Centre for Learning Sciences and Technologies
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Open University of the Netherlands

Centre for Learning Sciences and Technologies (CELSTEC)

Self-Evaluation Report 2006-2011

CELSTEC Self-Evaluation Report 2006-2011

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Table of contents

Preface

This self-evaluation report describes the research activities and products of the Centre for Learning Sciences and Technologies (CELSTEC) at the Open University of the Netherlands (OUNL) in the period 2006-2011, along with its prospects for the near future.

The documentation in the report has been structured according to the "*Standard Evaluation Protocol 2009-2015: Protocol for Research Assessment in the Netherlands*" (SEP, 2009) published by the VSNU, NWO, and KNAW (www.knaw.nl/sep).

In Part A, information at the level of CELSTEC as institute is given within the OUNL. In Part B, information at the level of the research cluster Learning Sciences (LS) is provided. In Part C, the same is provided at the level of the research cluster Technology Enhanced Learning (TEL). The descriptions of the two research clusters have been prepared by Prof. dr. Paul A. Kirschner and Prof. dr. Marcus Specht, respectively. A team working under the direction of Jos van den Broek, Director of Operations at CELSTEC took care of all administrative and financial accounting aspects of this report.

Prof. dr. Rob Koper
Dean
Centre for Learning Sciences and Technologies
Open University of the Netherlands
September 2013

Part A – Centre for Learning Sciences and Technologies (CELSTEC)

Preamble

The Open University of the Netherlands (OUNL) was founded in 1984 with no research mandate. In 1997, the predecessor of CELSTEC – The Educational Technology Expertise Center (Otec) was formed by the merger of the Center for Educational Productions (COP) and the Educational Technology Innovation Center (OTIC) and assumed a research mission.

In 2005, Otec took part in its first research evaluation. In 2008, with the publication of "The New Otec" memo, this institute was renamed as the Centre for Learning Sciences and Technologies (CELSTEC).

This Self-Evaluation Report is based upon the mission, goals and structure of CELSTEC in the period 2006-2011.

Main Conclusions from the Previous Research Assessment

	Quality	Productivity	Relevance	Viability
OUNL 1: Instructional Design for Open Tasks, Environments and Communities	5	4	4	5
OUNL 2: Learning Networks for Lifelong Competence Development	4	4	4	4

OUNL1 (Predecessor of the Learning Sciences cluster)
The cluster is a valuable mix of theory- and applications-oriented research and represents an excellent success story on all criteria. It provides an impressive model of steering the whole research process. The model might seem a bit rigid for some, but it is highly effective.

OUNL2 (Predecessor of the Technology Enhanced Learning cluster)
The cluster has been a very successful programme with great merits in the domain of educational technology. Continued European funding, good embedding in NeLLL (Netherlands Laboratory for Lifelong Learning) and an appropriate HR-policy may ensure the further success of the programme.

Name of Institute

Centre for Learning Sciences and Technologies (CELSTEC)

Mission

CELSTEC aims to improve learning and knowledge handling at work, school, home and on the move by combining state-of-the-art knowledge in the learning sciences with the innovative powers of new information and communication technologies.

Institute websites

http://celstec.org/ (English: International institutional presentation)
http://portal.ou.nl/web/leren (Dutch: Aimed at students/researchers)

1. Objective(s) and Research Area

The Centre for Learning Sciences and Technologies (CELSTEC) is a Centre of Excellence in the fields of Learning Sciences and Technology Enhanced Learning which aims to improve learning and knowledge handling at work, school, home and on the move, by combining state-of-the-art knowledge in the Learning Sciences with the innovative powers of new Information and Communication Technologies = Technology Enhanced Learning Sciences. New technologies and approaches to learning are extensively tested in its laboratories and in real educational practice. The core activities of CELSTEC are: research, innovation and education & training.

In the period 2006-2011, CELSTEC's activities concentrated on two major clusters, *Learning Sciences* (LS) and *Technology Enhanced Learning* (TEL). Each cluster combined research & development projects, innovation projects and education & training activities. The tight integration of research, practice,

experimentation and training in collaboration with partners established a process of open innovation in the field of learning and professional development. LS is an interdisciplinary field that works to achieve a scientific understanding of learning, engage in designing and implementing learning innovations, and improve instructional methodologies. Research in LS focuses on cognitive-psychological foundations of human learning, as well as the design of learning environments (see Electronic Appendix *Protocol OU CELSTEC Research Review*). The LS cluster deals primarily with empirical educational and learning research, educational/learning methods and prescriptions (including theory forming) with respect to learning.

TEL refers to the support of any learning activity through technology, focusing primarily on the design and engineering of technology mediated learning support and the effects of media and technologies in educational settings (see Electronic Appendix *Protocol OU CELSTEC Research Review*). The TEL cluster focuses on creating technologies to enhance human learning based on a *multi-disciplinary perspective* by studying technology enhancements via ICT in social media, immersive media, and ubiquitous media and its results aim to identify design principles and efficient technologies for more engaging, enriched, and deepened learning experiences.

CELSTEC is a multidisciplinary institute uniting the LS and TEL perspectives in joint projects in the Learning Media Lab which form the frame for joint Topic Groups bringing together experts from theory, instructional design, engineering and media. New technologies and approaches to learning are tested in the laboratory and in practice. As a Centre of Excellence, CELSTEC has three integrated functions:

- *Research*. Creating new knowledge, services and technology furthers scientific understanding while also informing educational practice and the development of educational resources. Grounded in empirical studies, CELSTEC strives to generate new knowledge that is relevant to the needs of education professionals and usable by researchers and practitioners alike.
- *Innovation*. In line with the statutory function of the OUNL, CELSTEC applies new and innovative educational knowledge and theories in developing services and technologies for innovation of Dutch higher education. CELSTEC's broad range of cooperation formats (pilot projects, collaboration with knowledge and technology partners, collaboration with faculties within the OUNL) enables implementation of innovations in- and outside the OUNL. In the current Dutch research policy agenda, this is labelled 'valorisation of research', and has a high priority at the national and university level.
- *Education, training and dissemination*. CELSTEC shares scientific knowledge, craft wisdom, prior experiences, and (technological) resources through various mechanisms, including diploma programmes in its *Institute for Education and Training* (e.g. MSc in Educational Science), online master classes in the state-of-the-art research, continuing education programmes for teachers, tailor-made training (e.g. half-day to yearlong trajectories), and dissemination activities (e.g. workshops, conferences, scientific publications, blogs, etc.).

2. Composition

CELSTEC employs over 100 FTE professionals (mainly assistant, associate and full professors, PhD-candidates and ICT Specialists) from more than 15 countries. About 40% of the total is allocated to research activities (see table A.1). It collaborates with hundreds of professionals in various countries, companies, agencies, schools and universities. Together, the staff and network represent many years of experience in research and innovation.

The management of CELSTEC is formed by:

- Prof. dr. Rob Koper (Dean)
- Dr. Jo Boon (Human Resource Manager)
- Jos van den Broek (Director of Operations)

The organisation of CELSTEC can be schematically depicted in figure A.1:

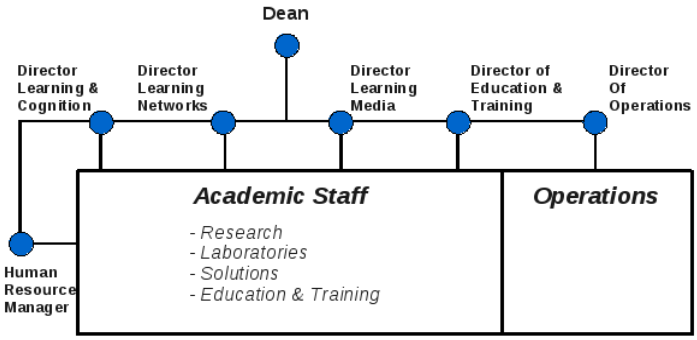


Figure A.1 CELSTEC management structure

Table A.1 presents the total research staff for CELSTEC. An analogous table for individual clusters can be found in Parts B and C.

Table A.1 Research staff at institutional level in fte (corresponds to Table 5.2 in the SEP)

	2006	2007	2008	2009	2010	2011
Tenured staff*	15.24	14.60	15.00	13.36	13.64	14.00
Non-tenured staff*	1.80	0.90	2.88	8.18	6.75	6.93
PhD-students**	11.58	11.62	14.56	9.80	11.20	16.80
Total research staff	**28.62**	**27.12**	**32.44**	**31.34**	**31.59**	**37.73**
Support staff	6.00	6.00	6.00	6.00	6.00	6.00
Visiting fellows	0 persons	0 persons	2 persons	0 persons	0 persons	2 persons
Total staff	**34.62**	**33.12**	**38.44**	**37.34**	**37.59**	**43.73**

* Research component

** Direct funding by the university or research grants; research component is 70% fte PhD-candidate

Table A.2 presents the funding and costs as received and spent per year from 2006-2011. The funding through research grants and contract research has been relatively stable through the year

Table A.2 Funding at institutional and programme level (corresponds with Table 5.4 in the SEP)

	2006	2007	2008	2009	2010	2011
Entire Institute						
Direct funding[1]	2,209,000/62%	2,007,000/56%	1,895,000/50%	1,954,000/43%	2,249,000/61%	2,208,000/66%
Research grants[2]	1,109,029/31%	1,282,807/36%	1,771,722/47%	2,231,532/49%	1,128,410/30%	923,248/28%
Contract research[3]	229,972/6%	286,473/8%	95,694/3%	409,773/9%	330,197/9%	198,731/6%
Total funding	**3,548,001**	**3,576,280**	**3,762,416**	**4,595,305**	**3,707,607**	**3,329,979**
Expenditures:						
Personnel costs	3,406,081/96%	3,433,229/96%	3,574,295/95%	4,365,540/95%	3,485,151/94%	3,130,180/94%
Other costs	141,920/4%	143,051/4%	188,121/5%	229,765/5%	222,456/6%	199,799/6%
Total expenditure	**3,548,001**	**3,576,280**	**3,762,416**	**4,595,305**	**3,707,607**	**3,329,979**
Research clusters						
LS	1,251,079/35%	1,358,243/38%	1,144,235/30%	1,240,563/27%	1,111,986/30%	1,305,851/39%
TEL	2,296,922/65%	2,218,037/62%	2,618,181/70%	3,354,742/73%	2,595,621/70%	2,024,128/61%
Total Funding	**3,548,001**	**3,576,280**	**3,762,416**	**4,595,305**	**3,707,607**	**3,329,979**

[1]: Direct university funding

[2]: Research grants from national and international scientific competition (e.g. NWO, KNAW, ERC) and European Commission

[3]: Research contracts for research projects from external organisations (e.g., industry, governmental ministries, charities)

3. Research Environment and Embedding

National and International Positioning

CELSTEC actively collaborates in national and international (mainly EU) projects. It has a fellowship plan to host visiting professors and offers research internships to master students in relevant fields. Within the OUNL, from 2006-2011 CELSTEC was a major participant within the Netherlands Laboratory for Lifelong Learning (NeLLL) where it held the Scientific Directorship (Prof. dr. Paul A. Kirschner) and Directorship of three of the six programme lines (Prof. dr. Paul A. Kirschner, Prof. dr. Peter Sloep, Prof. dr. Wim Westera).

Nationally, CELSTEC researchers are active in scientific organisations. CELSTEC researchers are active in the Netherlands Educational Research Association (NL: Vereniging voor Onderwijs Research - VOR) and two national research schools ICO (Interuniversity Center for Educational Research) and SIKS (School for Information and Knowledge Systems). CELSTEC also participates in Special Interest Groups (Unwired, Learning Analytics, Open Educational Resources) in the Netherlands Foundation University Computing Centres (SURF) along with international SIGs such as the European Association for TEL (SIG dataTEL and Assessment). There are also active partnerships with Dutch universities (e.g., Psychology Department at Erasmus University Rotterdam, ITS Institute for Applied Social Sciences at Radboud University Nijmegen). Finally, CELSTEC staff members are holders of two Extraordinary Professorships (Prof. dr. Liesbeth Kester, Prof. dr. Ton Mooij).

Internationally, CELSTEC has formal partner institutes in the USA (Learning Systems Institute at Florida State University, Stanford University H-STAR Institute), Asia (Singapore Learning Lab, University of

Tokushima), Australia (Education Media Laboratory at Wollongong University, University of Sydney), and in Europe (e.g., RWTH Aachen, Department of Education at Ghent University, Department of Educational Sciences at the K.U. Leuven, Knowledge Media Research Center at the University of Tübingen, Open University of Catalonia, CeLTech – Centre for e-Learning Technology in Saarbrücken, Helsinki University and CICERO Learning Network, eLearn Centre and the Learning and Technology Research Center at Oulu University Finland, Knowledge Media Institute at the Open University, UK). For a list of all national and international connections/collaboration see the Electronic Appendix *Overview of National and International Collaboration.*

Researchers are active in many scientific organisations such as the European Association for Research on Learning and Instruction (EARLI), American Educational Research Association (AERA), International Society of the Learning Sciences (ISLS), European Association for Technology Enhanced Learning (EA-TEL), International Association for Mobile Learning (IAML), as also professional organisations as the IEEE, IMS and EC-funded research projects and many other projects (e.g., funded by NWO) are performed in close collaboration with partners. This is stimulated by CELSTEC's paying of 50% of membership fees.

Literature

The catalogue of all of media available at the OUNL, as well as all media available at the library of Maastricht University, is available online to staff. This includes access to an online sources for periodicals (via EBSCO, Electronic Journals Service) and Science Direct as well as Current Contents Connect. Online resources are available on all workstations of all staff members through the OUNL-Intranet. Books and periodicals can be borrowed/ordered via the Interlibrary Borrowing System for which all staff members have an account.

