Institution: Institution: University of Bolton

Unit of Assessment: UoA 25 (Education)

a. Context

The research takes place within two groups: **Education**, and the **Institute for Educational Cybernetics (IEC).** There is considerable common ground between the two groups (See REF 5).

The research carried out by the **Institute for Educational Cybernetics** is focused on the intersection of three fields: pedagogy, technology, and the organisation of the institution, and informed by the view that an intervention in one of these areas inevitably has consequences for the other two. In carrying out this research the IEC seeks to bring about practical change through the use of technology to support the organisation and practice of education. In this the IEC has maintained continuity with the central role of impact in its RAE submission, which defined the mission of *having an international impact on the use of Information and Communication Technologies (ICT) for learning and learning management, in particular in research into issues around the adoption of technologies that embrace open standards for interoperability*.

The **Education Group's** research output is aimed at transforming classroom practice in the lifelong learning (post-compulsory) sector, both 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. Research impacts directly on educational institutions, and the practitioners within them, at a national, international and local level. We have close partnerships with many education providers in North West England, particularly in the further education and lifelong learning sector, and members of the unit also make substantial contributions to national bodies such as LSIS (and formerly LLUK), Ofsted, NRDC, National Numeracy, NIACE and UCET.

b. Approach to impact

The approach to impact adopted by the **Institute for Educational Cybernetics** places stress on supplementing high quality journal papers with excellent technical outputs, including applications, specifications, data models and reports which resolve clearly identified and theoretically justified problems within education. To realise their potential, these outputs are not simply published. The IEC also works with strategic partners to ensure that they are deployed and have impact in the wider education community, and thence to society as a whole. Extensive dissemination actions are carried out, including the organisation of special interest groups, publication of briefings, and the annual Cetis conference. This approach to impact ensures that outputs benefit society by informing public policy at both national and international level, and enhancing capacity and delivery of services within education and beyond. This is exemplified by the two impact case studies included in this submission, and in particular in the collaboration with the Apache Foundation in the development of Wookie (see case study 2). Other high impact research outcomes have been the Archi Archimate modeller (see UOA 36) and the RELOAD editor for interoperability specifications. This strategic approach is built into funding proposals and project deliverables.

The development of interoperability specifications is a key activity for IEC. They are a powerful means of achieving impact on education, capable of establishing a widely adopted set of functionality, beyond what might be achieved by the design of a particular application. As part of this work, the IEC often creates software products which embody a particular interoperability specification, both to demonstrate their capabilities, and also as a guide to other developers. These are reference applications, i.e. they constitute a definitive interpretation of the specification. This strategy for impact is made possible by the excellent level of ICT expertise in IEC, enabling the Institute to produce applications of the highest quality, which make a solid contribution to the evolving technical infrastructure for education. This is particularly important in achieving impact for the educational interoperability specifications which form a significant part of the IEC output. An interoperability specification may have research value as a document, but in order to achieve impact its functionality must be demonstrated, and tools must be available which enable it to be

adopted. The software activity of the IEC addresses both these needs.

The **Education Group's** outputs are also not confined to academia, and findings are disseminated to practitioners in accessible form through a variety of practitioner handbooks, newsletters and conferences. Key areas of impact include:

- Influence on CPD and professional practice: Staff share research findings with practitioners in teaching and teacher-education through CPD provision, seminars and professional conferences, for example adult numeracy at seminars for South Wales professional development network, RaPAL and NIACE (Oughton 2010; 2011; 2013).
- Influence on professional standards, guidelines or training: Group members play key roles in the development of national standards for teacher education (Waugh), and particularly adult numeracy teacher education (Moore) through their involvement in LLUK and LSIS.
- Shaping or influence on policy made by government, quasi-government bodies, NGOs or private organisations: Research in adult numeracy has informed curriculum development at a national level (Oughton 2007); has contributed to the national numeracy inquiry by NIACE (National Institute of Adult Continuing Education) (Oughton 2009; 2012); and is now forming part of the National Numeracy Challenge.

c. Strategy and plans

The **Institute for Educational Cybernetics'** strategy for impact is based on alliances with key partners, which greatly enhance the benefits generated by the outputs of IEC research.

Participation and alliances with standards bodies: The IEC maintains close collaboration with the majority of the major bodies in this area. IEC is a member of IMS Global Learning Inc., and staff serve on committees of ISSS, ISO, W3C and the Cabinet Office Open Standards Board. The effectiveness of this collaboration is the result of then years of activity in which the reputation of the IEC has been built to the point where industrial actors in the field are confident in working with us to achieve impact. These relationships will continue to be maintained and extended in order to maintain the impact achieved by the IEC. This key activity is described in detail in the Educational technology interoperability specifications case study in this submission, and it has achieved benefits in the practice and performance of educational technology.

