**delete as appropriate*

FORM R1 (Prac) Retrospective (Part time) (Mandatory Submission 5) (Revised Mar.11)

Application to register for the Degree of Doctor of Philosophy by Practice (by the retrospective route)

(All references are to the University's Research Degree Regulations; see also the Regulations and Procedures Governing the Award of the Degrees of Doctor of Philosophy by Published Work and Doctor of Philosophy by Practice)

THIS FORM SHOULD BE WORD-PROCESSED

Submitted by **Richard Millwood** (Candidate's name) **IEC** (School/Institute)

PLEASE USE ARIEL 12 FONT. References should be appended to section 2.3 of this document. Consult the published guidance booklet and notes before completion.

1. The Applicant

Name:
Richard Millwood

Present post and place of work:
Reader, University of Bolton

Specify the Source(s) of any External or University Funding for Student Bursary and/or Fees *(name the Research Council, Industrial or other Sponsor):*
Staff

Qualifications gained (see Regulations 2.1 and 2.2) *(include place(s) of higher education, courses completed, main subjects, classification of award, date and name of awarding body):*
King's College London, BSc Mathematics and Physics, Pass, 1976

Training and experience *(include details of activities (with dates) relevant to this application, and of any research or other relevant papers, books, etc. which have been published):*
The following preparations were successfully undertaken at King's College London in 1986 in order to qualify for registration for a part-time PhD. This was subsequently discontinued on changing jobs in 1990:

- A pass at Masters level in a module on Research Methods;
- The production of a qualifying essay 'Strategies for Computer Assisted Learning' January 1987.

Preparation for undertaking a PhD through seminars and supervision was undertaken at KCL throughout 1986-1990.
At Anglia Ruskin University, as a Reader, (1997 – 2006) I was asked to supervise and

examine PhD students, acting as Director of Studies for three students (two completed – Abraham Doron and Nili Naveh) and examining two students.
At the University of Bolton I am on the supervisory team for seven students.

Additional relevant published work:

Millwood, R., Riley, D. 1988. An Analysis of a Single Interaction. London. http://blog.richardmillwood.net/wp-content/uploads/2011/02/Analysis-of-a-single-interaction.pdf.
Millwood, R. 2008. Can we improve the future with lessons from our past? In JISC Regional Support Centre South West Summer Conference http://blog.richardmillwood.net/wp-content/uploads/2008/06/rsc-sw-keynote-richard-millwood.pdf.
Millwood, R., Powell, S. 2011 A Cybernetic Analysis of a University-wide Curriculum Innovation. Campus Wide Information Systems.
Millwood, R. 1983. The Subroutine Library Manual, Computers in the Curriculum
Millwood, R. Osborne, J., Riley, D. 1987. Modelling in the Secondary Curriculum. A workshop paper presented at CAL'87 conference at Strathclyde
Millwood, R. and Squires, D. 1988 The Influence of New Software Environments on CAL Development, Computer Assisted Learning - Selected Proceedings from the CAL '87 Symposium, Pergamon Press
Millwood, R. 1988. The Procedure Library Technical Guide, Computers in the Curriculum.
Millwood, R. 1988. The Procedure Library Design Guide, Computers in the Curriculum.
Millwood, R. 1988. Report on Actor: a development system for Microsoft Windows, Microelectronics Education Support Unit, 1988.
Crossfield, L., Mace, T., Millwood, R., Lewis, R., Beier, L. M., 1988. Authoring of Computer Based Training Materials - a report by ESRC for the Learning Technology Unit, Training Agency.
Millwood, R. Stevens M. 1989. What is the Modelling Curriculum?, Computer Assisted Learning - Selected Proceedings from the CAL '89 Symposium, Pergamon Press.
Millwood, R. 1990. Report on Smalltalk/V: An object-oriented development system for the IBM PC and compatibles, NCET.
Millwood, R. 1990. Report on CIX: The Compulink Information Exchange: computer conferencing for educational software developers, NCET.
Millwood, R. 1990. Report on Matrix Layout: A visual program design system, NCET.
Millwood, R. 1990. Report on Graphics Image Transfer: The problems of taking graphics images from one program to another and some of the solutions available, NCET.
Riley, D. with Millwood, R. et. al. 1990. Reference Manual, Design for Active Learning with HyperCard Pack, King's College London.
Heppell, S. and Millwood, R. 1992. Integrated Media in Teaching and Learning: Lessons From the Renaissance Experience, proceedings of the European University Consortium conference, Bruges, Belgium.
Millwood R., and Smith, T., 1994. Caught in the Web: Traditions, Cultures & Spidermen, proceedings of Multimedia over Networks conference, Mallorca, Spain.
Griffiths, D., Heppell S., Millwood R., Mladenova G. 1994. Translating software: what it means and what it costs for small cultures and large cultures, Computers Educ., Vol. 22, No.1/2, pp. 9-17.
Millwood R., Mladenova G. 1994. Educational multimedia - how to allow for cultural factors, in the proceedings of Multimedia Hypermedia and Virtual Reality Conference, pp. 187-191, Moscow, Russia.
Millwood R., Mladenova G., 1994. Modelling with ordinal data to support debate of subjective issues, proceedings of East-West conference Computer Technologies in Education part 2 p166, Crimea, Ukraine.

