

Technology-enhanced inquiry-based learning in higher education: what does the evidence-base tell us?

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Abstract

There is at present considerable international interest in strengthening the role of inquiry and research in the undergraduate experience. Against this background, the term ‘inquiry-based learning’ (IBL) is in increasing usage, to describe a range of pedagogical approaches in which student inquiry drives the learning experience. The conceptualisation of IBL is contested but often it is described as an ‘umbrella term’ encompassing approaches such as case- and problem-based learning. Digital technologies play an important role in IBL pedagogy and arguably there is a close affinity between the ethos and practices of networked learning, IBL and Web 2.0. However, the evidence-base that focuses specifically on the use of technology in IBL, although relatively small, is highly fragmented. Therefore, for this in-progress project, funded by the UK Higher Education Academy, we are drawing together material from disparate disciplinary and specialist/practitioner fields to offer a critical review and synthesis of research evidence on the use and potential of digital technologies to support IBL. As part of this, we are mapping conceptualisations and practices of technology-enhanced IBL according to a number of dimensions of IBL design and facilitation including: knowledge-orientation; inquiry-framing; process support strategy; technology-strategy. Our poster offers a preliminary analysis, identifies a number of questions that arise, and suggests areas in which further research is needed.

Keywords

inquiry-based learning, literature review

Introduction and project overview

There is at present considerable international interest in strengthening the role of inquiry and research in the undergraduate experience, stimulated in large part by the Boyer Commission’s (1999) critique of teaching in American research universities. Against this background, the term ‘inquiry- (or enquiry-) based learning’ (IBL) is in increasing usage, to describe a range of pedagogical approaches in which student inquiry drives the learning experience. The conceptualisation of IBL in higher education is contested but often it is described as an ‘umbrella term’ encompassing approaches such as case- and problem-based learning. Whereas in some conceptualizations IBL is presented as the means of engaging students actively with an existing knowledge-base rather than of engaging them in ‘actual research’, in others it is taken to encompass the potential for students to participate in the production of genuinely new knowledge or meaning. We suggest that the distinction made by Bereiter (2002) between ‘knowledge construction’ and ‘knowledge building’ – the former understood as personal conceptual development (learning) and the latter as a contribution to the improvement of ideas in a domain – is a useful one for distinguishing between different modes and experiences of IBL according to intended or actual outcomes.

Digital technologies are changing the processes of both knowledge (co)construction and knowledge building, and they play an important role in IBL pedagogy. Arguably, there is a close affinity between the ethos and practices of networked learning, IBL and Web 2.0. Indeed, we might see ‘inquiry’, as much as ‘connectedness’ (Goodyear, 2002), as fundamental to the conceptualisation and theoretical basis of networked learning.

The growing, largely single case-study based literature on IBL in higher education often describes the use of technology as an embedded element in learning designs without exploring its role, use and impact in detail. At the same time, the evidence-base that focuses specifically on the use of technology in IBL, although relatively

small, is highly fragmented. For example, there appears to be little cross-over between the literature arising from practice-led developments in IBL pedagogy and the specialist field of computer-supported inquiry learning (van Joolingen et al 2007) - or that of networked learning. Therefore, with this in-progress project, funded by the UK Higher Education Academy, we are drawing together material from disparate disciplinary and specialist/practitioner fields to offer a critical review and synthesis of research evidence on the use and potential of digital technologies, including a special focus on Web 2.0, to support IBL.

Method

Our approach is based on the procedures of systematic review, adapted to fit the nature of the evidence-base and purposes of the project. The focus is on mapping what has been investigated and learned recently about the use of current digital technologies in IBL, and what gaps and directions exist for further work. The international evidence-base generated in the last five years is being examined in detail against the background of a broader overview of prior evidence. We are adopting an inclusive definition of what constitutes 'research evidence' - encompassing pedagogical research, practitioner-led scholarship and evaluation studies - in order to represent the range of forms of knowledge in the field. The questions we are exploring are:

1. How is IBL conceptualised in the literature on technology-supported IBL?
2. Which digital technologies are being used in IBL approaches, with what purposes and in which ways?
3. How are students supported to use these technologies productively?
4. What are students' experiences of using these technologies and the impact on their learning?
5. What learning, teaching and other related issues/challenges arise?

We are mapping conceptualisations and practices of technology-enhanced IBL according to a number of dimensions of IBL design and facilitation including: knowledge-orientation (construction/building); inquiry-framing (student/tutor framed); process support strategy (loose/tight structures); technology-strategy (student/tutor roles).

Emerging patterns

At the time of writing, a corpus of *circa* 60 items (journal and conference papers from 2005-2009) in which the term IBL (or close synonyms, excluding PBL and CBL) is represented in titles or abstracts, along with terms relating to technology-enhanced learning, has been gathered via a number of database searches. Preliminary template-based analysis has been conducted. Rough mapping shows:

- Diverse conceptualisations of IBL, overlaps in terminology, with the distinctiveness of IBL pedagogy often unclear. Relatively little emphasis on students as instigators and designers of their own inquiries.
- A larger body of material from the Pure and Applied Sciences than the Social Sciences, and very little from the Humanities.
- Development and use of some specially-designed digital tools and environments for IBL as contrasted with the use of 'generic' web platforms/tools or institutional platforms (typically, virtual learning environments - VLEs).
- Proposed or reported use of digital technologies supporting a wide range of tasks in differing IBL contexts, including: information searching, retrieval and manipulation (*digital libraries, web portals, webquest*); online reflection, discussion and (inter)community interaction (*online forums*); scientific experimentation and modelling (*inquiry learning systems, virtual laboratories and field environments, intelligent tutoring*); design tasks (*webquest, customised inquiry tools, VLE*); problem analysis, case analysis, problem-solving, role-play (*multimedia scenarios, digital video, online simulations, hand-held computing, VLE*); digital storytelling (*digital photography and audio*); collaborative authoring (*wiki*). Design-for-learning system used to support teachers (and to an extent, students) as designers of IBL.
- Whether because of publication lag-time or other reasons, very little research evidence in this corpus on Web2.0 in IBL or on student-created or personalised digital inquiry environments.

Conclusion

The main focus of this study is on a relatively narrow segment of the evidence-base that relates to technology-enhanced IBL. The broader evidence-base on technology-enhanced learning includes much material that is likely to be of relevance to IBL - and, conversely, the broader evidence-base on IBL includes material that provides further insight into trends in technology use in that context. However, our preliminary analysis of the research literature that focuses specifically on technology-enhanced IBL suggests a number of questions to be asked of emergent practice in IBL and identifies areas in which further research is needed.

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