Learning Media Lab

CELSTEC maintains a Learning Media Lab (established in 2000) as a research and development environment to promote and conduct empirical research and test advanced learning technologies. The Lab supports:

- *Incubation*: The generation and expression of new ideas for learning and teaching.
- *Research and technology development*: The enabling of research and development projects to develop and configure appropriate media prototypes for exploration and experimentation.
- *Media technology scouting*: In view of the high innovation rate of media technologies, the Lab keeps track of new media opportunities for learning.
- *Sensibilisation/dissemination*: The Lab is used for displaying state-of-the-art technologies, concepts and practices for media experts, educators and user groups through seminars, showcases and workshops.
- *Open innovation workspace*: The Lab offers opportunity for joint projects and experiments with internal and external partners, acting as a media knowledge hub and broker between parties amplifying the networking role of the OUNL, helping fund raising and stimulating initiative and entrepreneurship.

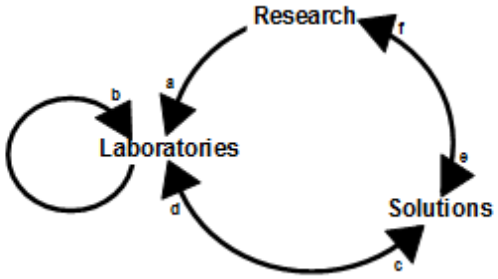
From 2006 through 2011, the Lab filled approximately 240 m^2 with flexible workspaces and experimental facilities including participant and observer experimental areas equipped with soundproof walls, one-way mirrors, cameras, scan converters and digital video recorders. Observer® Pro software (Noldus Information Technology) is used for collection, management, and analysis of observational data. One participant area, the *Eye-Tracking Lab*, is equipped for observation of eye movements of participants working with video- and computer-based stimulus sources. Eye movements can be tracked by two special monitor-based remote eye-tracking devices (Sensomotoric Instruments SMI RED 250, Tobii 1750) and recorded on video as an overlay on the stimulus source. Also, a mobile eye tracking device is available (Sensomotoric Instruments SMI HED) to allow observing eye movements of participants while they can move freely.

The Lab is also used for the developing a large scale, integrated new innovation platform to support social learning, personal learning and open educational resources (OpenU), including a new streaming video lab for online master classes.

The Lab was extended in 2010with flexible workplaces, dedicated data conversion and media processing workplaces, and Lab rooms for workshops and studies in different educational settings (i.e., team room (small group context), classroom (classroom context), educator studio (educational provider context), media lounge (home context). Educational scenarios were worked out and tooling was implemented in workshops with internal and external partners. All scenarios and software tooling were documented in a Lab WIKI.

In the period 2006-2011 the Learning Media Lab acted as a driver for innovation, working according to an open innovation model in which CELSTEC staff, OUNL faculty staff and private/public sector partners worked to explore, co-develop and test innovations,

forming an iterative cycle (see the following Figure).



Innovations are steered by guidelines derived from Research (a). Via developmental research, innovations are tested and refined within Laboratories (b). The innovations support Solutions (c) which can drive requests that could be incorporated in the innovations (d). Furthermore, research findings from the input for Solutions (e) also yield initiatives for joint field experiments (f).

Together with external partners or OUNL faculty staff, CELSTEC staff explores, co-develops, and tests innovations in - amongst others - the following areas:

- Instruments, tools and techniques to facilitate learning
- Modern learning environments to personalise learning material to the needs of learners
- Usability

Documentation and Archiving

All products produced by all members of CELSTEC are archived and made available in digital form via *DSpace*, the digital repository of the OUNL (http://dspace.ou.nl). Internal and external projects are managed and archived via Basecamp©, a web-based project management and collaboration tool.

Guest Appointments

- Dr. Liesbeth Kester, Visiting Fulbright scholar of Florida State University (2007)
- Dr. Susan McKenney, Visiting professor at the University of Pittsburgh (2011)
- Prof. dr Peter Sloep was appointed honorary professor of Technology Enhanced Learning at the Caledonian Academy of the Glasgow Caledonian University (2010-present).
- Prof. dr. Els Boshuizen, Visiting Scholar at University of Regensburg, Germany (2008)
- Prof. dr. Marcus Specht, Visiting Scholar at Stanford University, H-STAR Institute (2011)
- Prof. dr. Paul A Kirschner, Professor of Educational Sciences with special emphasis on Educational Psychology and ICT, Utrecht University (Zero appointment – 2006-2011)
- Prof. dr. Paul A Kirschner, Visiting Professor of Education with a special emphasis on eLearning at the Universitat Oberta de Catalunya (Open University of Catalonia), Barcelona, Spain (2008-2010)
- Prof. dr. Paul A Kirschner, Visiting Professor of Education with a special emphasis on Learning and Interaction in Teacher Education at the University of Oulu, Finland (2011-present)

Other Appointments

Finally, senior researchers have been appointed as Lector at a number of Universities of Applied Science strengthening CELSTEC's relation to this part of higher education in the Netherlands. The role of the Lector is to stimulate curriculum innovation and the professionalization of staff at the Universities of Applied Science.

- Dr. Desireé Joosten-ten Brinke: Lector Modern Testing and Assessment (Eigentijds toetsen en beoordelen) at the Fontys University of Applied Science Teacher's College Tilburg
- Dr. Hans Hummel: Lector Workplace Learning (Werkplekleren) at the NHL University of Applied Science
- Dr. Jan van Bruggen: Lector Educational Functions of ICT (Educatieve Functies van ICT) at Fontys University of Applied Science Teacher's College in Sittard
- Dr. Marcel van der Klink: Lector Professionalisation of Education (Professionalisering van het onderwijs) at Zuyd University of Applied Science in Heerlen
- Prof. dr. Peter Sloep: Lector Educational Functions of ICT (Educatieve Functies van ICT) at Fontys University of Applied Science Teacher's College in Sittard

Guest Researchers

- Dr. Andreas Gegenfurtner: Center for Learning Research, University of Turku, Finland (LS)
- Dr. Beatriz E. Florián Gaviria: University of Girona in Spain (TEL)
- Dr. Esther Argelagos: Department of Pedagogy and Psychology, Faculty of Science Education, Universitat de Lleida, Spain (LS)
- Dr. Eylem Kiliç: Computer Education and Instructional Technology Department, Middle East Technical University, Turkey (LS)
- Dr. Kenneth Holmqvist: Humanities Laboratory, University of Lund, Sweden (LS)
- Dr. Theresa Guasch: Department of Psychology and Education, Universitat Oberta de Catalunya, Spain (LS)
- Dr. Yvonne Kammerer: Knowledge Media Research Centre, Tubingen, Germany (LS)
- Prof. dr. Paul Ayres: School of Education, University of New South Wales, Australia (LS)
- Prof. dr. Roxana Moreno: College of Education, University of New Mexico, USA (LS)
- Victor Alvarez Garcia: University of Oviedo, Spain (TEL)

4. Quality and Scientific Relevance

Most noteworthy accomplishments of the institute as a whole are[1]:

- Christian Glahn was elected member of the executive board of the International Organisation of Mobile Learning (IAMLEARN)
- Liesbeth Kester acquired a Fulbright Junior Scholarship (2006)
- Liesbeth Kester acquired a prestigious 3-year personal NWO Veni-subsidy (2008)
- Paul A. Kirschner was appointed to the Scientific Technical Council of the Foundation for University Computing Facilities (WTR SURF; 2010-present)
- Paul A. Kirschner was elected President of the International Society for the Learning Sciences (2010-2011; President elect 2009-2010)
- Paul A. Kirschner was elected Research Fellow of the American Educational Research Association (2009) as first European to be given this honour
- Rob Martens was appointed Extraordinary Professor for the Dr. Gerard Veringa Chair in Multimedial Education, financed by Teleac/NOT
- Stefaan Ternier was chair of the Dutch NEN commission of standards Learning Technologies (SC 381036)
- Stefaan Ternier was chair of the CEN Workshop on Learning Technologies (CEN WSLT)
- Tamara van Gog acquired a prestigious 3-year personal NWO Veni-subsidy (2008)

[1] The reader will find here only a few highlights. For specifics, the commission is referred to the specific clusters.

Table A.3 presents the total output of CELSTEC; Table A.4 presents the total success rates of PhD-candidates.

5. Output

See Part 5 of Sections B and C as well as the (Electronic) Appendices *Output LS* and *Output TEL*.

Number of Publications

Table A.3 Main categories of research output at institutional level (corresponds with Table 5.3 in the SEP)

	2006	2007	2008	2009	2010	2011
Refereed articles	53	57	57	53	60	70
Non-refereed articles[1]						
Books	2	5	9	10	5	6
Book chapters	5	13	30	41	11	36
PhD-theses	2	2	7	7	2	4
Scientific Conference papers	40	40	28	42	43	22
Professional publications[2]	12	24	15	17	28	22
Publications aimed at the general public[3]						
Other research output[4]	206	248	217	320	282	301
- Awards		1	1	1	5	1
- Inaugural addresses	1	3	1	1		1
- Contributions to conferences and congresses	109	139	135	202	203	260
- (Technical) Reports	81	91	55	90	69	26
- Software	15	14	25	26	5	8
Total publications	**320**	**389**	**363**	**490**	**431**	**461**

[1] Articles in journals that are non-refereed, yet deemed important for the field
[2] Publications aimed at professionals in the public and private sector
[3] Also called "popularised articles" including blogs. The blogs are aggregated at http://portal.ou.nl/web/leren
[4] Other types of research output (e.g., abstracts, editorships, inaugural lectures, designs and prototypes, media appearances

Number of PhDs (completed and in progress)

Table A.4 Standard PhD-Candidates (corresponds with Table 5.5 in the SEP)

Enrolment				Success rates					
Starting year	Enrolment (male / female)		Total (M+F)	Graduated after 3 years	Graduated after 4 years	Graduated after 5 years	Graduated after 6 years	Not yet finished	Discon-tinued
2002		3	3		2/66.67%	1/33.33%			
2003	1	2	3		1/33.33%	2/66.67%			
2004		3	3		2/66.67%	1/33.33%			
2005		2	2		2/100%				
2006	7	2	9	3/33.33%	2/22.22%	1/11.11%			3/33.33%
2007	2	2	4		2/50%			1/25%	1/25%
Total	**10**	**14**	**24**	**3/12.5%**	**11/45.83%**	**5/20.83%**		**1/4.17%**	**4/16.67%**

In addition to standard PhD-candidates, there were also a number of staff members who received their PhD:

- Peter van Rosmalen (2008)
- Desirée Joosten-ten Brinke (2008)
- Hubert Vogten (2008)
- José Janssen (2010)
- Ellen Rusman (2011)

as well as a number of extraneous PhD-candidates:

- Anne Helsdingen (2008)
- Riina Vuorikari (2009)

6. Earning Capacity

See Table A.2, Part 6 of Sections B and C and the (Electronic) Appendix *External European and National Funding*.

7. Academic Reputation

See Part 7 of Sections B and C.

8. Societal Relevance: Quality, Impact and Valorisation

Organisational Strategy

From 2006-2008 the organisational strategy followed that of the previous audit. The 2008 strategy document 'The new OTEC' (NL; Het nieuwe OTEC) was predicated on the increased relevance of valorisation. Participation in external research and professional networks became an integral part of CELSTEC's mission. Also, CELSTEC management announced the active pursuit of strategic alliances, emphasising regional networks and projects. The resulting projects (See Electronic Appendix *Living Labs*) can be considered living labs *avant la lettre*. Also, redesign of CELSTEC websites (www.celstec.org; portal.ou.nl/web/leren) increased access to, and visibility of, CELSTEC information relevant to valorisation where CELSTEC experts present themselves as opinion leaders in their field through blogs, podcasts, master classes and other dynamic tools.

Research, and its related outcomes and valorisation activities in the domains of LS and TEL are grouped in themes that can change from time to time. Periodically the themes are revised when needed, as a response to developments in the field, staff interests and demands from society and/or university. This works as follows. Every year the responsible professors and management of CELSTEC meets to assess the state-of-the-art in our scientific fields, new research possibilities, staff interests and overall performance. In this meeting the themes are redefined where needed. The proposal is discussed with the staff members and agreed upon by the MT. In this process there is a balance between top-down and bottom-up steering of scientific developments, giving sufficient ground to the creativity of the scientific group. For each of these themes there is also a public summary available on our website, and monthly online master classes are organised sequentially for each theme to update the public about research developments. These master classes attract between 100 and 300 participants per class.

Societal Impact

CELSTEC research drives innovation ('valorisation' in the Dutch context) of the OUNL's educational programmes, training of teachers and other education/training professionals, and provides advisory and consultancy services to a wide range of clients. The distribution can be seen below.

	2006	2007	2008	2009	2010	2011
Higher Education NL*	46	28	24	21	22	50
International Education	8	4	3	3	9	23
Companies including SMEs	3	1	4	8	7	25
Other	13	3	1	3	1	4

** Mission*

Education

Since 2007, innovation of OUNL educational programmes and support services is organised in a university-wide programme, called IPO (Instellingsbreed Programma Onderwijs). IPO's operational staff, including programme leader and support staff, was almost entirely seconded from CELSTEC. On an annual basis this averaged 10.5 FTE. This has led to many projects and implementation projects, such as:

- Development and implementation of a new quality framework for the OUNL
- Development and tuition in the Basic Qualification for Education curriculum (BKO: BasisKwalificatie Onderwijs) required for all instructors at the OUNL
- Development and implementation of a new online testing facilities and procedures
- Selection and implementation of (versions of) new VLE's
- OU-wide implementation and use of various technologies for serious gaming (EMERGO-games), team collaboration (Elluminate®) and student evaluation (Sein)
- Development and implementation of new course formats and models for the OUNL
- The OUX concept, an additional OUNL offering for bachelor and master students who got delayed and/or need additional support

Training of Educational Professionals

CELSTEC's MSc in Educational Sciences is an important vehicle for disseminating research outcomes. Its students are primarily working professionals (e.g., teachers, education coordinators/managers, policy makers, trainers). It is largely based on CELSTEC's R&D work, with CELSTEC staff teaching these subjects. During, and after completing their programme, students play a role in educational innovations in their own institutions. The same applies to PhD-candidates who - after their degree - often become innovators elsewhere. In addition to the MSc, Certified Professional Programmes have also been developed along with a continuing educational programme *Learning and teaching in the 21st century* for professionalisation (PE-points) of teachers and other educational/training professionals to help them keep up-to-date with the latest developments. This learning path is implemented OpenU, CELSTEC's own innovation platform.

