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Enhancing learning and teaching through technology

A table of resources for academics

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Commissioned by the Higher Education Academy, York

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Studies of evidence-based technology-enhanced learning and teaching in higher education: practitioner view

This is a resource that provides a collection of studies that may be of use to HE practitioners. The studies have been examined in relation to an evidence-based approach to the use of technology in learning and teaching. A framework has been used to interpret variations in studies. Within the framework, evidence is characterised in two ways: first, in relation to the type of evidence provided; and second, in relation to its potential impact.

Types of evidence

These are divided into three main groupings:

1) **Accounts of interventions**

These are descriptions of how technology has been used in higher education. The evidence provided is typically of a less formal nature such as anecdotes, observations and questionnaire data, including measures of student satisfaction.

2) **Lessons learned**

These are accounts of learning and teaching with technology where lessons have been learned from their use. They include formal and/or informal forms of data collection, including both qualitative and quantitative data. The data also range in nature from weak to robust data collection methods.

3) **Changes in practice**

These provide good examples of how evidence has been used to drive an investigation into interventions in technology in learning and teaching, followed by an evaluation of its effectiveness for student learning. It also illustrates how the evidence is used in changing practice.

Impact of evidence

These are also divided into three main groupings:

a) **Micro**

These changes are usually confined to a level local to the teacher or classroom or a particular course.

b) **Meso**

These changes are usually within a department, faculty or institution and will have impact on more than one course or programme of study.

c) **Macro**

These changes impact on more than one institution at national level and may also have impact on institutions in different countries at an international level.

Studies of technology-enhanced learning and teaching in higher education

Study/form of evidence	L & T intervention	Subject/discipline & level	Challenge/aim of L & T intervention	No. of participants	Country	Research/evaluation method(s)	Key findings
Blended learning/e-learning/hybrid courses							
Cramer, Collins, Snider & Fawcett (2007) DOI: 10.1111/j.1467-8535.2006.00598.x 1a	Virtual Lecture Hall - electronic delivery of lectures	Introductory course in Psychology	Making available online recordings of 'live' lectures	165 on-campus students	Canada	Utilisation log; survey of students' perceptions and attitudes to VLH.	20% of students used the resource. Greater use of VLH corresponded with higher grades on mid-term assignment.
Arbaugh, Godfrey, Johnson, Pollack, Niendorf & Wresch (2009) DOI: 10.1016/j.iheduc.2009.06.006 General literature review	Online and blended learning	Business & management disciplines	Comparison with classroom-based courses	Various	International	Literature review	Results from the comparison studies generally suggest that online courses are at least comparable to classroom-based courses in achieving desired learning outcomes, while there is divergence in findings of comparisons of other course aspects.
University of Bradford, Promoting the patient perspective http://www.jiscinfonet.ac.uk/case-studies/tangible/br	Blended learning in practice-based courses.	Year 1 Physiotherapy students	To enhance the student learning experience and to contextualised professional learning in the behavioural sciences.	48	UK	Comparison of VLE course statistics with an equivalent course.	Significantly higher usage: 6,539 'hits' as against 3,990. It exposed students to a wider range of issues and broadened the range of learning activities.

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Study/form of evidence	L & T intervention	Subject/discipline & level	Challenge/aim of L & T intervention	No. of participants	Country	Research/evaluation method(s)	Key findings
adford/index.html 1a							
University of Central Lancashire http://www.iiscinfonet.ac.uk/case-studies/tangible/lan-cashire/index.html 1a	Accessible online diabetes training for Health Care professionals	Health Care Level not specified	To facilitate the implementation of the National Service Framework (NSF) for Diabetes. The philosophy encompasses constructivism theories.	Not specified	UK	Not specified	This case study illustrates staff satisfaction with e-learning , a positive effect on recruitment , use of resources , and an effect on social equality .
University of Derby http://www.iiscinfonet.ac.uk/case-studies/tangible/derby/index.html 1a	Formative e-assessment in Economics	Economics Year 1	To reduce failure rates among full-time students through improving self-regulating learning through computer-based formative private study.	Approximately 250 to 350 over two years	UK	Comparison of dropout rates and grades with previous two years and use of formal and informal feedback.	This case study illustrates a positive effect on retention , learning, exam results, student personal development, student and staff satisfaction with e-learning , and staff personal development.
University of Glamorgan http://www.iiscinfonet.ac.uk/case-studies/tangible/glamorgan/index.html 1a	Phased online summative assessment in undergraduate Accounting	Business Studies Year 1	To improve students' poor performance, lack of participation in the learning process and superficial engagement in the topic area.	60	UK	Not specified	Improved student engagement in double-loop learning: better integration between theory and practice. Also better engagement in both tutor-led and private study.
University of Derby http://www.iiscinfonet.ac.uk/case-studies/tangible/derby/index.html	Online delivery of MSc Strategic Management in Africa	Business Administration Masters	To meet university requirements to provide flexible learning and to offer courses to non-campus-based students.	306	UK/Africa	Changes in the distribution of outcome values were examined using the mean scores for summative assessments and examinations over a	Computer-based formative learning positively affected achievement rates. However, the process by which formative assessment affects achievement may differ between computer-based