**delete as appropriate*

2. Programme of Research

2.1 Proposed title of thesis:
The Design Of Learner-Centred Technology Enhanced Education

2.1.1 Applicant's work already completed and to be submitted for this award of PhD by Practice.
I have identified my contribution to this work and have begun to obtain others' agreement where there has been collaboration, but this is not presented in this R1.

Ref	Date	Title	Scope	Contribution
P1	1976 to 1980	Teacher of Mathematics and Computer Studies at Scott Lidgett School	Taught Mathematics to mixed ability groups from 11-16 and sixth form A-level groups. Took responsibility in 1978 for Computer Studies and created whole school curriculum analysis in 1979.	Created 'revelatory' interactive graphics software for teaching bearings as a game based on NDPCAL research findings. Analysed school curriculum and designed effective presentation.
P2	1980 to 1990	Researcher in the Computers in the Curriculum Project at Chelsea College London	Software development, team leadership, development of guidelines informed by research and eventual teacher education and Masters teaching.	Developed many educational programs, guidance documents, course materials and developed analytical models for interface design.
P3	1990 to 1997	Senior Lecturer in Ultralab at Anglia Polytechnic University	Teacher educator for BEd, PGCE and Masters level, developer of interactive multimedia and research team leader.	Developing course materials, employing grounded theory to develop teacher profiling tool, developing online Masters programme. Building Ultralab as a developer, technical expert and mentor in the design of interactive multimedia software.
P4	1979 to 1985	Member of Microcomputers in Computer Education (MICE)	Group of Computer Studies teachers concerned to create interactive software for learning concepts in computing	I developed my own program but also helped critique colleagues designs.

**delete as appropriate*

P5	1988	An analysis of a single interaction	First published in 'Design Guide for the Procedure Library' published by the Computers in the Curriculum Project.	I co-authored the design guide and co-created the diagram and analysis published.
P6	2003	Ultraversity	A new fully online work-focussed degree employing multiple innovations, created by a small team and further developed by a 20 strong team for which I had overarching responsibility. 144 students graduated in 2006.	I co-developed the validation documents and mentored the team.
P7	2009	Analysis of learning - expression and evaluation	A cybernetic inspired model of the learner activity which promotes learning, inspired by Kolb's models, but addressing modalities and technological support.	This is my original analysis, part of multiple keynote presentations at national and international conferences.
P8	2009	Analysis of education - the learner's perspective	A model of learner's decisions to progress in learning which ties in the full educational context.	This is my original analysis, part of multiple keynote presentations at national and international conferences.
P9	2009	Analysis of education – the stakeholders' perspectives	Simple models of key questions faced by teachers, organisational leaders and governments to sustain their educational contexts.	This is my original analysis, part of multiple keynote presentations at national and international conferences.
P10	1986 to 1991	Member of the London Mental Models Group	A multidisciplinary research group led by the late Joan Bliss of King's College London involving staff in science, mathematics and history education, but also in language, cognitive psychology, educational computing, expert systems and artificial intelligence.	I participated and contributed to seminars considering models of learning with technology.