Commercial Services

Next to the Master programme CELSTEC has offered a wide range of (commercial) advisory, consultancy and training services, for example, in the fields of:

- Testing and assessment
- (Procedures for) assessing prior learning
- Curriculum development according to the 4C-ID methodology

The OpenU Innovation Platform

OpenU (http://portal.ou.nl) is CELSTEC's innovation platform combining proven Learning Management System technologies with recent innovations such as social networking and non-formal learning to support continuous professional development. OpenU provides a platform where regular students, working professionals and alumni can meet, share, and learn. OpenU builds on the outcomes of the FP6 *TENCompetence* project, and was further developed with support from OUNL's central budget. It implements an OER business model and provides a learning habitat where various institutions and clients can host their own 'Professional portal'. CELSTEC uses OpenU to offer its full Master programme, its *Learning path Learning and teaching in the 21st century*, master classes and to build a community of professionals and researchers interested in our research fields. Currently OpenU has over 15.000 registered users.

9. Viability

CELSTEC in Transition Towards the New OUNL

CELSTEC is of high strategic importance to the OUNL's mission in terms of both research and innovation. Its research is the main focus area of OUNL research (profile research). CELSTEC research is historically grounded in the Dutch Law on Higher Education (WHW) where the OUNL has the task 'to innovate higher education', alongside her task as provider of *effective*, *efficient*, *enjoyable* and *accessible* distance teaching at the university level. In a strategy document recently signed by the minister of education (April 2013), CELSTEC is also assigned a prominent role. CELSTEC's funding has been stable, and the expectation is that this will continue, and even grow in the near future. The OUNL itself has fundamentally reorganised itself due to several challenges. First, as the OUNL is required to focus on lowering dropout in bachelor and master programmes (i.e., the educational offering must be redesigned to achieve this). Second, OUNL research institutes (CELSTEC and LOOK) will be integrated into a faculty context to comply with the constraints in Dutch law. Finally, there were technical norms, assessed externally, that the OUNL did not comply with, related to the ratio scientific/non-scientific staff at the OUNL. The result for CELSTEC is that:

- CELSTEC will be positioned as a research institute in a new - to be established - faculty of Psychology and Educational Sciences.
- CELSTEC's tasks will continue as is, focussing on high quality research to international standards and an increase of its impact (following the national 'valorisation' focus for all research).
- CELSTEC will have a budget directly allocated by the board (earmarked for CELSTEC within the faculty).
- Scientific personnel will stay employed at CELSTEC under the direct lead of the director/dean of CELSTEC. Support staff, however, will be available to CELSTEC as generic staff.

The OUNL will focus more on its core activities, among which the profile research of CELSTEC. Also, a new strategic fund will be created to support collaboration between the OUNL researchers from different faculties as well as to initiate state-of-the-art research. This provides opportunities for CELSTEC to collaborate with the staff of other faculties to explore new multidisciplinary research challenges.

Available Infrastructure

A sufficient and adequate infrastructure is available for CELSTEC, workplaces for staff, computer facilities, Learning Media Lab and since 2013 also a new Lab space in the LEX building.

Staffing

CELSTEC staff is organised in a capacity group. Staff is appointed by management to one of the clusters and to either educational tasks in the Master of Educational Sciences or valorisation tasks. There is space for projects and activities that transcend clusters; projects that use or integrate knowledge from both clusters. All activities are maximally related to research. Allocation can be revised to accommodate optimal project staffing. The information needed to decide on a good staff deployment is provided by the programme director and capacity manager.

Human Resource Management

The scientific staff, ICT-developers and designers belong to one human resource group. At least once a year, the Human Resource Manager arranges for the carrying out and completion of Result & Development Interviews (R&DI – NL: Resultaat- & Ontwikelingsgesprekken) to discuss the results/output of the previous year and the professional development needs and plans for the coming year/years. This interview establishes (1) which tasks the person carried out (and the quality of the task accomplishment including possible individual or structural/institutional reasons for poorer than expected results) in light of the agreements made the previous year, (2) which tasks the person is going to take on in the forthcoming period (usually one year) including the determination of whether further training or schooling is necessary to carry out those tasks to which level, and hence (3) to which programme she or he will be allocated. Obviously continuity in an academic career is important both for individual employees as for CELSTEC as a whole. Sometimes, however, a switch from one programme to another can be beneficial and offer new perspectives for both parties.

Competence Development

All staff members are encouraged to develop their own specific competences. In house, CELSTEC offers courses such as writing and structuring of communication, academic writing in English (at two levels), academic presentation in English, coaching and supervision of PhD-candidates. Requests of staff for internal or external professionalization, if they fit the agreements made in the RDI is always honoured. All PhD-candidates have their own specific Schooling and Supervision Plan which delineates the candidates route to development and how schooling (via the OUNL, their Research School or other institutions as sister universities) and supervision is expected to achieve this.

Personal/Professional Growth and Succession

Growth of staff members, including their succession as professors and thus as chairs for the specific topics due to anticipated events such as retirement or possible resettlement, is discussed with the management team in sufficient time allowing the appointment of a successor who can gain experience for the role to eventually fulfil the position. This includes personalised development trajectories including the necessary internal and external coaching and schooling.

Mobile/Flexible Work

Mobile/flexible work during a part of the week is customary at CELSTEC. Communication is facilitated using Skype; all staff receives, at the time of their appointment, a CELSTEC Skype name. All staff is expected – when working at home or elsewhere – to be reachable on Skype. Certain staff members are also outfitted with Skype Premium so that they can organise group meetings. Finally, meetings at the cluster and CELSTEC levels are always organised on fixed days, planned a year in advance.
CELSTEC facilitates working alone or in teams, providing adapted working places.

PHD-candidates

Supervision of CELSTEC PhD-candidates is done on a weekly basis by a daily supervisor and meetings with PhD-supervisors are scheduled monthly. After one year, each candidate is assessed on the quality of the output and the feasibility of finishing the research in the timeframe foreseen (4 years with a full time appointment). Working for shorter or longer periods at other institutes during the PhD period is encouraged. At the end of the period PhD-candidates are assisted with advice about their careers and career possibilities. High potentials are aided by their supervisors in applying for funding for bridging (Rubicon) and postdoc funding.
As a principle, all PhD-candidates work 20% of their time in an educational, project or consulting setting, allowing them to gain additional work experience. The OUNL offers and requires them to study for their Basic Qualification for Education (BKO). Finally, PhD-candidates as a group share experience and often assist in mutual experiments.

Policy of Care and Monitoring of Illness

The percentage of employees absent due to sickness in CELSTEC is relatively low (±2%), especially when compared to the OUNL as a whole (±4%). This success is due to the departmental policy, which is contributed by the organisation's medical officer and the manner in which CELSTEC policy is carried out. In case of illness, CELSTEC always keeps contact with the staff member. When illness is due to work related issues,

the help of the organisation's medical officer is called upon. CELSTEC always facilitates return to work by being very flexible on issues such as working hours, devices or aids. Both short-term absenteeism and the number of long-term sick are low as a consequence of this policy.
For the list of tenured research staff with birth year, see (Electronic) Appendix 2 *Tenured Staff CELSTEC*.

Innovative Capacity

CELSTEC advises institutes on educational innovation and organises workshops, presentations and innovation projects. In addition, CELSTEC collaborates with a variety of partners on Research and Open Innovation, and provides them with Solutions or Education & Training. In a number of projects CELSTEC supports (primary) teacher training institutes in the re-design of curriculum into a competency-based one. CELSTEC has also actively designed and implemented a Learning Media Lab structure and facilities. Following an open innovation policy, workshops have been run with faculty members of the OUNL as also with national and international cooperation partners. For a full list of the innovative work that CELSTEC has carried out see the Electronic Appendix *Projects with Partners 2006-2011.*

10. Next generation CELSTEC

Objectives and Outcomes

The primary objectives of and expected outcomes for PhD-graduates are to:

- become competent researchers who can pursue an academic and/or scientific career. This entails developing:
  - critical thinking skills
  - methodological and statistical knowledge and skills
  - communication, presentation and writing skills
  - planning and management skills
  - networking skills
  - an understanding of professional and ethical standards
- do high quality research
- make results known through publishing in high quality journals and presenting at high impact conferences
- make results known and usable through publishing in professional journals and presenting at professional conferences
- develop a national and international network within the chosen field
- enjoy the experience

Institutional Embedding

PhD-candidates working in CELSTEC and their CELSTEC-supervisors participate in national research schools: Interuniversity Center for Educational Research (ICO) and the School for Information and Knowledge Systems (SIKS). Within CELSTEC, PhD-candidates have their own consultative body. All PhD-candidates (OUNL-employed and external) carry out research based upon an approved PhD project proposal and are schooled and supervised according to a required Education and Supervision Plan (see Electronic Appendices *CELSTEC PhD Proposal for PhD-candidates* and *CELSTEC Education and Supervision Plan*). Approval of the proposal is either through an external funding body such as Dutch National Science Foundation (NWO) or internal assessment (i.e., based upon NWO guidelines) where at least one full professor (external to CELSTEC) and a CELSTEC full or associate professor (see Electronic Appendix *CELSTEC referee review form*) participate.

Each candidate has a PhD-supervisor (promotor; full professor) who meets with the candidate once every three to four weeks and a daily supervisor (associate or an assistant professor) who meets with the candidate weekly. The rules, regulations and procedures pertaining to PhD-candidates and their supervision can be found in the CELSTEC PhD-Guide which is updated yearly (see Electronic Appendix *PhD Guide CELSTEC* for the 2011 PhD-guide). Finally, the progress of PhD-candidates is monitored yearly, (see the Electronic Appendix *PhD Monitor CELSTEC* for an example of a PhD progress monitor).

PhD-candidates work, as a rule unless the contract with third party funders prohibits this, 70% of the time on research and 30% on valorisation of their knowledge and skills and 'overhead'. In the LS cluster this is usually course development and tutoring in the *Master of Learning Sciences* and/or workshops for practitioners based on their PhD project work. In the TEL cluster this often means contributing to the CELSTEC Learning Media Lab which is an important carrier of valorisation.

Along with internal CELSTEC PhD provisions, CELSTEC is an integral player in the Open University Graduate School (Prof. dr. Paul A. Kirschner is a founding member of its executive board). The graduate school is a quality control body for all OUNL faculties and expertise centres with respect to their PhD programmes and a provider of a community of peers, courses and facilities (e.g., use of electronic library facilities) for all OUNL PhD-candidates (internal and external).

CELSTEC plays a key role in ICO with senior researchers coordinating two thematic groups as well as fulfilling the role of instructor in the ICO educational programme (i.e., thematic master classes,

introductory course) and the annual national and international schools. CELSTEC also has a member on the Board of Governors of SIKS and regularly contributes to its educational seminars and training activities. Nationally, CELSTEC has co-organised several summer and winter schools for TEL, mainly in the EU *TENCompetence* Integrated Project that was co-ordinated by CELSTEC, and nationally also with SURF and Kennisnet. On a European level, CELSTEC co-organised the doctoral networks in the *Kaleidoscope Network of Excellence,* TENCompetence Integrated Project and the *STELLAR Network of Excellence*. Furthermore a doctoral online community has been initialised by CELSTEC in the context of the *TELeurope* platform. CELSTEC offers PhD-candidates the opportunity to follow courses offered by TELDA (Technology Enhanced Learning Doctoral School).

Success Rates and Career Destinations of PhD-graduates

The success rate of CELSTEC can be found in Tables A.4 and A.5 and their career destinations can be found in the Electronic Appendix *Career Destinations of PhD-graduates*. In general, of the 24 PhD-graduates, 22 went on to careers in universities/universities of applied science and 2 to para-university institutes.

11. SWOT-analysis

Strengths

- *CELSTEC has a strong academic reputation, nationally and internationally* which:
  - opens doors for collaboration (as evidenced by national and EU cooperative proposals)
  - opens doors for exchange (as evidenced by the visiting scholars at all levels)
  - sets a high standard to which the organisation proudly adheres (evident in the CELSTEC culture).
- *Connection between the LS and TEL clusters*. The LS cluster works with the TEL cluster on cross-boundary innovation. SIG meetings are frequently organised where representatives of both clusters work together on special topics of common interest to formulate new research plans and grant applications.
- *CELSTEC provides healthy breeding ground for innovation* as evidenced by its transdisciplinary approach to the design of education/instruction/learning, close collaboration between clusters on topics of special interest, increased collaborative tendering for research grants and availability of multidisciplinary expertise and varied backgrounds of staff.

Weaknesses

- *Location:* Neither an attractive starting point for national collaboration/meetings nor venue for relocation for prospective faculty.

Opportunities

- The new *Horizon 2020 initiative* and developments in the assigned *top industry sectors* in the Netherlands (CELSTEC participates in the 'creative industry' sector) provide opportunities for research and valorisation activities.
- *The policy to focus on turn-key solutions* (see *Electronic Appendices EMERGO-games, OPO, SAITO*) is developing successfully and there are many new possible solutions that we can bring to market in the near future, offering also new funding opportunities for research and increased impact.
- CELSTEC is well-positioned to hook on to many trends in higher education such as:
  - MOOCs: CELSTEC has experience with massive distance teaching, using advanced technologies and high quality learning designs and is currently discussing initiatives for collaboration with a number of Dutch universities.
  - Part time education is under pressure in the Netherlands, the OUNL positions itself as 'national co-provider' for part time academic education. CELSTEC has tools and methods to support this and is exploring the possibility of providing this type of blended learning in collaboration with universities and industry partners.
  - The quality of education at various levels is a continuing discussion. CELSTEC is increasingly being asked to provide help in establishing a better quality policy for educational institutes (or to assess their quality).
  - There is a focus on increased efficiency (with at least the same or higher quality) in Dutch education in which we get involved through various channels.

