Institution: University of Bolton

Unit of Assessment: UOA 25 (Education)

a. Overview

Research under this Unit of Assessment takes place within two groups: **Education**, and the **Institute for Educational Cybernetics (IEC).** The two groups are distinct in their institutional profile. The **Institute for Educational Cybernetics** is a research institute, and its principal activities are to conduct research and run a doctoral programme. It is constituted as a cost centre and department, and maintains its own Research and Ethics Committees. The IEC was established in 2007, building on the work of the Centre for Educational Technology, Interoperability and Standards (Cetis) and its spin-off projects. These were incorporated into the new Institute, and consolidated in the period covered by the REF.

The **Education Group**, on the other hand, is drawn from research active members of the wider Faculty. The group's activities focus on the transformation of classroom practice in the lifelong learning (post-compulsory) sector, through teacher education and by influencing policy. The research reflects the team's core values of inclusion and widening participation in education at all stages. The researchers were formerly practising teachers themselves, and all remain engaged in teacher education, training and development. The focus on initial teacher education and CPD means that much of the research is grounded in classroom practice, and aims to inform teaching and delivery of education, particularly in the post-compulsory, professional and HE sectors.

There has long been collaboration between the two groups. Firstly, the research carried out by the IEC is inter-disciplinary, and it operates at the intersection of three fields: pedagogy, technology, and the organisation of the institution. It therefore seeks opportunities to work with the Education group who are close to the realities of pedagogic practice. This is reciprocated by the Education group, which is active in computer-based learning and electronic personal development planning. This leads to sharing of supervisory capacity across the two groups, and participation by members of the Education group in the committees of the IEC, particularly by Kitchener. Secondly, the IEC contributes strongly to the Education group's development of research capacity across the University through delivery of Master's in Education and Doctor of Education degrees.

b. Research strategy

Institutional Research Strategy

The IEC and the Education group carry out a broad range of research, but the principal focus is on the analysis and critique of current practice in educational organisations and its technological support. In the course of this work many interventions in educational processes have been made, with results that have proved challenging to cumulate when working within a narrow disciplinary focus. An inter-disciplinary approach relating pedagogy, technology and institutional organisation, is adopted in order to elucidate the relationship between these factors, and to come to a clearer understanding of the results of educational interventions. This has led to a focus on systems thinking, and particularly cybernetics, which offers the possibility of developing overarching explanations for complex phenomena. Cybernetics may be understood as the science of organisation, and thus the task of IEC is to achieve a scientific understanding of the organisation of education, with a particular focus on how information and communications technologies affect the organisation of education from individual learning to the global system, and the communications which are carried on within it. Cybernetics is an inherently inter-disciplinary field of study drawing on, among others, organisational theories, psychology, sociology, pedagogy, design and computer science. The inter-disciplinary nature of IEC research is reflected in the request to consider cross-referral for Kraan's outputs, and the submission of IEC members Wilson and Olivier to UOA36.

Methods and models drawn from cybernetics are applied in the research carried out by the IEC, but they are used together with other compatible but distinct approaches. Much of the research may also be characterised as *performative* in Pickering's sense, see [1], p.20, in that it involves experimental interventions into complex systems. Multiple methodologies are applied to observe

the results following Mingers [2], which are analysed to identify mechanisms, following Pawson & Tilley [3]. The abstract components of description thus generated are generalised through a process of abduction, defined by Bateson ([4] p.142) as 'the lateral extension of abstract components of description'. This is often based on modelling which tests the scope within which an abstract description may be applied. Given the focus in both IEC and the Education group on practical change, action research is also used in a substantial part of the research carried out, and the IEC participates in cross-departmental seminars on this topic.

In order to understand the complex relationship between education and the technology used within it, the IEC has a strategy of maintaining a high level of technical development expertise. This enables the Institute to develop technologies which are deployed and evaluated in research interventions (see Griffiths outputs 1 & 3). This work leads not only to the publication of research papers, but also to the publication of other research outcomes, including applications, specifications and data models, enabling new types of functionality to be provided for educational users. This strategy builds strongly on the focus on *technologies that embrace open standards for interoperability*, set out by the IEC in its RAE submission. This is maintained in the current REF submission, but extended to address the wider mission of the IEC to investigate the ways in which information and communications technologies affect the organisation of education.