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rby/index_html1 1a						period of three years.	coursework and final written exam. It may also be affected by entry-level skills.
University of Glasgow http://www.iiscinfonet.ac.uk/case-studies/tangible/glasgow/index_html 1a	Supporting Scottish History courses via Moodle	History Years 1 and 3	Improving accessibility to course materials Improving communications between staff and students Reducing photocopying costs.	Not specified	UK	Not specified	Improvement in pass rates and in grades.
University of Glasgow http://www.iiscinfonet.ac.uk/case-studies/tangible/glasgow/index_html2 1a	Use of Moodle in Divinity	Theology and Religious Studies Years 2 and 3	Move from a paper-based distance education course to a VLE version.	Not specified	UK	Not specified	Students grades compared with the paper-based version were the same. However, the course was discontinued due to the increased costs.
University of Glasgow http://www.iiscinfonet.ac.uk/case-studies/tangible/glasgow/index_html3 1a	Use of Moodle to support active learning in Classics To integrate online and face-to-face learning	Classics Year 3	Encouraging students to take an active role in learning and to become critical thinkers.	Not specified	UK	Not specified	No tangible benefits per se – but has provided grounds for future development.
University of Glasgow http://www.iiscinfonet.ac.uk/case-studies/tangible/glasgow/index_html4	Use of Moodle in Multimedia analysis and design at Humanities Advanced Technology	Humanities Honours	To support constructivist approaches to learning and teaching.	Not specified	UK	Not specified	Enabled doing the same thing better. No grade or pass rate improvement.

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sgow/index_html4 1a	Information Institute (HATII)						
University of Hull http://www.iiscinfonet.ac.uk/case-studies/tangible/hull/index_html 1a	Online MEd in e-Learning programme	e-Learning Masters	To ensure access to remote students and to exploit the added value which the VLE offered.	Not specified	UK	Not specified	No previous course to compare to, but supported a symbiotic relationship between study and work contexts.
University of Hull http://www.iiscinfonet.ac.uk/case-studies/tangible/hull/index_html1 1a	Delivery of MA in Legislative Studies Online (MALSO)	Legislative Studies Masters	To support wide ranging student needs: staff working in or with parliaments; mature students with work and family commitments; improving access.	Not specified	UK	Not specified	Supports distance students. Brings together students who have wide ranging, and unique parliamentary experiences. It allows the exchange of experiences from around the world. Supports work-based learning approach. Improved student performance; some is of publishable standard
University of Hull http://www.iiscinfonet.ac.uk/case-studies/tangible/hull/index_html2 1a	Use of a VLE to support placement students on Westminster Hull Internship Programme (WHIP)	Politics and International Studies Undergraduate	To support students in their internship who make be in the UK or in Brussels	30	UK	Not specified	Better communication with and feedback to students.
Leeds Metropolitan University http://www.iiscinfonet.ac.uk/case-studies/tangible/lee	Use of summative computer-assisted assessment in Applied Technology and Finance		To provide quick feedback to students; to introduce them to HE assessment processes; and to save staff marking time.	350	UK	Discussions with students	Fast turnaround of exam marks (3 hours). The delivery of tests every two weeks gave rise to improved attendance. Mean student marks rose from 53% to 63%. Students less apprehensive of taking Finance