All this provides opportunities for future research and valorisation activities, increasing the impact of CELSTEC research and providing a base for new research.

Threats

- The major threat is of a *political and economic nature*: Will the core funding for universities and the OUNL be maintained in the future at the same level as it is now? Governments are changing many rules in the game which provides for uncertainties at the university funding level. This is also true for the policy regarding national research funding. At this moment research money is increasingly being connected to industry policy, meaning that research should be increasingly applied and industry-connected to attain 2nd money stream funding.

Conclusion

CELSTEC has a challenging future, with many new opportunities to perform valuable research and demonstrate its impact. A period of reorganisation which we are currently going through will cause some disturbances on different levels, but from the beginning of 2014 this will be completed and we can fully attend to the ambitious tasks we are focussing on.

12. Strategy

The focus of CELSTEC will be as agreed upon in the policy documents signed by the minister of education:

- Perform profile research in LS and TEL to the highest possible levels according to international measures. In size CELSTEC expects to grow in the coming years in primary, secondary and tertiary funding. Expected is that the tertiary funding will grow considerably due to the impact of its research.
- Reorganise and focus research in five research themes: Learning Objectives and Assessment, Learning Arrangements, Learning Environments, Digital Literacy and Managing Educational Excellence. Each theme will be approached from the perspective of LS and TEL. All current research can be organised within the first four themes, while Educational Leadership will be developed as a new theme. Assessment and Digital Literacy will be strengthened because of high demand.
- Increase valorisation activities using a wide variety of instruments (master classes/workshops, contract research, contract consultancy, turn-key solutions, professional publications, etc.). The income generated will be used to fund further research.

At the level of research funding opportunities, CELSTEC will orient itself to the new *Horizon 2020* programme and select target areas and opportunities to submit proposals. The changes are looking good as far as details are available. At the national level (NWO) CELSTEC is striving to submit projects in the industry policy areas, which are now 50% of the total budget and has elaborated a strategy and realised connections to realise this.

With respect to the new position in the OUNL, CELSTEC will focus primarily on research and valorisation. The educational and support activities will be organised by the new faculty (although performed by CELSTEC staff). This has consequences for the HRM management and policy. The strategy will be worked out at the end of 2013.

CELSTEC will also substantially contribute to the redesign of the OUNL's educational distance teaching system, using its knowledge and technologies in the field. This will be positioned as an institution-wide programme with projects in which most of them CELSTEC staff will have a leading position.

Part B – Cluster Learning Sciences (LS)

1. Objective(s) and Research Area

The cluster's mission is to support learners in (1) acquiring skills, knowledge, and attitudes (i.e., competencies), (2) transferring those competencies to a variety of settings and (3) planning, regulating and maintaining their own learning. The cluster does this via interdisciplinary research and innovation activities to uncover the cognitive processes underlying learning and using the resulting knowledge to develop a comprehensive theory of instructional design and investigate guidelines to inform the design of effective and efficient learning tasks, learning environments, and learning assessments. The cluster is positioned within the LS field making increased use of technology enhanced methods. This explicitly encourages and requires a multidisciplinary and/or interdisciplinary approach to studying educational questions, building on state-of-the-art knowledge in education, psychology, cognitive science, computer science, and neuroscience. The cluster concentrates on:

1. *Effective Learning Strategies* (Goal: Defining effective study and instruction strategies based on the working of human memory)
2. *Information Literacy* (Goal: Using Internet resources for solving complex information problems)
3. *Expertise Development* (Goal: Devising instructional strategies designed to aid learners in achieving expertise)
4. *Brain & Learning* (Goal: Determining how psychological and biological factors influence lifelong learning)
5. *Assessment* (Goal: Developing new methods of assessment to meet the challenges of modern societal needs)

The LS cluster has a strong focus on theory-based, use-inspired and praxis-oriented basic and applied research to provide valuable output for both the practical field of education (e.g., practical guidelines, workshops, models, tools, professional publications) and the international scientific community (publications in high-quality SSCI journals, scientific workshops, participation in international scientific conferences).

2. Composition

Table B.1 Research staff at programme level in fte (corresponds with Table 5.2 in the SEP)

	2006	2007	2008	2009	2010	2011
Tenured staff*	5.64	5.84	6.72	6.28	6.04	6.00
Non-tenured staff*	.90	.90	.90	1.7	1.44	.72
PhD-students**	8.08	6.02	9.1	5.88	7.28	10.78
Total staff	**14.62**	**12.76**	**16.72**	**13.86**	**14.76**	**17.50**

* Research component

** Direct funding by the university or research grants; research component is 70% fte PhD-candidate

Table B.2 Funding at programme level (corresponds with Table 5.4 in the SEP)

	2006	2007	2008	2009	2010	2011
Funding:						
Direct funding[1]	831,000/66%	834,000/61%	700,000/61%	855,000/69%	827,000/74%	924,000/70%
Research grants[2]	271,256/22%	334,000/25%	375,103/33%	299,768/24%	227,851/20%	276,691/22%
Contract research[3]	148,823/12%	190,243/14%	69,132/6%	85,795/7%	57,135/6%	105,160/8%
Total funding	**1,251,079**	**1,358,243**	**1,144,235**	**1,240,563**	**1,111,986**	**1,305,851**
Expenditures:						
Personnel costs	1,201,036/96%	1,303,913/96%	1,087,023/95%	1,178,535/95%	1,045,267/94%	1,227,500/94%
Other costs	50,043/4%	54,330/4%	57,212/5%	62,028/5%	66,719/6%	78,351/6%
Total expenditure	**1,251,079**	**1,358,243**	**1,144,235**	**1,240,563**	**1,111,986**	**1,305,851**

[1]: Direct university funding

[2]: Research grants from national and international scientific competition (e.g. NWO, KNAW, ERC) and European Commission

[3]: Research contracts for research projects from external organisations (e.g., industry, governmental ministries, charities)

For a complete overview of all research staff members, see (Electronic) Appendix *Staffing CELSTEC 2006-2011*.

3. Research environment and embedding

In the previous audit a threat was signalled: "The distance teaching setting (no campus with students) makes it more difficult to find participants for experiments". From 2010 onwards one of the senior staff members became responsible for participant recruitment. Through structural contacts with schools in the neighbourhood on both the administrative as well as the executive level this led to two-way collaborations guaranteeing both a platform to execute research as well as implementing new findings with educational relevance.

The LS cluster is a vibrant part of the international learning sciences field with national research collaboration within several NWO PROO programmes for interrelated research, Kennisnet research initiatives (two PhD-candidates), and the Fund for Strengthening Economic Infrastructure (FES; Fonds Economische Structuurversterking) Quick Result project 'Biopsychological conditions for learning' in the programme *Brain &Cognition: Societal innovation in health care, education and security*, within the focus area *Learning* (postdoc and PhD-candidate), and the Dutch Educational Television network (Teleac/NOT, now NTR) with an Extraordinary Professor for the Dr. Gerard Veringa Chair in 'Multimedial Education' and a PhD-candidate financed by Teleac/NOT.

National and International Collaboration

Noteworthy examples of national and international collaboration are:

- Centre for e-Learning Technology (CeLTech): CeLTech, Saarland University and German Research Center for Artificial Intelligence (DFKI)
- Erasmus University Rotterdam (EUR) Psychology Department, including an interlinked NWO research project 'Fostering self-monitoring and self-regulation in primary and secondary education' (2009-2013)
- Free University of Amsterdam (VU): The Centre for Brain and Learning is partner in a larger research programme *Learning in a brain and cognition perspective: A large-scale research programme in the Netherlands*
- Games and Professional Simulations (GAPS), University of Wisconsin-Madison, USA
- Knowledge Media Research Center, Tübingen, Germany: Knowledge acquisition, exchange and communication within innovative technologies
- Learning Systems Institute, Florida State University, USA to develop robust solutions using systems approaches to planning, design, evaluation, and improvement of instruction, learning, and human performance
- Maastricht University (UM): The department of Psychology is a main supplier of interns and PhD-candidates. Joint research meetings are organised monthly with the department of Education and Development.
- Open University of Catalonia, Spain: The programme director was visiting professor at the eLearn Centre of the UOC
- School of Education, University of New South Wales, Australia: Staff has held several research stays relating to collaboration on "cognitive load theory and instructional design"
- Stoas University of Applied Sciences and teacher education in their Master of Learning and Instruction for (Green) Education and Companies

Finally, senior researchers have been appointed as Lector at a number of Universities of Applied Science strengthening Celstec's relation to this part of higher education in the Netherlands. These include:

- Dr. Desireé Joosten-ten Brinke: Lector Modern Testing and Assessment (Eigentijds toetsen en beoordelen) on the Fontys University of Applied Science Teacher's College Tilburg
- Dr. Marcel van der Klink: Lector Professionalisation of Education (Professionalisering van het onderwijs) at Zuyd University of Applied Science in Heerlen

For a complete overview of all collaboration, see (Electronic) Appendix *National and International Collaboration*.

4. Quality and scientific relevance

As evidence of the high quality of research carried out in an international perspective, an analysis by Ozcinar[2] of publications relating to instruction and instructional design/science in between 1980-2008 (Note: OTEC/CELSTEC only existed in the period 1999-2008) concluded that the OUNL (OTEC/CELSTEC) was number 1 in the world with 5 of the top 10 authors working there. A more recent study for Taylor and Francis in 2011 (see Electronic Appendix *Institutions and Publications in the Top 12 Journals during 2011 - Learning Sciences Researcher_Feb 2013*) ranked the Open University (i.c. CELSTEC) as number 8 in the world in 2011.

[2] Ozcinar, Z. (2009). The topic of instructional design in research journals: A citation analysis for the years 1980-2008. *Australasian Journal of Educational Technology, 25*, 559-580.

Significant Results/Highlights Relevant to the Learning Sciences

- Basic knowledge is a prerequisite for learning from and using new information (Nievelstein, van Gog, Boshuizen, & Prins, 2010).
- Choice and variability of learning tasks affects learning (Van Gog, Kester & Paas, 2011).

- Life style factors such as breakfast and fish consumption play a significant role in academic achievement (De Groot et al, 2011; Boschloo et al, 2012).
- Professional knowledge structures such as illness scripts in medicine are developed and refined with (clinical) experience (Charlin, Boshuizen, Custers, & Feltovich, 2007). Reducing participation in clinical practice will, thus, adversely affect learning (Dornan, Boshuizen, King, & Scherpbier, 2007).
- Students' information literacy skills can best be fostered by embedding training in these skills in lessons concerning domain specific content (Walraven, Brand-Gruwel, & Boshuizen, 2009, 2010).
- Study behaviour (i.e., note taking and perspective taking) differentially affects learning as a result of prior knowledge (Wetzels, Kester, van Merriënboer, & Broers, 2011a[3], b[4]).
- The amount of use of Facebook® goes hand in hand with a lower grade point average (Kirschner & Karpinski, 2010; Karpinski & Kirschner, 2013).
- The use of development portfolios help students' self-direct and self-regulate their learning (Kicken, Brand-Gruwel, & Van Merriënboer, 2008; Kicken, Brand-Gruwel, Van Merriënboer, & Slot, 2008).
- Unguided inquiry learning leads to poorer learning results than structured instruction (Kirschner, Sweller, & Clark, 2006).
- Visual expertise can be trained through eye movement modelling examples (Jarodzka, Balslev, et al., 2012; Jarodzka, Van Gog, et al., 2013; Van Gog, Jarodzka, Scheiter, Gerjets, & Paas, 2009).

[3] *British Journal of Educational Psychology, 81*(2), 274-291. doi: 10.1348/000709910X517425

[4] *Computers in Human Behavior, 27*, 16-21. doi: 10.1016/j.chb.2010.05.004

Key publications per year[5] (references; full text in appendix and on secluded website)

- **Kirschner, P. A.**, Sweller, J., & Clark, R. E. (2006). Why minimal guidance during instruction does not work: An analysis of the failure of constructivist, discovery, problem-based, experiential, and inquiry-based teaching. *Educational Psychologist, 46*(2), 75-86. [IF: 2.795] [1780 citations[6]] [481 citations WoS[7]][8]
- Charlin, B., **Boshuizen, H. P. A.**, Custers, E., & Feltovich, P. J. (2007). *Scripts and clinical reasoning. Medical Education, 41*, 1178-1184(7). [IF: 2.562] [89 citations] [46 citations WoS]
- Könings, K. D., **Brand-Gruwel, S.**, van Merriënboer, J. J. G., & Broers, N. (2008). Does a new learning environment come up to students' expectations? A longitudinal study. *Journal of Educational Psychology, 100*, 535-548. [IF: 3.08] [24 citations] [9 citations WoS]
- Corbalan, G., **Kester, L.**, & van Merriënboer, J .J. G. (2009). Dynamic task selection: Effects of feedback and learner control on efficiency and motivation. *Learning and Instruction, 19*, 455-465. [IF: 2.372] [22 citations] [11 citations WoS]
- **Jarodzka, H.**, Scheiter, K., Gerjets, P., & van Gog, T. (2010). In the eyes of the beholder: How experts and novices interpret dynamic stimuli. *Learning and Instruction 20*, 146-154. [IF: 2.768] [68 citations][9][28 citations WoS]
- **De Groot, R. H. M.**, Jolles, J., Van Boxtel, M. P. J., Stein, A. D., Blauw, G-J., van de Bor, M., & Lumey, B. (2011). Prenatal famine exposure and cognition at age 59 years. I*nternational Journal of Epidemiology, 40*, 327-337. [IF: 6.414] [10 citations] [4 citations WoS]

[5] We have chosen to include past members (including PhD-candidates). Present members are **bold**, past and PhD are underlined. We have chosen not to include publications where all authors have gone to other institutions, though they had a higher impact factor!

[6] Based on Google Scholar (May 14, 2013)

[7] Based on Web of Science (May 14, 2013)

[8] Most cited and most downloaded article in the history of *Educational Psychologist*.