The research strategy of the **Education group** builds on a close integration with professional practice in education, which is at the core of the unit's activities. Many aspects of practice are investigated, with a strong practical focus on support for teaching. This leads to research publications such as those included in this submission, but these do not provide a full picture of the range of activity in the group. For example Noel [5] investigates diversity amongst trainees and trainers, and why some groups of trainees achieve higher success rates than others. Similarly the early career researchers Telfer [6] and Bacova [7] examine the use of theatre and drama in language teaching, with the results contributed to the HE Academy and informing practice across the sector. Rodriguez-Yborra [8] evaluates the feasibility and effectiveness of using digital PDP tools in the area of Art and Design, which due to its strong visual and creative practice has historically avoided the use of such tools. A £120,000 LSIS project has enabled the group to investigate and pilot on-line delivery of teacher education programmes. As described in section c, below, staff development activities have been put in place to increase the number of high quality research papers which result from this work with a strong focus on practice.

Principle lines of research

IEC research strategy focuses on three main lines of research, each developed by a cluster of IEC staff, as reflected by the papers related to each strand included in this submission.

- IEC research into **educational standards and interoperability** is described in detail in the case study *Educational technology interoperability specifications* in this submission. This includes research into concepts and standardization in areas relating to competence (see the papers of Grant). Within the same line of work is the representation of course related information which can be managed across different computer systems, also described in the case study Educational technology interoperability specifications in this submission.
- Research into **alternative educational approaches** includes two strands. The **work based learning** research strand is oriented around a radically innovative methodology developed by IEC in the IDIBL initiative, an internal University of Bolton project led by the IEC (see the papers submitted by Powell). This is complemented by study of the **educational affordances of computer games**. (See the papers submitted by Hollins).
- In research into **technological support for learning activities** the focus has developed during the period covering this submission. Work with the Learning Design method for specifying learning activities (see Griffiths, output 1), developed into the exploration of the concept of a Personal Learning Environment. This concept was established by Professor Liber of IEC, now retired, and has received substantial attention beyond IEC. For examples of this work see Johnson's outputs 3 & 4, and Wilson 2008, submitted to UOA 36. The development of Apache Wookie and the iTEC Widget Store was conceived of within this theoretical framework (see Griffiths, outputs 2 & 3), and Case Study 2 of this submission). This work has been extended since 2012 to encompass **learning analytics**, the analysis of

the traces left by learners in their use of educational systems, itself closely related to earlier IEC work on Adaptive learning with Learning Design. Through Cetis, the IEC has published an influential series of reports on this topic (see http://publications.cetis.ac.uk/c/analytics).

The **Education group's research strategy** complements that of IEC, in that it seeks to place education in a wider context. The work submitted here all has a focus on **educational processes beyond the traditional classroom**. Kitchener examines the role of leisure activities, Hyland researches into the role of mindfulness in education, while Oughton examines the connection between formal education and everyday life, with a particular focus on adult numeracy.

This research strategy outlined above has served IEC well, and it will be maintained in the coming five year period. As indicated, the **lines of research have evolved** in response to the results achieved and the changing social and technical environment, and this close engagement with a dynamic field will continue in future. **Educational standards and interoperability** covers a wide area of application within education, and some of the range is indicated in Case Study (i) above. The IEC will continue to develop and deploy the methodologies and skills which it has acquired over the past decade to seek areas of intersection between technology and education where the definition of interoperability specifications can constitute a powerful research intervention. Research with **alternative educational approaches** will be influenced by IEC having won funding as a partner in the VALS project promoting virtual mobility between education and industry making use of open source technology as a mediating artefact. This builds on the extensive experience of IEC in open source development, of which Case Study 2 above is but one example. The strongest growth is expected to be in **technological support for learning activities**, where learning analytics will have a key role. This will build on the strong presence established in this area by the Cetis Analytics Series, allied with the technical skills of the institute. Funding has been achieved for this work by the participation of IEC in the LACE project, a European Commission funded coordination and support action in the area of learning analytics, and a project to provide an analytics system to the University of Edinburgh for a MOOC course which they are developing.