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ds/index.html 1a							subject as they get regular feedback. Savings in cost and time due to increased use of reusable learning objects and question banks.
The University of Nottingham http://www.iiscinfonet.ac.uk/case-studies/tangible/nottingham/index.html 1b	Moving from optical mark recognition (OMR) to computer-based assessment (CBA) for summative exams in Medicine	Medicine Undergraduate	To reduce time pressures of increasing cohort sizes' marking and to create more realistic questions.	~ 1900	UK	Not specified	Easy to accommodate students with some disabilities. Students have also reported that they found the online exam cleaner. Students can change their answer selection as many times as they choose until finally submitting the form. Only one option can be selected for a multiple-choice question, thus avoiding problems with mistaken multiple answers.
The University of Nottingham http://www.iiscinfonet.ac.uk/case-studies/tangible/nottingham/index.html 1a	Disability support in computer-based assessment		To enhance an online assessment system to afford accommodations for those with disabilities. The aim was to focus on assessing understanding rather than a students' ability to interact with a particular assessment format.	30	UK	Informal	No formal research has been conducted. However, informal discussions with students highlighted the acceptability of the customisation approach.
University of Wolverhampton http://www.iiscinfonet.ac.uk/case-studies/tangible/wolverhampton/index.html	The 'Religions in Wolverhampton' web environment	Religious Studies	To offer students an experiential encounter with religion through a synchronic and diachronic study of religious communities.	Not specified	UK	Not specified	The students reported increased motivation and competence, and the web environment allowed for empowerment through the sharing of individual reports on

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_html2 1a							visits.
Oxford Brookes University http://www.iiscinfo.net.ac.uk/Resources/external-resources/iisc-elearning-case-study-oxfordbrookes-pdf 1c	Using formative assessments (replacing paper-based assignments), through a series of online assessments delivered through the VLE. The quizzes were accompanied by guidance on the module examination in the form of sample questions, model answers and marking schemes.	Law Undergraduates	To address unsatisfactory learner performance from a law course employing traditional teaching methods (weekly lectures and seminars), which was disappointing. Student feedback illustrated a gap in understanding course expectations.	Not specified	UK	Using the VLE tracking facilities.	Learners who had taken the quizzes performed significantly better in all aspects of the examination compared with those who had not used the quizzes. This included the development of higher order skills such as evaluation and synthesis.
University of Reading Moving Forward Through Feedback: Enhancing Feedback Provision in the Digital Age 1a	'Enhancing Feedback Provision in the Digital Age'	Various	Exploring a range of tools and methods for giving rapid and timely feedback to stimulate and support students' learning in the 'digital age'.	Various	UK	Various	Technology can have a positive impact in delivering clear and accessible feedback (and feed-forward). It can enhance students' engagement with feedback.
University of Sheffield	Embedding opportunities to feedback and feed forward into curriculum design	Engineering Year 1	Using a holistic approach to the curriculum delivery, evidence supported development of appropriate	Not specified	UK	Action research	Students perceived the programme to be more coherent.

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Embedding feedback and feed forward through curriculum design 1b/2b			assessment strategy and appropriate infrastructure or technology to deliver the curriculum.				

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Audio/podcasts							
University of Glasgow http://www.iiscinfonet.ac.uk/case-studies/tangible/glasgow/index.html 1a	Use of podcasting in Philosophy	Philosophy Year 3	Not specified	Not specified	UK	Informal feedback	Positive feedback from students.
University of Leicester Podcasting in Assessment: New Technology in Higher Education Research (PANTHER) 2a	'Podcasting in Assessment': an opportunity for the discussion and dissemination of the research findings of the JISC-funded curriculum delivery DUCKLING project	Masters level: work-based learning	Enhancing work-based learning experiences for students studying remotely.	Various	UK	Action research, semi-structured interviews and cognitive mapping	Podcasts enhanced students' learning experiences; built tutor-student relationships; provided clearer and more detailed instructions and guidance; provided reassurance; enabled learners to think ahead; increased flexibility and mobility in learning.

