilities according to need. They also noted that when students are conducting inquiries using digital technologies during contact time, this aspect of the learning process becomes more visible to staff – for example with benefits in terms of staff awareness of students' level of competence in using digital information sources and of their IL development needs.

Support

Support that combines technical know-how with an understanding of the educational potentials of new spaces and technologies for IBL is needed to enable academic staff to exploit technology-rich spaces to their best advantage. Aiming to give examples of 'why to use' technology, as well as 'how to use' it, support strategies employed by CILASS included a series of 'Unlocking Technology for IBL' workshops and a wide range of web-based video and printable user-guides.

'It has been useful learning more about how to use the technology. I'm able to be more creative when I don't have to worry so much about physical constraints.'

An inquiry collaboratory for music composition

The technology-rich collaboratory concept was adopted by the Music department for one of its IBL projects.[54] The space was designed to support creative interactions between students from different strands and levels of the Music curriculum (composers, developers and performers from first-year undergraduates to Masters students). A wiki was used to explore and chart the use of the collaboratory, with students building up a useful manual resource as part of a number of guided tasks which led them to explore fully what the collaboratory had to offer. The collaboratory has broadened the conception of what is possible in the studio by challenging students to develop new ideas about technologies in Music, and allowing them to share and converse about these ideas through the wiki.

Collaboratory 3, Bartolomé House

collaborate

Extra-curricular inquiry and research

CILASS's initial focus was solely on IBL in the curriculum. However, in response to trends in the wider sector combined with strong internal institutional interest, the CETL ran a two-year pilot for a new extra-curricular undergraduate research bursary scheme called the Sheffield Undergraduate Research Experience (SURE). Based on a competitive application process, the scheme enabled second-year undergraduates from all Faculties in the University to conduct six- to eight-week research projects over the summer vacation, supervised by academic staff. The scheme included a student-facilitated peer-support network for the student-researchers and a culminating poster conference.

Evaluative benchmarking against similar national and international schemes showed that benefits experienced at Sheffield were in line with those identified elsewhere, and the pilot served to confirm the strong contribution that undergraduate research can make to the research mission of a university. Students were highly enthusiastic about their experiences, reporting enhanced research skills and understanding, improved subject knowledge, increased intellectual confidence and a rewarding sense of enhanced participation in, and contribution to, their discipline.

A summary[55] of the international evidence-base on the impact of undergraduate research opportunity programmes points to the positive role these play, including fostering students' greater independence in learning, increased epistemological sophistication, improved critical thinking, problem-solving and understanding of how research is carried out, stronger identification with departmental research cultures, and development of the ability to assess research as a career. Evaluation of UK schemes highlights the benefits for student apprenticeship in research communities of practice.[56]

Historically, such schemes have been more common in the sciences than in other discipline areas. The CILASS scheme demonstrated the value of opportunities for students in other disciplines, as well, to experience working with professional scholars and researchers, either on projects of their own devising or designed by staff to support existing research activities or planned research grant applications. Some projects resulted in peer-reviewed or other publications, jointly-authored by staff and students or single-authored by students.

In 2008-9, Simon Crowther, then a second year Politics undergraduate, used the SURE scheme as an opportunity to cross academic discipline boundaries. He carried out a project examining controversial and important legal issues relating to the work of the Special Immigration and Appeals Commission. This led to publication in the Cambridge Student Law Review and in the national press, and confirmed Simon's interest in pursuing higher research and a legal career.

Among academic staff supervisors, the scheme was especially attractive to relatively early-career researchers. Feedback from staff was highly positive and indicated that students' research often contributed to advancing on-going work with some projects bringing a fresh, new dimension.

Student-led, extra-curricular IBL

In response to student interest, the CETL experimented with opening up its IBL small-grant scheme to students as well as to staff, for extra-curricular inquiry projects. Student-led IBL project activity was on a small scale but was successful in demonstrating positive impact for students and a model for a scheme with potential for wider application. With support from the CETL, students took forward a performance project entitled *theatre two point oh#* and created an online journal, *New Histories*.