**delete as appropriate*

P11	1987 to 1993	Renaissance Project funded by Apple Computer	A higher education interactive multimedia CD-ROM development project.	I helped design, collate, program and took sole responsibility for technical production of some of the earliest CD-ROMs developed for education.
P12	1994 to 2000	Learning in the New Millenium Project	Sponsored by Nortel this was a longitudinal project which connected academics, engineers at Nortel and school pupils in an online learning community.	Mentor, PhD supervisor for the lead researcher.
P13	1997	The Online Learning Network	An Institute for Public Policy Research funded project in advance of the University for Industry (UfI). Education professionals from the school, museum, HE, broadcast and private sectors generated dialogue on a selection of issues, and participated in "online experiences" to demystify and learn how use ICT effectively.	Mentor to project leader and contributor to the online community design.
P14	2000 to 2003	Talking Heads and Virtual Heads	Projects to develop informal and formal learning for the UK's head teachers.	Mentorship and hands-on practical help to establish project and design interactive multimedia learning resources.
P15	1996 to 2000	TeacherNet UK	A proposal for a national online community of practice for teachers.	Co-developer of the ideas and design, director of the organisation and designer and developer of web-site.

**delete as appropriate*

P16	1998 to 2000	Étui	Development of an educational toy to support children's learning as part of a European project in the Experimental Schools section of the i3 network (Intelligent Information Interfaces). The device stimulated meta-level learning awareness, problem solving, creativity and collaboration through activities.	Mentorship and development of key concepts of meta-level learning. Data collection in field research and data analysis and reporting.
P17	2000 to 2005	Summer School	A collaboration with the South East of England Virtual Education Action Zone to establish the capabilities in young people for digital creativity using technology.	Mentorship, organisation and presentation at the Victoria and Albert Museum.
P18	2002 to 2004	Input BBC	A collaboration between Children's BBC Television and Ultralab to explore the future of kids TV. Computers and digital video cameras were placed in schools, community and learning centres across the North of England to find out what television could be like if children were to make it themselves.	I co-directed the project with TV producer Cathy Derrick and took part in the organisation of workshops, gathering and analysis of data, design of web site and online survey.
P19	2003 to 2006	Ultraversity	An undergraduate degree programme with a personalised programme that enabled students to gain a degree in three years through researching into their current work role. The focus of the degree is on students 'understanding why and knowing how to ' and develops individuals to become articulate, critically reflective problem solvers within their work context.	Initially involved as co-writer of the validation documents, designer of marketing and publicity and developer of key concepts. Ultimately I was responsible for oversight of the project which involved 20 staff.

P20	2007 to 2011	Inter-Disciplinary Inquiry-Based Learning Project	A framework model for undergraduate and postgraduate learning based on the Ultraversity work, but intended to support innovation at the University of Bolton.	Collaborator with two others to develop model further and to collect data, analyse and produce peer-reviewed publications.
P21	1992 to 2011	National Archive of Educational Computing	A research and public archive of artefacts, papers, software and media recording the UK history of technology enhanced learning.	Initially collaborator in acquisition and formulation of concept, latterly director and developer of web-site. Direction and development of research methodology, cataloguing, curation and interpretation.

2.2 Overall aims of the research as encompassed by the practice ***(bullet points only***):

- To improve the design practice of educational materials, contexts and pedagogy which use computer technologies
- To develop a theoretical framework for decision making in such design practice

2.3. Give an account of the development of the research in your practice. Include its relationship to previous work, with references, and its intended outcomes *(around 1000 to 1500 words)*. **Please include word count.** Summarise clearly and succinctly the original contribution to knowledge to be made by this research *(See Regulations 1.3, 1.4, 3 and Annex 3)*

FOCUS

I have been developing educational materials, contexts and practices based on computer technologies since 1978, and as a practitioner in this field, sought analytical and descriptive means to more effectively design these.