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Video resources/lectures/games							
University of Glamorgan http://www.iiscinfonet.ac.uk/case-studies/tangible/glamorgan/index.html 1a	Simulation gaming in Business	Business Studies	To allow students to examine a set of key concepts using experiential learning through simulation gaming.	150	UK	Quantitative and qualitative student feedback.	Pass rates improved as well as the average marks. Evidence that students' performance has improved as a result of changing the method of assessment.
Sheffield Hallam University http://www.iiscinfonet.ac.uk/case-studies/tangible/hallam/index.html2 1a	Use of video case studies to highlight issues in Qualitative Research Methods	Social Science Masters level	To integrate video texts examples which illuminate issues in Qualitative Research Methods	Not specified	UK	Not specified	General increase in the interest in visual methods. Students are better able to recognise agendas presented through visual representations of issues. The video sequences have applicability in other courses. Development of a more active research culture. The resources have universal appeal.
Swansea University http://www.iiscinfonet.ac.uk/case-studies/tangible/swansea/index.html 1a	To enable students to see a series of images of archaeological sites or objects, and to listen to an 'expert' commentary made in the field.	Archaeology Undergraduate and postgraduate	Focused on student-centred learning, encouraging a collaborative and reflective learning experience by using podcasting to present material from archaeological sites and public collections.	Not specified	UK	Not specified	Students felt that they were engaging with the fieldwork. Students seem to engage with the sites and artefacts in a more meaningful way.

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Swansea University http://www.iiscinfonet.ac.uk/case-studies/tangible/swansea/index.html 1a	Collaborative teaching and video-conferencing in Classics	Classics Masters level	Video-conferencing was used to support and deliver modules for Swansea University, the University of Wales and Cardiff University in Ancient History Classical Culture.	Not specified	UK	Not specified	There are cost-saving benefits in spreading expertise across institutions. The statistical analysis suggests that students enrolled on modules delivered by video-conferencing are not disadvantaged.

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Multimedia tools							
Leeds Metropolitan University http://www.iiscinfonet.ac.uk/case-studies/tangible/leeds/index.html 1b	Use of WebCT in a blended approach to developing multimedia design skills	Business Information Management, Year 2	To integrate theory with practical application. Lecture time was reallocated to lab time.	Not specified	UK	Not specified	Student achievement did not appreciably increase. However, students reported a positive learning experience.

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Virtual laboratory/fieldwork							
University of Edinburgh http://www.iiscinfonet.ac.uk/case-studies/tangible/edinburgh/index.html 1a	e-Assessment: specifically to replace clinical practice previously executed face to face.	Year 3 Medicine and Veterinary Medicine	To reduce possible student collusion To reduce the costs of face-to-face clinical practice To provide a system-based standard for marking To reduce complex assessment administration To provide assessment that accurately reflects student ability	Not specified	UK	Comparison of exam results with face-to-face clinical assessment, questionnaires, anecdotal feedback.	Effective high quality assessment. Efficiency savings: examinations, assessment marking, and in developing assessment questions. There was also an impact on College assessment policy.
University of Edinburgh http://www.iiscinfonet.ac.uk/case-studies/tangible/edinburgh/index.html 1a	Virtual patient cases developed by students using Labyrinth	Year 5 Veterinary	Enabled student groups to collaborate in generating their own e-learning resources in the form of virtual patient scenarios.	Not specified	UK		The process of creating Labyrinth virtual patient cases allowed students to contextualise their own learning in a way not previously possible. Extended the range of student-centred learning activities staff had previously been able to use. An added benefit was that the completed cases could be used as future learning objects.
University of Edinburgh http://www.iiscinfonet.ac.uk/case-studies/tangible/edinburgh/index.html 1a	The Virtual Farm An online resource delivered via a bespoke VLE	Veterinary Year 5	To address the limited access that students had to the farms by providing ready access to the real-life educational farm resources (animals, agricultural practice and records).	Not specified	UK	Anecdotal feedback At assessment events external examiners asked students about their views of the exam. The examiners also effectively 'sat' the exam.	The informally gathered feedback from these sessions was positive.