Collaboration with government agencies: Firstly, the IEC has for a decade been funded by JISC to provide advice and guidance to JISC and the HE sector. The public outputs of this work are available at http://www.cetis.ac.uk/publications/. In recognition of this work Adam Cooper, Deputy Director of Cetis, was appointed to the Cabinet Office Open Standards Board in 2013. Secondly, through the iTEC project the IEC is collaborating with ministries of education in large scale pilots of the iTEC Widget Store, developed by the IEC (see Griffiths 2012, and http://itec.eun.org/web/guest/widget-store)

Participation in open source foundations: IEC has a policy of publishing all code as open source. This makes the work carried out available for other researchers and the IEC itself to build upon, and has benefits in the capacity, performance and practice of educational technology. For example the iTEC Widget Store builds on the Edukapp project https://code.google.com/p/edukapp/ to which IEC contributed, and publishes its contributions back to the community. However, many open source projects are abandoned without achieving impact. The IEC therefore works wherever possible to achieve adoption of its outputs by Open Source foundations, whose mission is to achieve sustainable impact of code. A major success has been the adoption by the Apache Foundation of Apache Rave (to which IEC was a major contributor in through the Omelette project) and Apache Wookie (see the Wookie case study in this submission). The active participation of IEC member Scott Wilson in Apache has greatly facilitated this process.
IEC will maintain this strategy, building a portfolio of outputs with which to build impact. Current work in two areas will add to this: the Open Mashup Description Language, to which IEC made a major contribution and maintains the site for the specification at omdl.org; the iTEC Widget Store, which has been designed to deliver widget services to wide range of platforms and contexts. It is also planned to expand collaboration with industrial partners. An example of this is the work on

enterprise architecture with the Open Group documented in the submission to UOA 36.

Research within the **Education Group** is fully integrated with professional practice, which is at the core of the group's activities. Researchers within the group were formerly practicing teachers themselves, and are currently still engaged in teacher education, training and development, including regular observation visits to local education providers. The research conducted by the group directly informs the delivery and content of our teacher education and CPD programmes, and thus the practice of classroom teachers.
Strategies for maximising the potential impact from current and future research include:

- Staff maintain partnerships with local educational institutions, particularly in the FE and lifelong learning sector, to ensure relevance of research and opportunities for dissemination
- Staff play active roles in regional and national institutions which influence policy and professional guidelines, e.g. LSIS, UCET, NIACE, RaPAL, NARN, CRA and HEA.
- Income from previous RAE 2008 made available to staff to support dissemination of subsequent research (Strategic Research Investment Grants).

d. Relationship to case studies

As described in Section b above, educational interoperability specifications are a powerful means of achieving impact, intervening directly in the adoption of technology within the sector. However, for a specification to achieve impact it needs to:

- **Meet the needs of its target users.** IEC research has led to development and implementation of methods for community driven specification development, the effectiveness of this is shown by the success of the specifications detailed in case study (i).
- **Create alliances with key stakeholders.** IEC's research and development work in specifications would have achieved little attention if it had been carried out in isolation. The impact of the two case studies is the result of continuous work in carrying out the IEC policy of establishing and maintaining alliances with key stakeholders.
- **Creation and dissemination of reference applications.** IEC impact strategy emphasises not only the creation of papers, reports and specifications, but also the creation of software which embodies the research conclusions, and provides a means for adoption and experimentation beyond the IEC.

These strategic approaches are exemplified in the two case studies.

Case study (i): Educational technology interoperability specifications
This case study exemplifies the achievement of impact through collaboration with a key set of stakeholders: international standards bodies. The principal strategic partners involved in achieving impact in this area are the International Standards Organisation (ISO), IMS Global Learning Inc., and the Comité Européen de Normalisation (CEN). Through these organisations the IEC also reaches the member organisations, including major commercial stakeholders such as Blackboard and Pearson. The methodologies developed in this work ensured that the specifications are relevant and practicable for users, leading to substantial international impact for the outcomes.

Case study (ii): Apache Wookie
This case study exemplifies the IEC's strategy of achieving impact through engagement with open source foundations. The Wookie Widget Server was developed by IEC within the EC funded TENCompetence project, in response to the research problem of providing flexible ICT services to learning management systems. Research was carried out into the W3C Widget Specification, to establish how it could be used to support educational systems. IEC built an open source reference application, which provided a new architecture and methods for implementing the specification. Many eLearning projects deliver their code as open source, but in many cases this remains unused. The IEC policy was to deliver the code to the highest professional standards, and to work closely with a range of stakeholders to gain acceptance of the code by the Apache Foundation. Wookie has now attained the status of a full Apache project. This is not only a substantial achievement in its own right, but has enabled this work to achieve a deeper and wider impact.