In that time I have focused on learner-centred approaches and researched widely across multiple disciplines to improve the design of education.

KNOWLEDGE

I have progressed from an individual enthusiastic and creative teacher [P1] to a teacher-educator [P2] and leader of innovation in education [P3], taking a full part in a developing research community.

My early work concentrated on improving the design of individual pieces of software for addressing challenging learning in the school curriculum. [P4]

An interest in user-interface design led to an approach to analysing individual learning based on cybernetic principles. [P5]

An increasing awareness of the wider context of education has informed a holistic and systemic approach to large-scale action research which has addressed the development of new systems of education. [P3, P6]

CONCEPTUAL FRAMEWORK

My increasingly responsible role as a teacher, software developer, media designer, team leader and director has led to a broad and deep knowledge of the factors which lead to effective design methods and criteria for improving design quality in iterative design cycles.

These factors and criteria are based on a creative and constructivist model of learning [P7], a learner-centred holistic model of the decision points in education [P8] and a perspective analysis of other stakeholders in education [P9].

This conceptual framework has been developed and articulated in practice, conference presentations and research papers and used to inform the design decisions made throughout 33 years of practice.

CLAIM

The PhD report will clarify and defend the conceptual framework in the light of literature (a selection of influential works are included below), which will form a summary of the original contribution to knowledge made through my practice. My claim for PhD by Practice will demonstrate the threads which have emerged in this career, linking projects, artefacts, peer-reviewed publications, team leadership & conceptual development. It will also identify the original contributions and doctoral level activity that has been sustained for much of that time and account for my learning journey and learning outcomes.

PORTFOLIO

My work began in 1976, aged 20 as an untrained teacher of Mathematics in a secondary school in London. Even at this stage, I was exposed to the design of (mathematics) education through the SMILE (Secondary Mathematics Individual Learning Experiment).

In my second post as a Mathematics and Computer Studies teacher (1977-1980), I developed an interest in the teaching of both Computing and Mathematics using the computer. As well as taking part in the design of the Computer Studies Mode 3 CSE exam syllabus, I attended continuing professional development courses in the design of educational materials for the computer and joined a development group of computer studies teachers, Microcomputers in Computer Education [P4], to develop computer software as educational resources for learners. In this period I developed a computer program called ‘Snooker’ [P1] which simulated a snooker table, inviting learners to estimate angles to improve their knowledge of bearings, which was subsequently published as part of the SMILE Mathematics scheme after peer review by teachers engaged in that curriculum development.

In 1980 I sought a position as a university researcher to develop educational resources. I was appointed as the first developer for the Computers in the Curriculum Project [P2] at Chelsea College, University of London. Over the decade I became a project leader in software development, an author of design guidelines [P5] for the team and a teacher educator involved in teacher training. I was responsible for the design and development of many educational packages based on computer simulations, working with teams including practising teachers to offer advice on the pedagogical and practical design issues. In researching human computer interface issues, I was strongly influenced by Donald Norman’s models of user-centred design which proved practical as applied theories in my everyday work and formed the basis for my working model of the learning process [P7]. In this decade I joined the ESRC funded London Mental Models Group [P10] led by the late

Professor Joan Bliss and Professor Jon Ogborn and planned to conduct a PhD supervised by Professor Paul Black to focus on modelling using computers. I took part as a lecturer in the development of a diploma course to retrain teachers for Computer Studies and finally as a half-time lecturer in Mathematics Education [P2]. I co-directed the Modus project to develop computer modelling software for learners to create their own simulations, resulting in the development of Expert Builder and Model Builder software [P2]. I acted as Research Fellow on interoperability in educational software for the national Microelectronics Education Support Unit [P2], creating several publications and was a member of the Software Advisory Group for the BBC Domesday Project [P2]. I began to be invited to academic conferences as a speaker and to take part in international seminar and workshop activity as co-tutor [P2].