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Blogging/promoting reflection							
Sim & Hew (2010) DOI: 10.1016/j.edurev.2010.01.001 General literature review	Weblogs in educational settings	Various	Various	Various	International	Literature review of empirical studies	Results usually obtained from self-report studies. Initial familiarisation or guidance to improve user confidence and ice-breaking activities to help to reduce possible discomfort. Privacy a cause for concern.
Kerawalla, Minocha, Kirkup & Conole (2009) DOI: 10.1111/j.1365-2729.2008.00286.x 2b	To promote reflection, knowledge sharing and collaboration	Masters-level Education modules (online)	Motivations for and issues associated with students' blogging; impact of pedagogy	25 distance learners	UK and international	Semi-structured interviews; content analysis of blog postings	Blogging can be appropriated by students to meet a range of personal learning needs, not always as a collaborative/communication tool. Presents a framework for developing blogging behaviour and skills within the technological and pedagogical context of any course.

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Collaborative tools/wikis							
Wyatt, Krauskopf, Gaylord, Ward, Huffstutler-Hawkins & Goodwin (2010) http://www.nlnjournal.org/doi/abs/10.1043/1536-5026-31.2.109 2a	Mobile tools (PDAs) to support mobile and co-operative learning	Nurse practitioner students	Do co-operative and interactive m-learning techniques enhance classroom and clinical Nursing education at multiple locations? Is there a relationship between m-learning and students' learning styles?	22 students at two universities	USA	Survey; focus groups	PDAs are useful reference tools in the clinical setting and all students benefited from using them. Connecting students with classmates and other nurse practitioner students at distant universities created a co-operative learning community providing additional support and knowledge acquisition.

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Online discussion boards/conferences/forums							
Kanuka, Rourke & Laflamme (2007) DOI: 10.1111/j.1467-8535.2006.00620.x 2a	Comparison of instructional activities intended to facilitate asynchronous online discussion	Education – Year 4	Does the type of instructional activity influence the quality of students' contributions to online discussion?	19 distance learners	Canada	Case study – qualitative content analysis of messages	Discussions do not automatically become interactive and collaborative simply by virtue of being conducted in an asynchronous medium. Highly structured, planned, confrontational and demanding activities that include directed roles and responsibilities for students are key elements to moving them to higher levels of understanding and critical discourse.
Melrose & Bergeron (2007) http://www.ascilite.org.au/ajet/ajet23/melrose.html 2a	Strategies to facilitate group work in online graduate study	Postgraduate Health Care students	What issues do online graduate learners face during the beginning, middle and end stages of their small group work? What instructional behaviours help address these issues?	Distance learners on two graduate programmes	International	Qualitative: 20 individual interviews and four focus groups over a three-year period.	Various instructor immediacy strategies were helpful at different stages of online group work. Linking and feeling close to their teachers helped the graduate learners feel safe, encouraged them to risk participating in group projects and allowed them to achieve closure.
Thorpe (2008) http://www.ascilite.org.au/ajet/ajet24/thorpe.html 2a	Structured tasks to promote effective online interaction – interpersonal and with resources, etc.	Environmental Studies	Positive engagement with co-operative and collaborative online tasks	Undergraduate distance learners	UK and international	Course retention data; semi-structured interviews with tutors and students	Computer-mediated interaction (of various kinds) provided a highly structured context which successfully engaged students and supported their achievement of key skills and assessment goals, notably problem solving, teamwork and tackling unfamiliar problems.

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e-Portfolio							
Sheffield Hallam University http://www.iiscinfonet.ac.uk/case-studies/tangible/hallam/index.html 1a	Use of e-portfolios in Social Sciences	Social Science Years 1, 2 and 3	Used to integrate, group work, peer/tutor support, regular feedback as the focus for personal development planning.	Not specified	UK	Not specified	Ease of use of the package appears to have motivated many students to engage with it.
University of Wolverhampton http://www.iiscinfonet.ac.uk/case-studies/tangible/wolverhampton/index.html 2c	Use of e-portfolios and blogging in Teacher Education	Education PGCE	The impact of e-portfolios on learning: the affective, social and conative aspects of the student experience, in contrast to the conventional focus on the cognitive.	15 per year for three years	UK	Naturalistic using 'Interview plus', where some artefact or activity is chosen to guide, recall or aid thinking aloud.	e-Portfolios benefit learning most effectively when considered as part of a joined-up teaching and learning approach, rather than as a discrete entity.