> *'New Histories has given me the opportunity to pursue areas of interest independently from the syllabus, and improve my writing skills, making my work accessible to a non-specialist audience.'*

New Histories[57]

Liam Geoghegan, Department of History, UoS

As described by Liam Geoghegan, an MA student in the Department of History, this project was motivated by the aim to 'encourage a new kind of history writing – something that was enjoyable, easily accessible, wide-ranging and fun to read and write. During my History degree I was often struck by the inaccessibility of academic history writing and how even 'popular' history was just as dry, and less wide-ranging in content. In addition, I noticed that most of the assessment for a [student] historian was exactly the same – technical, academic essays, to be read by a tutor or two, and then never seen again.' This led to the creation of a vibrant, fully student-led on-line magazine that aims to be a truly accessible resource for history writers and readers, and that has widened the research interests of those involved, giving them a new outlet for their own historical ideas.

> *Since I started researching [for the magazine] I have not only enjoyed the process but also looking at areas of history I wouldn't generally have considered before.*

theatre two point oh#

Tom Szekeres, School of Modern Languages;
Laura Jenkins, School of English, UoS

theatre two point oh# was an extra-curricular, interdisciplinary, student-led IBL project that aimed to enhance students' understanding of performance and at the same time to utilise theatre as a means of conducting inquiry and sharing ideas, practice and knowledge. The project used digital technologies, collaborative working and innovative documentary methods to support the creation, performance and evaluation of a performed play. One of the original ideas that inspired the project was to tailor an extra-curricular activity towards academic goals and imaginative ways of problem-solving. The project examined the role of CCTV and surveillance systems in contemporary society. It was purposefully exposed to surveillance itself through use of the internet and rehearsing in a glass-fronted inquiry collaboratory space.

Institutional strategies for developing IBL

Institutional strategies that were found to be productive by CILASS in promoting IBL, and supporting its development, are highlighted here.

Developing IBL	Institutional strategies
Reward and recognise	The CETL ran an institutional award scheme for excellence in IBL, with awards for individuals, team and departments, and including a student-nominated strand.
Support development	The CETL encouraged creativity, experimentation and 'risk-taking' in funded curriculum development projects. Targeting of development grants and support was multi-level, to include: individuals/teams; academic and professional services departments; faculties. Thematic priorities for development projects were promoted, including collaborative inquiry, information literacy in IBL, and the use of digital technologies in IBL. IBL was an embedded focus in Learning Teaching and Assessment Strategies at institutional, faculty and departmental levels, and championed by senior institutional managers. Development initiatives were supported by strong cross-professional partnership working, between academic staff and professional services staff including librarians, educational developers and learning technologists. Internal commissioned support and secondments to the CETL helped to spread IBL ideas across professional services departments. Student partnership in educational enhancement was an important dimension of the CETL's approach. A student ambassador network for IBL with participants from each academic department in the CETL's core faculties was co-facilitated by a student and a member of staff. Educational developer/researchers acted as 'winged messengers' between staff developing new IBL initiatives in different parts of the institution, and connectors of people with shared purposes and interests. The CETL established and coordinated formal networks and special interest groups, and fostered informal networking among academic staff and between academic and professional services colleagues. Creation of network connections external to the institution were encouraged.
Align the physical estate	The design of new IBL collaboratory spaces was learning and teaching focused, and developed through a process of close partnership working between academic and professional services staff. The new spaces were used for staff development about IBL as well as teaching. Support for new users provided blended technical/educational development support.

Developing IBL	Institutional strategies
Stimulate, support and conduct evaluation, scholarship, research	The CETL promoted, supported and carried out scholarship of teaching and learning and pedagogical research for IBL. It also carried out institutional research on staff and students' perspectives on the relation between research and teaching.[58] New IBL initiatives were evaluated using a 'Theory of Change' evaluation approach developed at UoS.[59]
Engage and disseminate	The CETL provided wide variety of IBL-related events, characterized by inclusion of informal and social networking approaches and strong student participation. Some events were designed specifically for professional services staff. Dissemination-of-practice strategies included case studies, briefing papers and an internal newsletter with an informal flavour and with strong student visibility.