In seeking funding a key component of the research strategy is to maintain close contacts with a range of external partners. This feeds into, and is supported by, the high international profile of the Institute. The CELSTEC institute of the Open University of the Netherlands, is a particularly prestigious partner in the area of educational technology. IEC has collaborated with them on research into Learning Design and competence development, and participated in three joint projects during this reporting period. The GRIAL group in the University of Salamanca, the oldest university in Spain, has also been a partner in the areas of competence development and informal learning. The two groups publish research together, working on special issues of journals, and two joint projects in this period. The applied nature of much of IEC's research has led to strong alliances with non-academic partners. Standards and specifications bodies are key research partners, including CEN-ISSS, W3C, and IMS Global Learning, as are government agencies SURF and Jisc. A strong relationship has been maintained with Pearson, as well as with numerous technology SMEs (for example RayCom in the Netherlands, with whom a long working relationship has been continued in the recently commenced VALS project). With these high profile partners the IEC contributes a systems perspective, which places their more tightly focused research in a wider context.

References including outputs from staff ineligible for full submission:

[1] Pickering, A. (2011). *The Cybernetic Brain: Sketches of Another Future*, University of Chicago Press.
[2] Mingers, J., 2006. *Realising Systems Thinking: Knowledge and Action in Management Science*, Springer
[3] Pawson, R. & Tilley, N. (1997). *Realistic Evaluation*, Sage Publications Inc.
[4] Bateson, G. (1979) *Mind and Nature: A Necessary Unity*. New York: E. P. Dutton
[5] Noel, P. (2009) Differentiation, context and teacher education: the changing profile of trainees on in-service initial teacher training programmes in the lifelong learning sector. *Teaching in Lifelong Learning: a journal to inform and improve practice* 1(1), 17–27
[6] Telfer, S. (2013). Using Creative Writing and Storytelling in Language Teaching. Ars Aetena
[7] Bacova, D. (2013). Tvorenie kurikul – filozoficke a pedagogicke perspektivy – Curriculum development in the philosophical and pedagogical perspective*. Proceedings of Education*

through Theatre, University of Constantine the Philosopher, Nitra.
[8] Rodriguez-Yborra, Maria A. and Thomas, Barbara E. (2012) Recording student experiences in Art and Design: what suits our students best? *On Reflection*. (23), pp.17–25.

c. People, including:

i. **Staffing strategy and staff development**

As described above, the research strategy of the IEC is inter-disciplinary, and operates at the intersection of pedagogy, technology and the organisation of the institution. The first priority of staffing strategy is to provide sufficient in house expertise to be able to work effectively across these fields. Thus, of the 15 core members of IEC, five have degrees in computing or related areas, and have strong application development skills, including Johnson. A further five have a background in education, including Professor Griffiths and Powell. Two have high levels of expertise in specification development (Grant and Kraan). Two have particular skills in systems architecture, which relates computing to organisational structure, Professor Olivier and Wilson (both submitted to UOA 36). Cooper (director of Cetis, not submitted) was recruited from Tribal, a leading provider of products and services to the international education, training and learning markets. Hollins, director of IEC, was recruited from the games industry. Both contribute their knowledge of management, as does Wilson, who has also worked in industry, and Professor Griffiths, who worked on HR development with IBM before focusing on learning technology.

In making appointments an effort is made to maintain this mix of capabilities, and to appoint people who as individuals have interests in a number of areas. Thus the staff submitted include among their first degrees anthropology, philosophy, architecture, history of art, psychology and music. This range of experience provides fertile ground for intellectual enquiry and innovation.