[9] One of the five most cited articles in Learning & Instruction (http://www.journals.elsevier.com/learning-and-instruction/most-cited-articles/).

Number of Articles in Top 10% and 25% of Publications Relevant to the Discipline

	SSCI-1**		SSCI-2**		SCI-1**		Total*	
Year	10%	25%	10%	25%	10%	25%	10%	25%
2006	8	10	1	10	1	3	10	23-8
2007	2	4	2	3	0	1	4	8-0
2008	1	3	2	3	0	0	3	6-0
2009	5	7	5	8	1	1	11	16-3
2010	8	12	3	10	2	2	13-3	24-3
2011	8	12	6	7	0	0	14-4	19-4
Total	32	48	19	41	4	7	55-7=48	96-18=78

* Some journals appear on more than one category list (e.g., Learning and Instruction). In the total score one of each double has been deleted from the score. Therefore the total number of publications is less than the sum of its parts.

** SSCI-1: Education & Educational Research; SSCI-2: Educational Psychology; SCI-1: Education, Scientific Disciplines

Most Important Books or Chapters of Books[10]

- **Boshuizen, H. P. A**. (2009). Teaching for expertise; problem-based methods in medicine and other professional domains. In K. A. Ericsson (Ed.), *The development of professional performance: Approaches to objective measurement and designed learning environments* (pp. 379-404). New York: Cambridge University Press.
- **Brand-Gruwel, S.**, & **Wopereis, I.** (2010). *Word informatievaardig: Selecteren, beoordelen en verwerken van digitale informatie* [Become information literate: Selection, evaluation and processing digital information]. Groningen: Noordhoff.
- **Kester, L.**, Paas, F., & Van Merriënboer, J. J. G. (2010). Instructional control of cognitive load in the design of complex learning environments. In J. L. Plass, R. Moreno, & R. Brünken (Eds.) *Cognitive load theory* (pp. 109-130). New York: Cambridge University Press.
- **Kirschner, P. A.** (2009). Epistemology or pedagogy, that is the question. In S. Tobias & T. M. Duffy. *Constructivist instruction: Success or failure?* (pp. 144-157). New York: Routledge.
- Van Merriënboer, J. J. G., & **Kirschner, P. A.** (2007). *Ten steps to complex learning*. Mahwah, NJ: Lawrence Erlbaum[11].

5. Output

Number of Publications

The output of the LS cluster is at a stable high level, in spite of important personnel changes. Its target is 3 ICO-recognised scientific publications per year for full time fte staff members and 1 per year for PhD-candidates (thesis counts as a publication). In 2006-2011 the LS cluster had an input of 90.22 fte research capacity and delivered 337 scientific publications exceeding the target (184 articles in journals with impact factor (previously SSCI/ISI journals, now Thomson Reuters), 41 in ICO accepted journals, 8 in other journals, 59 books and book chapters, 15 theses, and 30 conference papers. Average IF of the 186 scientific publications with an IF is 1.711. This must be seen in light of the 'norms' of the domain and the CELSTEC choice for interdisciplinary research. For the Educational Sciences this is 0.590 and for Psychology 1.387. The (Electronic) Appendix *Scientific Output* contains a complete overview of scientific output.

[10] We have chosen to include past members (including PhD-candidates). Present members are **bold**, past and PhD are underlined.

[11] This book has been translated into Chinese and Korean.

Table B.3 Main categories of research output of the Learning Sciences cluster (corresponds with Table 5.3 in the SEP)[12]

	2006	2007	2008	2009	2010	2011
Refereed articles	42	35	32	32	43	47
Non-refereed articles[1]						
Books		2	3	1	3	2
Book chapters	3	4	16	5	9	11
PhD-theses	2	2	5	3	1	2
Scientific conference papers	7	1	9	2	10	1
Professional publications[2]	9	22	11	16	7	15
Publications aimed at the general public[3]						
Other research output[4]	53	97	71	101	113	173
- Awards		1			3	
- Inaugural addresses	1	3				1
- Contributions to conferences and congresses	50	86	70	90	103	157
- (Technical) Reports	2	7	1	11	7	10
- Software						2
- Rest						3
Total publications	**116**	**163**	**147**	**162**	**186**	**251**

[1] Articles in journals that are non-refereed, yet deemed important for the field
[2] Publications aimed at professionals in the public and private sector, including patents
[3] Also called "popularised articles" including blogs. The blogs are aggregated at http://portal.ou.nl/web/leren
[4] Other types of research output (e.g., abstracts, editorships, inaugural lectures, designs and prototypes, media appearances

Number of PhDs (completed and in progress)

Table B.4 Standard PhD-Candidates (corresponds with Table 5.5 in the SEP)

Enrolment				Success rates					
Starting year	Enrolment (M / F)		Total (M+F)	Graduated after 4 years	Graduated after 5 years	Graduated after 6 years	Graduated after 7 years	Not yet finished	Discon-tinued
2003		3	3	2/66.66%	1/33.33%				
2003	1	2	3	1/33.33%	2/66.66%				
2004		3	3	2/66.66%	1/33.33%				
2005		2	2	2/100%					
2006	1	1	2	2/100%					
2007		2	2	2/100%					
Total	**2**	**13**	**15**	**11/73.33%**	**4/26.67%**				

[12] In this table and in the analogous table for the TEL cluster the output is based upon the primary author. Note that some output is a joint effort between the two clusters.

6. Earning Capacity

The research funding for the LS cluster was approximately 66% direct from the OUNL (€ 4,971,000), 24% second stream (€ 1,784,669) and 10% third stream contracts (€ 656,288) in the period 2006-2011. The cluster worked in that period on a total of 17 projects acquired via second stream funding (primarily from NWO) for a total of € 3,320,472. The projects can be found in Electronic Appendix *External European and National Funding*.

7. Academic Reputation

A full list of signs of academic reputation is included in the (Electronic) Appendix *Academic Reputation*. A few signs of recognition in the period 2006-2011 are:

- Els Boshuizen is co-editor of the Springer *Innovation and Change in Professional Education* book series.
- Fleurie Nievelstein (PhD-candidate) won the AERA prize for best paper for a new researcher for: *Learning to solve legal cases: The effects of instructional support* (co-authors: Tamara van Gog, Els Boshuizen).
- Karen D. Könings won the award for Best Dissertation of 2007 from the Netherlands Educational Research Association and Flemish Forum on Educational Research for her PhD thesis *Student perspectives on education: Implications for instructional redesign* (promotors: prof. dr. J.J.G. van Merriënboer & prof. dr. S. Brand-Gruwel
- Liesbeth Kester acquired a prestigious 3-year personal NWO/Veni-subsidy (2008).
- Liesbeth Kester was appointed Associate Editor of the *Journal of Computer Assisted Learning.*
- Ludo van Meeuwen, Halszka Jarodzka, Saskia Brand-Gruwel, Jeano de Bock, Paul Kirschner and Jeroen van Merriënboer won the 'Best Poster Award' during the EARLI SIG 6/7 conference.
- Paul A. Kirschner was appointed Editor of the *Journal of Computer Assisted Learning* and Associate Editor of *Computers in Human Behavior*.
- Paul A. Kirschner was appointed to the Scientific Technical Council of the Foundation for University Computing Facilities (WTR SURF; 2010-present).
- Paul A. Kirschner was elected President of the International Society for the Learning Sciences (2010-2011; President elect 2009-2010).
- Paul A. Kirschner was elected Research Fellow of the American Educational Research Association and was the first European to be given this honour.
- Rob Martens was appointed Extraordinary Professor for the *Dr. Gerard Veringa Chair in Multimedial Education*, financed by Teleac/NOT.
- Saskia Brand-Gruwel was recognised as best PhD supervisor by the Netherlands Educational Research Association (VOR).
- Tamara van Gog acquired a prestigious 3-year personal NWO/Veni-subsidy (2008).

8. Societal Relevance: Quality, Impact and Valorisation

Learning – both formal and informal – plays a key role in society and is necessary for both social equality and sustainable economic development. Personalising learning for effective and efficient knowledge and skills acquisition, making effective and efficient use of the internet for learning and instruction, bridging the gap between initial learning and expertise, proper assessment of learning are of major concern in the Netherlands and Europe. The LS cluster contributes to addressing these concerns through, (1) studying, designing and developing interventions to make teaching and learning more adaptive and flexible, (2) carrying out in depth research on digital/internet literacy and translating this into usable interventions for both teachers and learners, (3) using new and powerful techniques (i.e., eye tracking) to study how experts approach complex cognitive and perceptual problems to acquire knowledge and expertise, and (4) working with other institutions of higher education to implement all of this in actual learning settings.

LS staff members are active in the OUNL Master of Learning Sciences programme in different roles, including course design, course development, tutoring, examining & assessing and thesis supervision. The LS cluster has also worked with a number of external societal partners such as schools, companies and municipalities carrying out curriculum design and development for both formal and informal learning. Further, staff members serve on policy advisory boards of the Dutch and European government and have played a role in many information and consultation forums for school and parent associations were invited as speakers to conferences for practitioners, professionals and policymakers, make use of different forms of social media (primarily blogs) and have been interviewed for newspapers, radio and television.

In addition, the following online master classes have been organised:

- How do I make my students critical web-users? Prof. dr. Saskia Brand
- How do I achieve a balance between formative and summative assessment? Dr. Desirée Joosten-ten Brinke
- How do I design modern vocational Education? Dr. Bert Hoogveld & Monique van Bemmelen

- How do I develop expertise? Prof. dr. Els Boshuizen
- How do I create Education for cognitively excellent students? Prof. dr. Ton Mooij
- How do you teach someone to learn effectively? Dr. Liesbeth Kester
- Google yourself smart! Prof. dr. Saskia Brand-Gruwel
- How does your lifestyle influence your school results? Dr. Renate de Groot (opnamen beschikbaar)
- How do you stimulate self-regulated learning? Dr. Wendy Kicken

Finally, staff members are currently supervising 10 external PhD-candidates (NL: buitenpromovendi) including holders of NWO Teacher Scholarships.

For details see (Electronic) Appendix 3 *CELSTEC Societal Relevance and Valorisation*

9. Viability

Content / Themes

In the course of the period 2006-2011, the role of cluster leader moved from Prof. J.J.G. van Merriënboer to Prof. F. Paas, to Prof. P.A. Kirschner. The original programme audited in 2005 and revamped in 2006 had as focus: *Instructional Design for Open Tasks, Environments and Communities (ID-Otec)*. With the arrival of Prof. Kirschner, a new cluster was set up leaning heavily on the prior but revitalised in a cluster on *Design and Support for Learning and Expertise Development* to better exploit the expertise of the senior staff. The cluster focuses on (1) Creating Flexible Environments for Acquiring Complex Cognitive Skills (i.e., Effective Learning Environments), (2) Solving Complex Information Problems (i.e., Internet Literacy), and (3) Developing Domain-specific Expertise (i.e., Expertise Development and Assessment) and was expanded with (4) Brain & Learning (i.e., Biological and (Neuro)-psychological Determinants of Learning). These themes contribute, by their timeliness, to increased viability.

Resource Management

The LS cluster is jointly managed by one professor supported by a team of theme chairs. Staffing (i.e., personnel) is centrally managed and allocated via the HR manager and the MT of CELSTEC. The cluster management adapts the staffing to specialised expertise and additional funding acquired via research grants and contract research. Further, see section A.9

Innovative capacity

The LS cluster Advises institutes on educational innovation and organises workshops, presentations and innovation projects. This is often based upon its world renowned *4C-ID* instructional design model and the blueprint for its use *Ten Steps to Complex Learning*. The institutes include: ROC Leeuwenborg, ROC Arcus College, Freudenthal Institute for Science and Mathematics Education, Avans University of Applied Science, STOAS University of Applied Science, INHOLLAND Den Haag University of Applied Science, Universitat Oberta de Catalunya (Foundation for the Open University of Catalonia, FUOC), CITO/CE, VLHORA, European Patent Office and Utrecht College of Applied Science (Technical Business Administration). In addition, there is a number of partners with whom the LS cluster collaborated on Research and Open Innovation, and which it provides with Solutions or Education & Training. This list is not exhaustive, but gives an impression of the kind of partnerships in which the cluster is engaged or which might be established in the future.

- Teleac/NOT: strategic co-operation, especially in the area of lifelong learning
- LVNL/NLR/KDC: Air Traffic Control of the Netherlands (LVNL), the National Aerospace Laboratory (NLR) and the Knowledge Development Centre main port Schiphol (KDC) on various research projects on the instructional design of training for air traffic controllers
- ROC-A12: Research to redesign their curriculum in the 'care and welfare' sector

In a number of projects CELSTEC supports (primary) teacher training institutes in the re-design of curriculum into a competency-based one.

- Fontys University of Applied Science for professional education: implementation of a curriculum
- USEM: a European project to promote empowerment of end users with disabilities in standardisation activities
- AVANS University of professional education in Breda: training teachers to set up and carry out research
- Cooperation with Ruud de Moor Centre at the Open Universiteit: design of instruments for workplace learning of teachers in Dutch schools (Inspirator environment)
- Consultancy and training for the Netherlands Patent Office
- Life Long Learning Limburg project: re-schooling project and mobility centre

In addition, the LS-cluster has either partnered with aided many institutions, public, private, and combined with respect to (1) formative/summative assessment and quality control, (2) advancing digital literacy for teachers, students and the general population, and (3) most recently on lifestyle factors such as nutrition and physical activity on cognition and learning.

For a complete list, see (Electronic) Appendix 3 *CELSTEC Societal Relevance and Valorisation* and the Electronic Appendix *Projects with partners 2006-2011.*

10. Next generation Learning Sciences Cluster

The relevant information about PhD training specific to the Learning Sciences cluster can be found in the following texts dealing with proposals, supervision, training and community.