In 1990 I joined Prof Stephen Heppell to form a new research centre, ultimately called Ultralab [P3]. Over seventeen years I offered practical, analytical and evaluative guidance to a team which grew to fifty staff, offering research leadership and developing collective knowledge, procedures, values and attitudes for the development of delightful learning approaches. I developed new interactive multimedia CD-ROM materials, taking responsibility for production within a team of experts for all phases of published learning resources in Environmental Science, Mathematics, Drama and Business Studies [P11].

The predominant research approach was that of applied and action research, creating small and large-scale actions involving education in formal and informal contexts. I helped formulate the conceptual framework, manage development and analyse findings in many projects including the a longitudinal study of online community as a learning tool ‘Learning in the New Millenium’ [P12], the University for Industry pilot ‘Online Learning Network’ [P13], the headteachers’ online community ‘Talking Heads’ [P14], the teachers’ informal continuing professional development online community TeacherNet UK [P15], the creation of a new toy for pre-school meta-level learning, Étui [P16], the development of learner’s creativity through multimedia technology for our own ‘Summer School’ [P17] and the BBC’s ‘Input BBC’ pilot [P18], and many more. In 2005 I took over as head of Ultralab for two years before joining the University of Bolton in 2007 to further develop Ultralab’s ground-breaking Ultraversity project [P19] as the Inter-Disciplinary Inquiry-Based Learning project. [P20]
This final period has permitted substantial reflection, analysis and articulation of ideas through peer-reviewed publications developed in over thirty years of practice in technology enhanced learning and has led to this proposal for the award of PhD by Practice.

BIBLIOGRAPHY

Bruner, Jerome S. 1966. *Toward a Theory of Instruction*. Cambridge, Massachusetts: Harvard University Press.

Denzin, Norman K., and Yvonna S. Lincoln, eds. 2005. *The SAGE Handbook of Qualitative Research*. Sage Publications, Inc. http://www.amazon.co.uk/SAGE-Handbook-Qualitative-Research/dp/0761927573.

Hill, Winfred F. 1985. *Learning: A Survey of Psychological Interpretations*. Cambridge Massachusetts: Harper & Row.

John Heron. 1992. *Feeling and Personhood: Psychology in Another Key*. London: Sage Publications.

Kolb, David A. 1984. *Experiental Learning*. New Jersey: Prentice-Hall.

Marr, David. 1982. *Vision*. *Vision A Computational Investigation into the Human Representation and Processing of Visual Information*. New York: Freeman.

Millwood, R., and D. Riley. 1988. An Analysis of a Single Interaction. London. http://blog.richardmillwood.net/wp-content/uploads/2011/02/Analysis-of-a-single-interaction.pdf.

Millwood, Richard. 2008. Can we improve the future with lessons from our past? In *JISC Regional Support Centre South West Summer Conference*, 32. Brentwood: Richard Millwood. http://blog.richardmillwood.net/wp-content/uploads/2008/06/rsc-sw-keynote-richard-millwood.pdf.

Millwood, Richard; Powell, Stephen. 2011 "A Cybernetic Analysis of a University-wide Curriculum Innovation." *Campus Wide Information Systems*.

Papert, S. 1980. *Mindstorms: Children, Computers, and Powerful Ideas*. Sussex: Harvester.

Powell, Stephen, Ian Tindal, and Richard Millwood. 2008. "Personalized learning and the Ultraversity experience." *Interactive Learning Environments* 16 (1) (April): 63-81.

Trowler, Paul. 2008. *Cultures and Change in Higher Education: Theories and Practices (Universities into the 21st Century)*. Basingstoke: Palgrave Macmillan.

Vygotsky, Lev. 1986. *Thought and Language*. Cambridge, Massachusetts: The MIT Press.

Wenger, Etienne. 1999. *Communities of Practice: Learning, Meaning, and Identity (Learning in Doing: Social, Cognitive and Computational Perspectives)*. Cambridge University Press.

Wertsch, James V. 1985. *Vygotsky and the Social Formation of Mind*. Cambridge, Massachusetts: Harvard University Press.