The period covered by this submission was marked by the retirement of the founder of the IEC, Professor Liber. Succession has been achieved by a combination of internal promotion (with Dr. Griffiths gaining the title of professor, and Paul Hollins being appointed Director of IEC), and an external appointment (with the appointment of Professor Olivier, who brings with him many years of experience in research and development of educational technology). Professor Griffiths of the IEC has been awarded two competitive personal research fellowships in this period: the Open Learning Scholar award to fund a three month visiting professorship to Thompson Rivers University (TRU), Canada, in 2011, and the Programa de Doctorado en Formación en la Sociedad del Conocimiento to fund a two month visiting professorship to the University of Salamanca, Spain, in 2013. In TRU he worked on a Learning Analytics project which has fed into the development of this emerging line of work in IEC. In Salamanca he extended existing collaboration focussed on work-based learning and competence management which will feed into new research funding proposals in 2014. Adam Cooper of IEC was appointed a member of the Cabinet Office Open Standards Board in 2013.

The staffing strategy for the Education group similarly builds on its principal focus of professional practice while developing its research capacity. New appointees have been selected for potential to contribute to key research strands (for example, recent appointments include Bacova (2013) whose research relates to innovative classroom practice.)

All research positions are job evaluated and the role aligned to the University's new pay and grading arrangements, which ensure that all researchers are rewarded according to the requirements of the role irrespective of the type and duration of contract. The University's policies on equality and diversity, and on bullying and harassment are fully respected. Staff also have access to 24 hours support and counselling on personal and work related matters.

Early career researchers who are not yet regular authors of journal papers contribute to the annual Research and Innovation conference. Each staff member has a Personal Development Plan reviewed annually which encourages post doctoral researchers to start to make their own applications for funding to develop their future and research as independent researchers with the University. Monies awarded from RAE 2008 were made available to staff for research capacity development, and supported four PhD bursaries.

A new Doctor of Education programme was introduced in 2013 (see following section), and current staff who are not already research active are being encouraged through the PDP process to join

this programme. The PhD by publication or practice is valuable route for staff who are research active but who do not yet have a PhD. In the IEC two of the submitted staff have recently achieved PhDs by this route, and two more will be starting the process this academic year.

Supervision capability is provided by the following submitted staff: Griffiths, Hollins, Hyland, Johnson, Kitchener, Oughton, Powell, and Olivier (submitted to UOA 36). These staff also participate in standing panels to review research student progression. The following submitted staff also teach on the EdD programme: Kitchener, Oughton, Griffiths, Johnson, and Powell. Capacity for post-graduate supervision is currently being increased through recruitment of new research-active staff, and through completion of PhDs and EdDs by existing staff. The University runs a series of training sessions for new PGR supervisors annually.

ii. Research students

There are currently over 20 research students studying within Education and 10 within the IEC. The completion rate reported in this submission is lower than might be expected because many of these are part-time students who take at least six years to complete, with many students nearing completion. Additionally two students completed PhDs by practice or publication during this reporting period but are not reported here. A further 20 overseas MPhil students study through international collaboration with institutions such as New York College, Athens.

The IEC runs monthly seminars, open to University members, which provide PhD students the opportunity to engage with senior research staff in presenting and discussing on-going IEC research. The IEC research strategy strongly informs the work carried out, and particularly the emphasis on realistic evaluation, abduction of the mechanisms which are identified, and the construction of models. Action research has a strong role, and current students are carrying out action research at RNIB, the Dublin office of a large French multi-national, and a social housing provider in Bolton, while Powell's recently awarded PhD by practice was the result of many years of action research into curricular innovation.

To develop capacity, all local research students, and many remote students, submit papers to the University's annual Research and Innovation Conference. This provides an ideal environment for PhD students and early-career researchers to undertake first paper or poster presentations, and to prepare for journal publication. To support students in moving to journal publication, more established researchers in IEC publish together with younger researchers. This has led, for example, to the PhD student Sherlock publishing with Johnson in *The International Journal of Continuing Engineering Education and Life Long Learning* (2009) and *Interactive Learning Environments* (2012); PhD student Goddard publishing a peer-reviewed chapter with Professor Griffiths, and PhD student Keseniah Clement-Obookoh authoring publications with Professor Olivier. Early-career researchers are also supported in Education through mentoring in publishing their research, and Telfer (2013) published her first outputs in the last year. The development of a new Writing for Publication module is designed to further increase outputs. Authorship questions are handled by the Research Committee, which has the policy of recognising technical development work as a direct contribution to research, while excluding administrative and editorial support. This is reflected in the authorship of the papers included in this submission.