Proposals:

PhD proposals always go through a strict review procedure. Externally funded projects have been approved by the funding agency. Internal projects are based on NWO-PROO proposals which are submitted to a review board external to CELSTEC composed of three researchers (full and associate professors) with a strong background in research in the proposal's area. The reviewers review according to NWO-PROO criteria. External PhD-candidates use the same forms and have the same requirements as the previous, but approval is based upon review by two internal staff members of which at least one is a full professor.

Supervision:

All PhD-candidates have a PhD supervisor (allotted 0.05 fte) and a daily supervisor (allotted .1 fte) for supervision. They also have a Supervisory Commission containing a minimum of three external members, all of whom have received a PhD and are knowledgeable in the candidate's field of research. At the end of the first year, the Commission evaluates progress and quality and advises the cluster coordinator on continuation of the project. In the following years it can advise the PhD-candidate about the research being done.

Training:

PhD-candidates also have an Education and Supervision Plan. Over the course of the 4-year appointment, 1200 hours (150 days) are for education and training. All internal candidates are members of the ICO Research School and are required to fulfil all ICO requirements, including participation in specific courses, master classes, and a yearly community event which alternates between a 2-day national session in odd years and a 5-day European event in even years. Beyond this, internal candidates follow internal courses on Scientific Writing in English and Scientific Presenting in English. They also take part in the internal OUNL-wide programme for obtaining a Basic Qualification in Teaching (BKO) to prepare them for an academic future at a university once they have completed their PhD. Finally, all internal candidates spend 20% of their time working outside of their research on professional activities. For LS, this is primarily as tutor and/or course designer in the Master programme.

Community:

PhD-candidates also have their own community. Upon being appointed, each internal candidate is assigned a *big sister* or *big brother* to help become acclimatised to CELSTEC. Further, PhD-candidates meet approximately once a month in their own PubGroup (Publications Group) to discuss each other's work and profit from each other's knowledge and experience. Finally, the OUNL has a graduate school in which all PhD-candidates (internal and external) are members.

PhD Publications and Process

All work is reported in international journals, primarily those registered in the Thomson Reuters (was SSCI) preferably with an IF > 1, although journals accepted by the ICO research school are acceptable but not preferred. In addition, PhD-candidates attend national and international conferences, presenting at one conference per year, excluding local and national conferences and meetings. Important conferences for LS field are the Educational Research Days (Onderwijs Research Dagen – ORD) held in the Netherlands or Belgium, the EARLI (European Association of Research on Learning and Instruction) Conference and the AERA (American Educational Research Association) Conference. Finally, PhD-candidates are also urged to publish (as spin-off) in professional journals or present to non-scientific audiences. This helps CELSTEC fulfil its valorisation duties.

11. SWOT-analysis

Strengths

- *International visibility and reputation.* In previous midterm (2003, 2009) and official (2007) evaluations the LS cluster and its researchers were praised for having achieved an excellent international reputation. In this review this has been maintained. International visibility and reputation is growing as can be seen by increasing board memberships in international scientific organisations, editorships of leading scientific journals, and invitations for keynotes at national and international conferences as well as presentations for the general public. This also immediately reflects the national and social visibility.
- *Academic output.* The cluster's output is high (see table B.3). Besides quantity, quality as expressed by impact factor has also increased. In 2005, an average impact factor of 1.0 was reached for the first time. In 2006-2011, an average impact factor

of 1.711 (see section B.5) was realised which is well above the average of the fields in which it publishes. Finally, LS researchers average 3.3 academic publications per FTE (including PhD-candidates), well above the national average.
- *Efficiency.* The LS cluster was realigned to better exploit the expertise of the senior staff (see section B.1). Strong links and collaborations exist within the cluster as seen in joint grant applications and projects.
- *PhD Guidance.* The LS cluster is strong in guiding PhD-candidates (quality and quantity; see B. 10) which is reflected in the 100% success rate of candidates and the low average time span to thesis completion (73.3% within the nominal 4 years and 26.7% within 5[13] with 0 dropouts, well below the national average[14]).
- *No Glass Ceiling.* The cluster has a high number of female researchers in important positions. Each expertise area is headed by a woman, 3 of whom have the rank of professor, 1 of associate professor and 1 lector.

Weaknesses

- *Financing.* The cluster is to a large extent dependent on internal funding; external funding must increase. Attempts to acquire funding should be directed at different funding agencies, such as NWO, the new National Initiative for Education Research (Nationaal Regieorgaan Onderwijsonderzoek; NRO), EC et cetera. Also, contract research must be explored and exploited. From 2007 on, the OUNL receives a premium for completed PhD projects, which equalised the playing field with the other Dutch universities. This allowed for establishing a fund for matching external projects that are partially funded (i.e., increased sustainability).
- *International collaboration.* For international research collaboration, the cluster strongly relies on contacts of specific staff members. This needs to be broadened and institutionalised through expert networks. Steps have to be taken to strengthen, broaden and link these networks so that all staff members are included.

Opportunities

- *Public funding.* An important task of the OUNL is "contributing to the innovation of Dutch higher education". Based on the available expertise, LS can contribute to the urgent need of improving and innovating Dutch education, as seen in the newly established NRO which is responsible for prioritising research topics and funding research projects. In this way the cluster can contribute to narrowing the gap between scientific educational research and educational practice. This has been strengthened through the expansion of the cluster to include *Brain & Learning*, which is a new and increasingly important research area.
- *Commercial funding.* New opportunities are cropping up due to technological advancements. For example, educational publishers, software developers and web designers struggle with establishing new learning materials and guidelines for them for evolving markets and business models to enable them to meet the changing needs of teachers and schools. Collaborations between businesses and researchers can achieve synergistic benefits: businesses gain access to state-of-the-art expertise which is both insightful and positive for branding; researchers gain access to state-of-practice dilemmas, which helps them understand and pursue relevant and meaningful lines of inquiry and the provision of blended (workplace) learning models.
- *Horizon 2020* and developments in the assigned *Top Industry Sectors* in the Netherlands provide opportunities for research and valorisation.

Threats

- *Academic attrition.* Due to stagnating funds for the scientific staff, several non-tenured positions academics could not be continued. The composition of the cluster, thus, is characterised by a relatively large number of full professors and PhD students and few associate and assistant professors. It is necessary to restore balance by implementing a HRM-strategy that provides junior staff the time to ripen, become competent in supervising PhD-projects, acquire external funds, and build reputation leading to tenured positions.

[13] This includes PhD-candidates for whom the nominal time was 5 years as they chose for a 5-year, 0.8 fte position.
[14] According to the ICO audit of 2006 for their reinstatement as research school, the national averages for the educational sciences were: 8.5% within 4 years, 41.5% within 5 years, 12.3% within 6 years, 6.6% within 7 years and 31.1% dropout.

Conclusions

	Strengths	Weaknesses
Opportunities	*Which opportunities can be exploited through the strengths of the institute?* The LS-TEL cooperation is unique for addressing challenges in the higher education and training market (e.g., health, public administration, logistics). The LS-cluster has shown itself to be leading in the field and can expand upon this to become an example of a truly technology enhanced learning sciences group.	*Which opportunities help overcome weaknesses?* Co-operation and alliances with different national/international higher education institutions and industry sectors with LS as expert partner in educational design/consulting and assessment is promising. Specific areas are tools/methods: • to support part-time and blended learning; • for enhancing quality policy for educational institutes.
Threats	*How can the institute use its strengths to reduce its vulnerabilities?* The close cooperation between LS and TEL offers a unique transdisciplinary possibility for research, development and valorisation as well as partnering with others in the public and private sectors. This opens doors to developing and exploiting new turn-key products, carrying out state-of-the-art research and acquisition of funds at the national, European and international levels.	*To which threats is the institute particularly vulnerable and how can they be overcome?* Unpredictable government policy on core funding is the major threat. This can be overcome by aligning LS-research with societal challenges and thus linking all activities to CELSTEC expertise areas. This, in turn, will make the unique combination of educational and technology expertise more visible.

12. Strategy

The CELSTEC LS-cluster will work on the following main strategic objectives:

- *Developing close cooperation with researchers within the OUNL faculty of Psychology & Educational Sciences (P&ES)* and ultimately with all three OUNL faculties. The new OUNL strategic research fund supports collaboration between researchers from different faculties aiding the initiation of state-of-the-art research and providing opportunities to collaborate and explore new multidisciplinary research challenges. This goes hand-in-hand with research and expected products in the CELSTEC expertise areas (Learning Objectives & Assessment, Learning Arrangements, Learning Environments, Digital Literacy and Managing Educational Excellence).
- *Aligning research activities and societal challenges:* All LS research projects will contribute to the main objectives elucidated in the Performance Criteria defined by the OUNL board. In this way, all research activities will be linked to the five defined expertise areas (i.e., Learning Objectives & Assessment, Learning Arrangements, Learning Environments, Digital Literacy and Managing Educational Excellence). These areas of expertise are also directly linked to the CELSTEC product portfolio, piloting activities in the CELSTEC and OUNL Learning Media Labs, and research projects.
- *Developing scientifically robust designs and design competences.* LS will broaden its ken from research *focused on* design to include research conducted *through design*. Through this: (1) research capacity will be increased by embedding robust studies into live design/development initiatives; (2) innovative capacity will be increased when stimulated and supported to shape designs that are socially relevant; (3) viability will increase as researchers engage in on-the-ground initiatives and develop sensitisation to practical and political climates, helping them to develop funding proposals and cooperative networks that are linked to societal demand.

Part C – Cluster Technology Enhanced Learning (TEL)

1. Objective(s) and Research Area

The mission of the Technology Enhanced Learning (TEL) cluster is to research and develop innovative, challenging and pervasive ways of learning and teaching that exploit the opportunities of emerging digital media. The cluster concentrates on:

1. *Immersive Media* (Goal: To research methods and technologies for challenging, adaptive and responsive learning environments based on gaming concepts and immersive media)
2. *Mobile Media* (Goal: To research methods and technologies to use mobile and ubiquitous technology for learning support. To research effects of these methods and technologies in ubiquitous content access, learning in context, and seamless learning support)
3. *Networked Learning* (Goal: To research methods and technologies for professional, informal learning in networked settings and social media)

TEL research covers the whole research cycle from user requirements analysis, to theoretical grounding of research in pedagogical and cognitive sciences, to engineering TEL artefacts, and evaluating them in educational settings. *The main focus of the research programme is in engineering, embedding, and evaluating technology for enhanced learning support*. The output of the cluster is focused on top journals and conferences in the field of Computer Science, Education, and New Media and open source software and media products.

From 2006-2011, TEL research was supported by European and International research funds ranging from Networks of Excellence in TEL (ProLearn, STELLAR, GALA), Integrated Projects (TENCompetence), and focused research grants. The grants focus on developing specific technologies (GRAPPLE, LTfLL, idSpace) and in many cases directly link to specific stakeholder requirements and industry sectors (MACE, ShareTec, OpenScout, iCoper) to amplify innovation. The close cooperation in these projects with industry sectors and stakeholder groups (logistics, health, culture) is essential for societal relevance and impact of the TEL research output. The cluster integrates a mix of computer scientists, educational scientists, cognitive scientists, and implementation and facility support staff. The research cluster links to the OUNL open innovation policy, which is implemented in the Learning Media Lab. The technology artefacts conceptualized and developed are further developed and up scaled into pilots with external and internal partners, and further matured into products and services offered by CELSTEC and the OUNL. For a description of the linkage of research, piloting, and product development see (Electronic) Appendix *CELSTEC Labs White Paper 2011.* Established products and pilots also frame a context for further research into more effective, efficient, usable and acceptable technologies for enhanced learning/teaching.

2. Composition

Table C.1 Research staff at programme level

	2006	2007	2008	2009	2010	2011
Tenured staff*	9.60	8.76	8.28	7.28	7.60	8.00
Non-tenured staff*	.90	.00	1.98	6.48	5.31	6.21
PhD-students**	3.50	5.60	5.46	3.92	3.92	6.02
Total staff	**14.00**	**14.36**	**15.72**	**17.68**	**16.83**	**20.23**

* Research component

** Direct funding by the university or research grants; research component is 70% fte PhD-candidate

Table C.2 Funding at programme level

	2006	2007	2008	2009	2010	2011
Funding:						
Direct funding[1]	1,378,000/60%	1,173,000/53%	1,195,000/46%	1,099,000/33%	1,422,000/54%	1,284,000/63%
Research grants[2]	837,773/36%	948,807/43%	1,396,619/53**%**	1,931,764/58**%**	900,559/35%	646,557/32%
Contract research[3]	81,149/4%	96,230/4%	26,562/1%	323,978/9%	273,062/11%	93,571/5%
Total funding	**2,296,922**	**2,218,037**	**2,618,181**	**3,354,742**	**2,595,621**	**2,024,128**
Expenditures:						
Personnel costs	2,205,045/96%	2,129,316/96%	2,487,272/95%	3,187,005/95%	2,439,884/94%	1,902,680/94%
Other costs	91,877/4%	88,721/4%	130,909/5%	167,737/5%	155,737/6%	121,448/6%
Total expenditure	**2,296,922**	**2,218,037**	**2,618,181**	**3,354,742**	**2,595,621**	**2,024,128**

[1]: Direct university funding

[2]: Research grants from national and international scientific competition (e.g. NWO, KNAW, ERC) and European Commission

[3]: Research contracts for research projects from external organisations (e.g., industry, governmental ministries, charities)

For a complete overview of all research staff members, see (Electronic) Appendix *Staffing CELSTEC 2006-2011*.

3. Research Environment and Embedding

The TEL cluster is interdisciplinary with a focus on using ICT for learning, teaching, assessment and educational management. The research is grounded in educational sciences, computer science, and cognitive sciences.

The TEL cluster contributes to and follows the quality criteria of the national research school SIKS as a KNAW accredited research school using international reference indices as Thomson Reuters (ISI/SSCI) Impact Factors, DBLP indexed research journals, conference proceedings and workshops.