Students as partners in educational enhancement

The CILASS Student Ambassador Network was a vibrant and powerful mechanism for facilitating development in IBL at the University.

CILASS student ambassadors produced films on IBL and information literacy, jointly coordinated annual Sheffield Staff-Student Conferences on IBL, contributed to the evaluation of CILASS-funded IBL projects, ran workshops in academic departments, conducted research into the student experience, contributed to national conferences and acted as invited advisers to other HEIs. Peer workshops they led on topics such as group-working were seen to be especially effective in communicating messages to other students. Ambassadors reported very strong benefits for their employability profiles and included CETL work in portfolios submitted to the University's 'Sheffield Graduate Award' for extra-curricular achievement.

'Having CILASS ambassadors in the department has raised the profile of an integrated approach between staff and students, transforming the learning experience for staff by empowering students. The work that CILASS ambassadors do contributes to the collegiate nature of university, promoting the vision of university as a community'.

'I thought it was really great to be working on something that was actually going to make a difference – it's fine working on an essay for a module, and you get some satisfaction out of it, but what is going to DO? Working in CILASS we've actually DONE something!'
Student ambassador

‘Top 10’ messages about IBL from CILASS evaluation and research

IBL can have a powerful impact on students’ intellectual, professional and personal development. Students experience benefits including greater enjoyment and engagement in learning and knowledge-building, and enhanced capabilities in areas including: self-directed inquiry; information literacy; communication; collaboration; use of digital technologies.

There are benefits in introducing students to IBL at the start of students’ experience of university learning, in areas including fostering enthusiasm for study and development of self-confidence. This also allows positive norms relating to IBL to be established early.

As well as developing students’ subject knowledge and ‘transferable’ skills, IBL can in a positive way challenge limiting beliefs and expectations that they may have about their role in learning and knowledge-building.

Approaches to IBL that offer students opportunities to formulate their own questions and lines of inquiry can be especially powerful.

Students value the relevance of IBL to life beyond university. IBL addresses the expectations of employers by providing a context for the development of a wide range of skills for the workplace and lifelong learning.

IBL can be applied flexibly in different ways across different contexts of undergraduate and postgraduate education. The CETL demonstrated its value in pure and applied disciplines, and in interdisciplinary learning, from the first undergraduate year upwards. IBL can be used successfully with large as well as small cohorts of students.

Provision of carefully-designed orientation and support in response to student needs is essential for productive IBL. Students may struggle if appropriate process support is not in place. For example, it is valuable to embed information literacy development explicitly into IBL, in the form of information literacy tasks and assessments.

Learning spaces can be designed specifically to support IBL, with positive impacts for both students and staff and closer partnership relations between them. Web 2.0 technologies can be effective in supporting student-led inquiry in ways that foster autonomy and creativity.

When promoting and extending IBL across different academic and professional disciplines it is important that a broad-based definition is used. At the same time there is a need to communicate the distinctiveness of IBL in terms of the central role of the inquiry question and process in the student experience and the implications of this for learning design.

Extra-curricular IBL opportunities, in the form of IBL projects or research bursary schemes, benefit students and promote an integrated perspective on university provision for a ‘research-led’ or ‘research-engaged’ student experience. IBL can play a key role in university strategy to strengthen teaching-research linkages.

Top 10

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Evaluation and research sources drawn on for the Companion

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Complete listings of CILASS evaluation data are provided in:

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‘Universities should treat learning always as consisting of not yet wholly solved problems and hence in a research mode *(forschendes Lernen)*.’[60]

‘Enquiry (Latin *quaerer verum*, to seek the truth) involves seeking. Pedagogically, perhaps the most important task of the teacher is to develop, among students, an atmosphere or an attitude in which they seek.’[61]

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www.shef.ac.uk/ibl

This website provides access to resources generated through CILASS, including: case studies, bibliography, evaluation and research reports, downloadable version of The Sheffield Companion to IBL.

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