The Doctor of Education (EdD) programme, launched in 2012-13 (see http://courses.bolton.ac.uk/Details/Index/2217) was developed to encourage applications from those who prefer a more structured approach to PGR study, with a focus on professional practice. The EdD is located in Education, but with strong input from IEC. It provides students with access to a larger number experienced research staff than is possible with a traditional PhD, providing input on a range of topics which help students to develop a research goal and methodology. It also provides structured support and mentoring in developing a research proposal, before moving into a more traditional supervisory relationship. The EdD is seen as having an important role in developing the research capacity of the University in the field of Education, and currently 8 external and 4 internal students are actively following the programme.

Following the successful re-launch of Cetis, the IEC is currently reviewing its PhD programme. It is felt that the marketing message could be clearer and better targeted. This process has been taken forward in three all day meetings in 2013, and in working groups on the Web presence and marketing. Contacts have been made through our existing links with China to explore the potential

market there, and a visit was made to Botswana, where the University has a presence.

The Education group's close links with professional practice strongly influence recruitment to our PGR programmes, with teacher-education programmes feeding into Masters courses including MPhil and a forthcoming MRes, and then on to EdD or PhD PGR. This also reflects the University's widening participation agenda, with students from non-traditional academic backgrounds supported in their progression to research degrees.

The University supports its research students and requires participation in PDP addressing Vitae's Research Development Framework. Students' core documentation includes the Postgraduate Skill Record, which records progress with the acquisition of research-specific and transferable skills and on programmes of related studies, including relevant modules from taught masters' programmes.

d. Income, infrastructure and facilities

Income

The **Institute for Educational Cybernetics** has been outstandingly successful in attracting research income during this period, with a total of £5,321,534.00 of funding returned to this UOA. The details are not described here, as they are provided in REF4b. However, the largest funder was Jisc, with major grants for the core Cetis service, which led to the outputs of Kraan. However Jisc also funded specific research projects, such as that the XCRI project (see case study (i)), and the Coeducate project (see Powell output 1), and the SPLICE and MANSLE projects, which fed into the Personal Learning Environment research reported in Johnson's outputs 3 & 4. Funding to from the European Commission (especially through its ICT and Life Long Learning programmes) is also significant, and this is reflected in the submission from Professor Griffiths. The true picture of IEC research income, however, is distorted by the fact that the Institute's submission is split between UOA 25 and UOA 36, where the great majority of reported research funding was won by the IEC, including all of the European funding. This is shown in the following table.

IEC research funding from UK and European bodies (UOA 25 and UOA 36)			
	UK Gov. Bodies	European Commission	Total
UOA 25	£4,710,128.00	£515,349.00	£5,321,534.00
UOA 36	£739,361.00	£615,729.00	£1,355,090.00
Total	£1,131,078.00	£5,449,489.00	£6,580,567.00

As may be seen, not only is the total substantially higher, with a total of well over a million pounds research income per year, the proportion of European funding is significantly higher, and reliance on UK Government Bodies funding proportionally lower.

The funding profile of the IEC will change in the coming years, as an anticipated reduction in Jisc funding activity. This will impact on research at the Institute, but action has already been taken by Cetis to move from a service model with core funding, to active marketing of research capabilities. In preparation for these changes Cetis was rebranded and re-launched in 2013. First successes in this strategy have been achieved in late-stage funding negotiations underway with IMS Global Learning and with Pearson at the time of writing, and finalisation of a contract with Creative Commons for Cetis to fill the role of Project Manager for the Learning Resource Metadata Initiative. Nevertheless, a high priority for IEC is to diversify funding, with an increasing role for contracts from industry, and charitable foundations such as the Nuffield Foundation and the Leverhulme Trust, and to a revised strategy for obtaining Research Council funding.