On a national level the TEL research cluster forms a unique focus on the multidisciplinary research combining expertise and researchers from educational, cognitive, and computer sciences. On a European level several research evaluation and road-mapping projects have analysed European TEL research. TELMAP evaluates CELSTEC and its research as one of the top two players in Europe (Derntl, 2011). An analysis of co-authorship from 2006-2011 of the European Conference on Technology Enhanced Learning has identified Prof. Rob Koper and Prof. Marcus Specht as two of the most influential authors in the conference series[15].

Based on national and international research grants co-operations exist with the top-universities on a national level (TU Eindhoven, TU Delft, Twente University) as also on a European level. For a complete overview of all collaboration, see (Electronic) Appendix *Overview of National and International collaboration*.

National and International Collaboration

Noteworthy examples of national and international collaboration are:

- SURF and SURFNet, ranging from the joint organisation of Workshops, Spring School on Mobile Learning and others to participation in EU funded projects (TENCompetence). Research staff from CELSTEC is an active member of several SURF SIGs (e.g., Unwired, Learning Analytics, Open Educational Resources). Furthermore CELSTEC has been a leading partner with the development of research programmes as the international e-framework or the framework for service-oriented architectures in Higher Education
- Digital University of the Netherlands in which CELSTEC was a founding partner and had the highest involvement of all partners. Several results have been transferred into higher education practices.
- TU Eindhoven the department of Computer Science is a close cooperation partner in European projects and national initiatives on personalized learning support
- Utrecht University, Radboud University, and the HZ University of Applied Sciences have been active partners in the serious gaming development around EMERGO.
- Fontys University of Applied Sciences was a close cooperation partner in Lectorships and supervision of Master and PhD-candidates, as well is in projects for networked learning.
- Knowledge Media Institute of the Open University is a close partner in international research projects.
- KU Leuven is a close cooperation partner including the organisation of meetings and workshops as wll as active cooperation in EU Research projects and national consortia
- The Institute for Educational Cybernetics at the University of Bolton (UK) is a close cooperation partner for developing new technologies and joint research projects with JISC/SURF or based on EU grants
- RWTH Aachen is a close cooperation partner with Computer Science I9, Institute for Media- and Communication Science (ISK), and the Center for innovative Learning Technologies (CiL).
- Glasgow Caledonian University has been a close partner in staff exchange and joint research and publications.

Finally, senior researchers have been appointed as Lector at a number of Universities of Applied Science strengthening CELSTEC's relation to this part of higher education in the Netherlands. These include:

- Dr. Hans Hummel: Lector Workplace Learning (Werkplekleren) at the NHL University of Applied Science
- Prof. dr. Peter Sloep: Lector Educational Functions of ICT (Educatieve Functies van ICT) at Fontys University of Applied Science Teacher's College in Sittard
- Dr. Jan van Bruggen: Lector Educational Functions of ICT (Educatieve Functies van ICT) at Fontys University of Applied Science Teacher's College in Sittard

[15] Reinhardt, W., Meier, C., Drachsler, H., & Sloep, P. B. (2011). Analyzing 5 years of EC-TEL proceedings. In C. D. Kloos, D. Gillet, R. M. C. García, F. Wild, & M. Wolpers (Eds.), *Towards ubiquitous learning. Proceedings of the 6th European Conference on Technology Enhanced Learning* (pp. 531-536). Berlin/Heidelberg: Springer.

4. Quality and Scientific Relevance

Significant Results/Highlights Relevant to Technology Enhanced Learning

The TEL cluster follows a strict open source and open innovation policy. Results of innovation projects and research prototypes are available via open source licence via the internally maintained DSpace repository as also the software versioning systems. The main categories of results are software prototypes and products, media productions, content packages, as also instructional designs, which have all been published via dspace.ou.nl. An overview of software components developed in this context is given in Electronic Appendix *CELSTEC Software 2006-2011.*

CELSTEC has led the development of the IMS-LD specification, based on its previous research on the Educational Modelling Language (EML). Many international activities have been the consequence of this activity in the period 2006-2011. For instance, the building of a repository of reference designs and IMS-LD packages in 2006 and various new tools and methods to support IMS-LD or to renew the specification in European projects. In 2007 the focus was on positioning and navigation services related to the TENCompetence software. In 2008 the EMERGO gaming toolkit was released and several competence management and metadata services were developed. In 2009, a Learning Path Specification was released in a first version, positioning and navigation services have been updated, and the EMERGO toolkit has been extended with an authoring component. Furthermore based on these specifications new IMS-LD packages and new reference content packages have been released integrating competence related features and personalised and adaptive designs (MACE, GRAPPLE projects). In 2010 the development for a new innovation platform for CELSTEC has been started, based on the TENCompetence project knowledge and technologies and implemented within the OUNL as the innovation platform of the OUNL (see A-part).

Key Publications TEL[16] (references; full text as appendix and on secluded website)

- **Rosmalen van, P.**, Sloep, P., **Brouns, F.**, Kester, L., Koné, M., & **Koper, R.** (2006). Knowledge matchmaking in Learning Networks: Alleviating the tutor load by mutually connecting learning network users. *British Journal of Educational Technology, 37*, 881-895. [IF: 0.406] [38 Citations]
- Burgos, D., Tattersall, C., & **Koper, R.** (2007). Re-purposing existing generic games and simulations for e-learning. *Computers in Human Behavior, 23*, 2656-2667. [IF: 1.344] [57 Citations]
- **Drachsler, H.**, **Hummel, H. G.**, & **Koper, R.** (2008). Personal recommender systems for learners in lifelong learning networks: the requirements, techniques and model. *International Journal of Learning Technology, 3*, 404-423. [IF: n.a.] [110 Citations]
- **Rusman, E.**, **Bruggen van J.**, Córvers, R., **Sloep, P. B.**, & **Koper, R.** (2009). From pattern to practice: evaluation of a design pattern fostering trust in Virtual teams. *Computers in Human Behavior, 25*, 1010-1019. [IF: 1.677] [32 Citations]
- **Rusman, E.**, **Bruggen van, J.**, **Sloep, P. B.**, & **Koper, R.** (2010). Fostering trust in virtual project teams: Towards a design framework grounded in a TrustWorthiness ANtecedents (TWAN) schema. *International Journal of Human-Computer Studies, 68*, 834-850. [IF: 1.600] [21 Citations]
- **Specht, M.**, Ternier, S., & **Greller, W.** (2011). Dimensions of mobile augmented reality for learning: A first inventory. *Journal of The Research Center For Educational Technology, 7*(1), 117-127. [IF: n.a.] [13 Citations]

Most Important Books or Chapters of Books

- Dillenbourg, P., & **Specht, M.** (2008). *Times of convergence: Technologies across learning contexts. Proceedings of the 3rd European Conference on Technology Enhanced Learning, September 16-19, Maastricht, The Netherlands*. Lecture Notes in Computer Science, Vol. 5192 Berlin: Springer.
- **Koper, R.** (Ed.). (2009). *Learning network services for professional development*. Berlin, Germany: Springer-Verlag.
- **Koper, R.,** & **Specht, M**. (2008). Ten-competence: Life-long competence development and learning. In M-A. Cicilia (Ed.), *Competencies in organizational e-learning: concepts and tools* (pp. 234-252). Hershey, PA: IGI-Global.
- **Specht, M.** (2008). Designing contextualized learning. In H. H. Adelsberger, Kinshuk, J. M. Pawlowski & D. Sampson (Eds.), *Handbook on information technologies for education and training, 2nd ed.* (pp. 101-111). Berlin: Springer.
- **Westera, W.** (2008). Web 2.0 in Dutch Higher Education. In J. Armstrong & T. Franklin (Eds.), *A Review of Current and Developing International Practice in the Use of Social Networking (Web 2.0) in Higher Education* (pp. 61-71). Bristol, UK: Clex.

[16] We have chosen to include past members (including PhD-candidates). Present members of the cluster are **bold**, past and PhD are underlined. We have chosen not to include publications where all authors have gone to other institutions, though they had a higher impact factor!

5. Output

Number of Publications

The output of the TEL cluster is at a stable high level. In the period 2006-2011 the TEL-cluster had an input of 98.82 fte research capacity and delivered an output of 425 scientific publications (51 articles in journals with impact factor (previously SSCI/ISI journals, now Thomson Reuters), 21 in ICO accepted journals, 45 in other refereed journals, 114 books and book chapters, 9 theses, and 185 SIKS-accepted conference papers). The average impact factor of the 51 scientific publications for which there is an impact factor is 0.929. This impact factor must be seen in light of the 'norms' of the domain; for Media and Communication 0.69, Computer Sciences 0.63, en Educational Sciences 0.59. The (Electronic) Appendix 4b *Scientific Output Technology Enhanced Learning Cluster* contains a complete overview of scientific output.

Table C.3 Main categories of research output of the Technology Enhanced Learning cluster (corresponds with Table 5.3 in the SEP[17])

	2006	**2007**	**2008**	**2009**	**2010**	**2011**
Refereed articles	11	22	25	19	17	23
Non-refereed articles[1]						
Books	2	3	6	9	2	4
Book chapters	2	9	14	36	2	25
PhD-theses			2	4	1	2
Scientific conference papers	33	39	19	40	33	21
Professional publications[2]	3	2	4	1	21	7
Publications aimed at the general public[3]						
Other research output[4]	153	151	146	219	169	128
- Awards			*1*	*1*	*2*	*1*
- Inaugural addresses			*1*	*1*		
- Contributions to conferences and congresses	*59*	*53*	*65*	*112*	*100*	*103*
- (Technical) Reports	*79*	*84*	*54*	*79*	*62*	*16*
- Software	*15*	*14*	*25*	*26*	*5*	*6*
- Rest						*2*
Total publications	**204**	**226**	**216**	**328**	**245**	**210**

[1] Articles in journals that are non-refereed, yet deemed important for the field
[2] Publications aimed at professionals in the public and private sector, including patents
[3] Also called "popularised articles" including blogs. The blogs are aggregated at http://portal.ou.nl/web/leren
[4] Other types of research output (e.g., abstracts, editorships, inaugural lectures, designs and prototypes, media appearances

Number of PhDs (completed and in progress)

Table C.4 Standard PhD-Candidates (corresponds with Table 5.5 in the SEP)

Enrolment				Success rates					
Starting year	Enrolment (M / F)		Total (M+F)	Graduated after 4 years	Graduated after 5 years	Graduated after 6 years	Graduated after 7 years	Not yet finished	Discon-tinued
2002									
2003									
2004									
2005									
2006	6	1	7	3/42.85%		1/14.3%			3/42.85%
2007	2		2					1/50%	1/50%
Total	**8**	**1**	**9**	**3/33.33%**		**1/11.11%**		**1/11.11%**	**4/44.44%**

[17] In this table and in the analogous table for the LS cluster the output is based upon the primary author. Note that some output is a joint effort between the two clusters.

6. Earning Capacity

In the period between 2006 and 2011 the TEL cluster had an average of 50% direct funding, 44% research grants, and 6% contract research. At the start of the period, the focus of the TEL programme was on European and National research grants. In that time period, one major *Integrated Project TENCompetence* was coordinated by the TEL cluster with the largest research grant in the OUNL's history (total budget € 13,876,185 for the whole consortium; OUNL grant € 8,796,021). Furthermore the cluster acquired and successfully completed 27 focused research projects with an overall budget of € 6,662,079 for the OUNL. Along with international research grants the TEL cluster actively cooperated with different industry partners. The projects can be found in Electronic Appendix *External European and National Funding.*

7. Academic Reputation

In the time period 2006-2011 the leaders of the different research programmes of the TEL cluster have been programme chairs of the leading conferences in TEL research. In 2006 Rob Koper has been the programme chair of the ICALT 2006 Conference, which has been hosted and co-organised in Kerkrade. 2008 and 2009 Marcus Specht has been programme chair and general chair of the EC-TEL conferences, in 2008 EC-TEL has been organised in Maastricht. Peter Sloep was programme chair of the first CSERC conference 2011 organised in Heerlen. On a variety of national and international conferences the scientific staff of the TEL cluster has been invited to give keynotes (EDEN 2006, IMS-Summit 2006, SURF 2007, EDU-Media 2008, ICDE 2009, UNESCO 2009, DELFI 2009, OpenED 2010, Mobile Learning 2011).

- In 2010 Prof. dr Peter Sloep was appointed honorary professor of the Glasgow Caledonian University.
- In 2011 Prof. dr. Marcus Specht was invited as visiting scholar to the H-STAR research centre at Stanford University.
- In 2011 Dr. Adriana Berlanga was awarded the title of National Researcher by the Mexican Council for Science and Technology.

The TEL cluster has received several best paper awards and prizes in the time period 2006-2011 including the Comenius Seal of Approval for the EMERGO software, and a best paper and poster awards at the ICALT 2009 and ICCE2010 conferences.

8. Societal Relevance: Quality, Impact and Valorisation

The TEL programme combines expertise from different areas of media technologies relevant for supporting learning and educational processes. The research in the TEL cluster has always been related and structured according to generic problems in the field of competence development and the role of media. The TEL-cluster works in close cooperation with different stakeholder groups (teachers, learners, managers, educational service providers). To this end, different facilities and educational contexts have been realised and used for designing and evaluating research prototypes and innovation activities with the different stakeholder groups in the Learning Media Lab. The societal relevance and impact of the research has been demonstrated on several levels. First, the TEL research has contributed to international standards and their implementation in educational settings:

- Learning Path Specification (2008) for the lean definition of learning paths and linking of learning activities. This has been picked up by several national and international consortia. This builds on earlier standardization activities of CELSTEC as the definition of IMS-LD (2003)
- Example IMS-LD packages, CELSTEC has supported and developed reference implementations of IMS-LD Units of Learning on adaptive learning scripts
- OAI-PMH and meta-data harvesting protocols have been developed in several projects and are reused in a broad range of implementations. CELSTEC has contributed to the further development of these protocols
- CELSTEC has contributed to the development of the higher educational quality assurance framework in the E-xellence project.