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Online course resources							
University of Exeter http://www.iiscinfonet.ac.uk/case-studies/tangible/exeter/index.html 1a	Online Economics texts Using online formative exercises for several modules	Business and Economics	To address changes in the structure of the course from one 30-point course to two 15-point courses. Also to address issues related to students' desire to 'get the right answers' from lectures.	Not specified	UK	Statistics recorded students logging in and completing assessments Student feedback: formal and informal. Log-ins records were compared with exam results.	The pass rates/average marks with prior modules compare favourably. Retention rates were very high. Improved student access to resources. Savings in staff time were identified.
Newcastle University http://www.iiscinfonet.ac.uk/case-studies/tangible/newcastle/index.html 1 1b	Use of a VLE to deliver a 'regional' medical school	Medicine	To collate learning resources and organise them around the Medical programme structure, allowing both students and staff to identify what learning outcomes were being met.	~1700	UK	Online questionnaires and focus groups	Significant improvements in student learning (e.g., assessment performance, pass rates, retention and student access).
Sheffield Hallam University http://www.iiscinfonet.ac.uk/case-studies/tangible/hallam/index.html 1	Use of a VLE to introduce contemporary resources on 'Drug use in context'	Social Science and Law	To provide a flexible format for the student and a rewarding and continuously updatable module for the tutor.	Not specified	UK	Not specified	The use of e-learning has produced improvements in student learning with increased numbers of first and upper second class awards.

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1a							
Dublin City University Access to lecture notes 1a	Providing lecture notes to students	Various	Examining whether providing lecture notes encourages more discussion and interactive learning	Not specified	Ireland	Not specified	Student notes generated using partial notes supplied by the lecturer were more effective to aid learning than self-generated notes alone or full lecture transcripts.

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Study/form of evidence	L & T intervention	Subject/discipline & level	Challenge/aim of L & T intervention	No. of participants	Country	Research/evaluation method(s)	Key findings
Electronic voting/personal response systems							
Kay & LeSage (2009) DOI: 10.1016/j.compedu.2009.05.001 General literature review	Use of audience response systems with on-campus students	Various – mostly undergraduate students of science- or maths-based subjects in large classes	Examining the benefits and challenges of audience response systems	Literature review of 67 studies	International	Literature review	<i>Classroom benefits:</i> attendance; attention; anonymity; participation; engagement. <i>Learning benefits:</i> interaction; discussion; contingent teaching; learning performance; quality of learning. <i>Assessment benefits:</i> feedback; formative; comparison with class. <i>Technology challenges:</i> remotes missing/not working. <i>Teacher challenges:</i> responding to student feedback; coverage; developing questions. <i>Student challenges:</i> new method; discussion; effort; summative assessment; attendance for grades; identifying individuals; negative feedback.
University of Glasgow Shared Thinking 1a	Using voting technologies and interactive whiteboards for collaborative reflection and co-operative inquiry	Various	Shared thinking as a form of group-oriented generative learning (GOGL).	Not specified	UK	Not specified	The use of voting technology changes pedagogical orientation towards: <ul style="list-style-type: none"> - co-operative inquiry; - the class working as a group; - participation and dialogue as the content.

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Study/form of evidence	L & T intervention	Subject/discipline & level	Challenge/aim of L & T intervention	No. of participants	Country	Research/evaluation method(s)	Key findings
Work-based learning/employability							
Institute of Education, University of London Harnessing technology to enhance teaching and learning 2b	Collection of studies examining the student experience of technology use in supporting mixed-mode professional courses.	Various	Facilitating innovations in: learning at work and through professional practice; teaching and assessment modes for work-related and work-located learning; uses of e-learning and digital technologies.	Various	UK	Small-scale research projects based on qualitative data collection and some included literature reviews.	Careful exploration of what constituted valid evidence of impact of technology on learning is required. Examination results alone need not necessarily be the best indicators. The session raised the important question of 'old wine in new bottle' approach often inherent in the introduction of new technologies.
The Open University Employer Engagement and Development of Skills for Employability 1c	The 'Employer Engagement and Development of Skills for Employability'	Business and Health and Social Care	To explore the challenges and opportunities for effective learning in the workplace.	Various	UK	Action research, telephone interviews, questionnaires.	Learners gained increased confidence in ICT, even when already proficient. ICT had a positive in their lives and their practice. However, motivation was affected by lack of reward.

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