Education

Funded projects during this period include: NARN ePDP (£20,000 2011-12); LLUK Adult Numeracy (£1000 2009-10); Point of Employability (£1400 2009-10); LSIS on-line teacher education £120,000 2012-13). Potential sources for future funding applications include for example Nuffield Foundation (Mathematics education post-16).

Infrastructure and facilities

The nature of research in IEC and Education does not require specialised facilities or equipment specific to the group. Full library facilities (including access to a wide range of relevant journals) and full ICT facilities (including access to software such as SPSS) are available to all staff and

PGR students. In Education a separate room, with ICT facilities, is reserved within the department for the exclusive use of PGR students, and there is a resource room within the library dedicated to the key research area of adult literacy and numeracy. In the IEC, the policy is to integrate research students into the open plan office shared by all staff.

e. Collaboration and contribution to the discipline or research base

A key aspect of the IEC research strategy is to develop and maintain close working relationships with external partners, and the strength of this network is testament to the international profile achieved by the Institute. The IEC maintains a strong network of contacts with partners across the UK and Europe with whom it develops collaborative funding proposals and research, with an excellent record in achieving funding for collaborative international projects. Collaborators are too numerous to mention, but three areas are of particular relevance.

- **Standards and specifications bodies** are key partners. These include CEN-ISSS, W3C, and IMS Global Learning, as well as the Cabinet Office Open Standards Board, and government stakeholders SURF (in the Netherlands) Jisc in the UK.
- **Open source foundations**, particularly the Apache Foundation. Two software systems to which IEC has been a leading contributor have become top-level Apache products through the work of IEC member Scott Wilson (submitted to UOA 36). These are Apache Wookie (see the case study The Wookie Widget Server), and Apache Rave, developed in the Omelette project (see http://rave.apache.org/). In the VALS project, funded in 2013, IEC will collaborate with a wide range of open source organisations.
- **Industry partners**. IEC has worked with many industrial partners over the years, including multiple projects with Tribal and Logica. Particularly important are Pearson and the Open Group (with both of whom IEC is currently collaborating) and with SMEs such as Knowledge Integration, and RayCom (partners in the VALS project)

The quality of the research carried out by IEC has been recognised in links with other institutions. In 2009 Professor Liber was invited to visit the normal universities of Shaanxi, East China and Beijing, with additional visits by Professors Griffiths and Olivier in 2010. Professor Griffiths won competitive awards for bursaries as a visiting professor to Thompson Rivers University (2011) and the University of Salamanca (2013). These visits have been reciprocated by study visits to Bolton, including year-long residencies by a PhD student from East China Normal University in 2011-12, and a lecturer from Shaanxi Normal University in 2012-13. PhD students from The University of Salamanca and from Valladolid have taken three month residencies in IEC, and Professor Griffiths has acted as a PhD examiner in Salamanca, Valladolid and Universitat Pompeu Fabra, Barcelona.

IEC encourages its members to take part in activities which enhance the scholarly environment. Examples include Professor Griffiths, who was lead editor of a special issue of International Journal of Learning Technology 2008 Vol. 3 No. 4 'Towards an Interoperable and Open-Source Infrastructure for Lifelong Competence Development', and editor of two special issues of Kybernetes devoted to the proceedings of the annual American Society for Cybernetics conferences of 2012 and 2013. He was also joint chair of the conference when the IEC hosted it in 2013. Mark Johnson and Professor Liber edited a special issue of Interactive Learning Environments on 'Personal Learning Environments'. Scott Wilson is a member of the board of Campus Wide Information Systems. IEC staff are active on numerous conference committees, and reviewers for many journals.

Members of the Education group work collaboratively with a number of national institutions, including LSIS, NIACE, UCET, Ofsted, NCETM, Mindfulness.ie and Turning Point. Journals for which staff members have been on editorial panels and peer review teams during the assessment period include: Journal of Technical and Vocational Education; Adults Learning Mathematics International Journal; RaPAL journal; Reflect journal. Staff also participate in national and international research forums such as RaPAL; ALM; and UKLEF.