(1352 words)

2.4 Resources *(details of facilities and resources e.g. hardware, software, methods and tools available, including location if not at University of Bolton)*

The research portfolio is linked to the evolving National Archive of Educational Computing [P21] a project which I am the director and lead developer. This collection of over 500 crates of papers, software and hardware provides evidence and artefacts to tell the story of technology enhanced learning in the UK and acts as a backdrop for my own work. The development of its website is paralleled by the development of my own portfolio of work.

3. Related Studies (Complete either 3.1 or 3.2)

3.1 Details of any programme of related studies to be undertaken *(see Regulations 3.1(ii) and Annex 3, Para 1).* **This should include the PGR Student Skills Development Programme.**

Attendance at PGR Student Skills meeting, participation online and membership, attendance and contribution to BEE Research Action Learning Set.

3.2 Where an integrated programme of study is proposed, details of the course of postgraduate study on which the candidate's performance is to be formally assessed *(see Regulations Annex 3, para 1, 4 and 6*

**delete as appropriate*

N/A

4. Period of Study (see Regulation 4)

Amount of time (hours per week average) allowed for programme:
16 hours

Expected duration of programme *(in months)*:
12 months

5. Statement by the Applicant

I wish to apply for registration for PhD by Practice on the basis of the proposal given in this application.
I confirm that the information given above is correct.
If the practice forming the basis of this proposal was based on research involving human participants, data or material, then that research did, where necessary, receive ethical clearance from the relevant authorities at the time.
I understand that except with the specific permission of the Board of Studies for Research Degrees, I must prepare and defend my thesis in English.

Signed  Date 27th October 2011

**delete as appropriate*

Section 6 onwards to be completed by the School/Institute on behalf of the student

6. Supervision *(see Regulation 5)*

6.1 Director of Studies (First supervisor) *(include name, qualifications, post held and place of work)*

Professor Dai Griffiths, PhD, University of Bolton

Experience of supervision of registered research degree candidates:

	Masters by Research	Doctorates	
Currently supervising	0	3	*UK candidates*
Previously supervised to successful completion	0	1	*UK candidates*

6.2 Second Supervisor(s) *(include name, qualifications, post held and place of work)*

Stephen Powell, MA, University of Bolton

Experience of supervision of registered research degree candidates:

a.	Masters by Research	Doctorates	
Currently supervising	0	3	*UK candidates*
Previously supervised to successful completion	0	0	*UK candidates*

Keith Alexander
BSc (Hons), BArch, RIBA, CFM, IFMA Fellow, RSA, FCIOB
Director Centre for Facilities Management

b.	Masters by Research	Doctorates	
Currently supervising		*9*	*UK candidates*
Previously supervised to successful completion	*3*	*22*	*UK candidates*

6.3 Details of any other person(s) who will act in an advisory capacity *(name, qualifications, post held and place of employment:*

7. Recommendation by the Supervisors

We support this application and believe that **Richard Millwood** has the potential to complete successfully the programme of work proposed.

We recommend that this applicant be registered as a candidate for the research degree of Doctor of Philosophy by Practice (by the retrospective route)

Signed S Powell Date 27th October 2011

Signed _____ Date 27th October 2011

Signed _____ Date 27th October 2011

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8. Confirmation of Support by School/Institute and Research Co-ordinators

It is the responsibility of Schools/Institutes and Research Co-ordinators to ensure that all registration proposals are considered by them and that any external approval is secured (where appropriate) before Standing Panel scrutiny on behalf of the School/Institute Research Committee or equivalent and submission to the Secretary for the Board of Studies for Research Degrees. In particular, signatories should satisfy themselves that:

i. there are appropriate facilities in place and adequate funding to support the proposed research project for its duration;
ii. the proposed arrangements for supervision, research training etc. are commensurate with University Regulations and Procedures;
iii. the proposed programme of work is of an appropriate standard for the award for which it is submitted and is in accordance with the School/Institute/Team Research Plan.

Signed _____ Date 27th October 2011
(Research Co-ordinator)

Signed _____ Date 27th October 2011
(Dean of School/Director of Institute)

When this application has been approved by the School/Institute Standing Panel, the Chair should sign below:

Signed _____ Date 27th October 2011

(Standing Panel Chair)