Second, several developments of its research have been adopted by stakeholder groups and organisations either independently or in valorisation projects and contract research, these include:

- The CopperCore 3.1 IMS-LD runtime engine has been downloaded 13.423 times in the time period relevant for this visitation, the detailed and ongoing analytics are available on Sourceforge[18].
- The MACE competence metadata framework is integrated in the MACE Association which delivers services to educational institutions in the field of Architecture and Construction Engineering and integrates more than 20 online archives and repositories in the field of architecture and construction engineering.

[18] http://sourceforge.net/projects/coppercore/

- The EMERGO toolkit has been used in more than 30 cases of implementation and contract research since 2007 addressing over 7000 students with 100,000 study hours with 450 downloads[19].
- The ARLearn mixed reality framework has been used by UNHCR to develop hostage simulations and deploy them in worldwide seminars since 2011.
- The ReCourse Learning Design Editor 2.0 developed in the context of the TENCompetence project.
- The TENCompetence framework was the basis for the development of the OpenU software now at the core of the new approach for learning at the OUNL.
- OpenU: the new innovation platform for the OUNL has been developed since 2010 based on learning networks research in the TENCompetence project and focussing on Open Educational Resources (MOOCs), Personal Learning, Learning Management and Social Learning.

9. Viability

In the period 2006-2011, due to organisational changes, several developments occurred in the TEL cluster. In the 2005 audit, the cluster consisted of themes within the *Technology Development programme* and was led by Prof. dr. Koper. Besides the *Technology Development Research Programme*, an *Implementation programme* existed, led by Prof. dr. Westera. In 2007 Prof. Koper became dean of CELSTEC and the lead of the Learning Networks programme was taken over by Prof. dr. Sloep. In 2008 a new TEL research programme *Learning Media* was started under the lead of Prof. dr. Westera and Marcus Specht became Full Professor and Director of the *Learning Media Laboratory*. The Laboratory was setup as a facility for research collaboration, technology development and valorisation following an open innovation approach and integrating across the LS and TEL clusters. From 2009 to 2011 a variety of innovation workshops and research transfer activities have been organised and implemented in the Lab (see Section 'Innovative Capacity'). From 2010, the TEL cluster continued successful acquisition of international and national research grants and successful activities in the area of Mobile Media led to a split of the *Learning Media programme* to an *Immersive Media programme* (Prof. dr. Wim Westera) and a Mobile Media programme Prof. dr. Specht). Thus, at the end of 2011 the TEL-cluster contained three programmes, each responsible for one of the selected TEL themes: immersive media, networked learning and mobile media.

Resource Management

The TEL cluster is managed by the three professors who are leading the programmes: networked learning, immersive media and mobile media. Staffing of personnel is centrally managed and allocated via the HR manager and the MT of CELSTEC. The staffing allocates a fixed number of FTE's to direct research and the cluster management adopts the staffing to specialised expertise and to additional funding acquired via research grants and contract research.

Innovative Capacity

The TEL cluster has actively designed and implemented the CELSTEC Learning Media Lab structure and facilities. Following an open innovation policy, workshops have been run with faculty members of the OUNL as also with national and international cooperation partners. For the Lab, four main educational settings have been worked out and educational scenarios have been designed and used in the workshops in the Lab. In 2009 and 2010 several international guests and visitors have been participating in workshops including:

- *Academic Partners*: Hogeschool Zuyd, Universität Duisburg-Essen, Universität Salzburg, Universiteit Maastricht, RWTH Aachen University
- *Ministry and Public Organisations*: TELEAC, Directeur Generaal Higher Education (OCW), Members of Parliament of the Netherlands
- *Industrial Partners*: Philips Research, TGP, Océ, Avacast/Ericcsson, InBrain, Cyntelix
- *International Delegations*: Delegation Open University Japan, Delegation Ministry of Education Greece, Delegation Open University China, Delegation of the Open University

10. Next generation Technology Enhanced Learning Cluster

Most of the PhD projects in the Technology Enhanced Learning cluster are primarily funded from the second and third budget flow, in particular EU funding, mostly in the context of the EU's Framework Programmes. For PhD projects, this means that a detailed plan for the overall project is available, but it does not provide a separate description of PhD work beforehand. Therefore, a PhD student usually needs to develop a proposal first. This is done in close collaboration with the daily supervisor and, to a lesser extent, the PhD-supervisor. Ideally, the formulation of such a plan is completed after 6 months from the start; it then will be submitted for review to 2 to 3 external

[19] http://sourceforge.net/projects/emergo/

reviewers (see the description of the process in section 4.1). Their assessment may result in a rejection of the plan, although usually an adjustment according to their comments and suggestions suffices. Once the revised plan is in hand, it will be submitted to the relevant research school, usually SIKS.

Results from the PhD work are reported in research articles submitted to international, peer-reviewed journals for publication. The field of Advanced Learning Technologies or Technology Enhanced Learning as it is called in Europe is growing rapidly. To help scholars, especially PhD-candidates, to make adequate choices about the journals in which to publish, the TEL-cluster has published a list of journals which are the most important ones in the field in the context of the TENCompetence project. However, ultimately it is up to the supervisor, daily supervisor and candidate to decide on a suitable outlet. Impact of a journal is one of the considerations that enter such a decision, furthermore indexing in IEEE and ACM libraries is of relevance.

Conference publications are also an important outlet for the TEL-cluster. Suitable conferences are listed in the PhD guide. Again, the supervisor, daily supervisor and candidate should decide on a suitable conference. As a rule, a PhD-candidate should present at one research conference each year, excluding contributions to local and national conferences and meetings.

Along with its research, the TEL cluster emphasises valorisation as an important outlet. PhD students are invited to use their fifth day for contributing to the arrangement of the CELSTEC Learning Media Lab, which is an important carrier of valorisation.

11. SWOT-analysis

Strengths

- *High reputation in the education and innovation research sector*. The TEL-cluster is involved in national and international research projects. It contributes to international high reputation conferences and journals. The team consists of many internationally reputed scientists. Partners see the cluster as a high quality, highly reliable research partner.
- *Leading innovators for higher education.* TEL's unique combination of interdisciplinary competencies combined with strategic product development focus enables it to drive innovative developments.
- *Multidisciplinary background of research staff*. The TEL staff has a broad background in the educational and the technical field. This combination enables the cluster to perform high quality research involving innovative educational scenarios and leading edge technologies. In research projects the TEL cluster internally can form interdisciplinary teams bringing together expertise from computer science, educational science, cognitive science, and media and communication technologies.
- *Unique and scalable products*. The group is committed to the development of technologies with a clear impact focus in mind. These technologies are used in a cross-project manner maximising synergies. Technologies developed in this manner are used as basis for new products to evolve. At the same time, the cluster's strategic orientation allows it to perform product developments over a longer period of time, ensuring high product quality and scalability, while at the same time the research focus permits it to experiment with new technologies leading to innovative solutions.
- *Unique partner networ*k. TEL's high reputation enables it to maintain a network of relevant national and international partners. The partner network fosters exchange of ideas and topics as well as personnel mobility. Furthermore, the partner network allows TEL to include additional expertise in its research work (such as domain expertise). Furthermore, the group is experienced in working with all major national and international funding bodies.

Weaknesses

- *Lack of technical implementation capacity*: To support the full TEL research cycle typically researchers need to do a theoretical framing, conceptualization, design a technology artefact, and run empirical evaluations of the technology artefacts produced. Based on background of staff all the competences are not always found in one person but have to be supported and done in interdisciplinary teams. For most staff with an educational science background support from technology development is needed. This capacity is limited for research support in CELSTEC and the OUNL. Furthermore the maintenance and development of technology competences for the variety of rapidly changing technologies (Mobile, Gaming, Social Media, Content Engineering) used in TEL is a problem even with an active development support staff which is currently available in CELSTEC

Opportunities

- *Changes in national and international research agendas.* The broad TEL focus enables the cluster to react to changes in the research agenda related to funding streams.

- *The potential market to address is large.* The sector independent TEL focus enables work with partners from different fields (e.g., health, logistics, military, architecture) including a broad range of topics like digital competencies, learning skills and domain related topics.
- *Strategic alliances.* TEL's partner network keeps it in the loop with all relevant developments and trends. At the same time the good partner network allows forming alliances to address new topics/markets.
- *New OUNL business model.* As CELSTEC aims at innovating OUNL education, interesting opportunities can be found in the new educational model the OUNL is developing. The new model, with its emphasis on cohorts, might integrate mobile delivery, gaming and learning network aspects. As this new model will allow the design of more collaborative learning, it can also be worthwhile looking into the implementation of some products from recent PhD research.

Threats

- *Publication in multiple outlet fields.* As TEL research is multidisciplinary in nature also the publication outlets come from different fields. This also means that the publications must fulfil the quality criteria in different research fields ranging from educational science to computer science. In most cases there are different criteria for high impact journals in these different fields and the works that are done in TEL have to be conceptualized, implemented and evaluated with these different targets in mind. This leads to a situation where high quality criteria from the technology development perspective and technology innovation but also in the educational innovation have to be fulfilled
- *Economic crisis and management of key personnel*. The cluster's good network to external institutions also offers a lot of opportunities to internal staff. Time limited contracts lead to a situation where key personnel actively look for alternatives. Economic crisis may lead to a shift of external money streams away from research towards other priorities, lowering the budgets available. The on-going engagement and hiring of high quality personal with a multidisciplinary background is a highly challenging task and needs on-going investments in HR development strategies and a highly attractive working environments and conditions.

Conclusions

	Strengths	Weaknesses
Opportunities	*Which opportunities can be exploited through the strengths of the institute well?* The multi-disciplinary group and strong co-operation with the LS cluster is a unique opportunity for addressing the TEL market embedded in different industry (top) sectors. The current developments in different sectors as health, logistics, public administration, or architecture are exemplary for the high need of interdisciplinary expertise as it exists at CELSTEC.	*Which opportunities may help overcome weaknesses?* The opportunities for co-operation and strategic alliances with different industry sectors and the positioning of the expertise of CELSTEC as an expert partner in the educational consulting, technology design, and evaluation of technologies is a promising possibility. As most industry partners do their own technology development this suits the open innovation policy and can stimulate the implementation of innovative concepts in different industry sectors. This can lead to compensation of the internal lack of implementation capacity.
Threats	*How can the institute use its strengths to reduce its vulnerabilities?* The unique combination of the TEL and LS clusters and the existing knowledge of high quality publishing in different research areas is a strength which in combination with clear internal publishing guidelines and a strong quality management can help to overcome the high requirements. The central involvement of the TEL cluster in international Networks of Excellence aims at establishing interdisciplinary research communities. The management of key personnel is a serious threat, which can be overcome by an attractive and open work atmosphere as created in the Learning Media Lab and flexible workplaces, flexible career opportunities and the integration of high research quality with application domains.	*To which threats is the institute particularly vulnerable and how can they be overcome?* The TEL group actively structures its network and co-operations according to industry sectors and alternative funding sources. The systematic research, evaluation, and innovation of educational practice is increasingly integrated in daily life and work practices. The TEL group with its interdisciplinary background and methodological expertise aims to research technologies in laboratory contexts as well as in ecologically valid settings.

12. Strategy

The CELSTEC TEL-cluster will work on the following main strategic objectives:

- *Creation of an active research environment in an open innovation context*. By implementing an open innovation policy the cluster will both boost research quality and relevance. This targets also the thread of losing key staff. By further developing focus on the specified research topics. Excellence in the areas of Mobile Media, Social Media, and Immersive Media will be strengthened.
- *Alignment of research activities and societal challenges:* All TEL research projects will be aligned with the main objectives of the 'Prestatie Criteria' [Performance Criteria] as agreed with the Dutch ministry. This links all research activities to the five defined societal priorities of Learning Objectives and Assessment, Learning Arrangement, Learning Environments, Digital Literacy and Managing Educational Excellence.
- *Building integrated research and stakeholder communities* will be a core element of the strategy to create relevant impact of TEL research and new funding opportunities. This is implemented via several activities around the OpenU platform in which topic communities are created since 2010 linking research, education, and innovation activities in communities.

Abbreviations and Acronyms Used

AERA	American Educational Research Association
BKO	Basic Qualification for Education
CELSTEC	Centre for Learning Sciences and Technologies
COP	Center for Educational Productions
EARLI	European Association of Research on Learning and Instruction
EATEL	European Association for Technology Enhanced Learning
ICO	Interuniversity Center for Educational Research
IAML	International Association for Mobile Learning
IPO	University-wide-Education Programme
ISLS	International Society of the Learning Sciences
EARLI	European Association for Research on Learning and Instruction
FES	Funds for Strengthening the Economic Infrastructure
KNAW	Royal Netherlands Academy of Arts and Sciences
LS	Learning Sciences
NeLLL	Netherlands Laboratory for Lifelong Learning
NRO	National Initiative for Education Research
NWO	Netherlands Organisation for Scientific Research
OpenU	CELSTEC's own innovation platform
Otec	Educational Technology Expertise Center
OTIC	Educational Technology Innovation Center
OUNL	Open University of the Netherlands
SIG	Special Interest Group
SIKS	School for Information and Knowledge Systems
SSCI	Social Science Citation Index
SURF	Netherlands Foundation University Computing Centres
TEL	Technology Enhanced Learning
TELDA	Technology Enhanced Learning Doctoral School
VSNU	Vereniging van Samenwerkende Nederlandse Universiteiten
VOR	Netherlands Educational Research Association

Appendices

Printed and Electronic:

1 Staffing CELSTEC 2006-2011
2 Tenured Staff
3 CELSTEC Societal Relevance and Valorisation
4a Scientific Output Learning Sciences Cluster
4b Scientific Output Technology Enhanced Learning Cluster
5a Academic Reputation Learning Sciences Cluster
5b Academic Reputation Technology Enhanced Learning Cluster
6a Top Articles Learning Sciences Cluster
6b Top Articles Technology Enhanced Learning Cluster
7 Editorships, Awards, et cetera

Electronic

- Career Destinations of PhD-graduates
- CELSTEC Education and Supervision Plan for PhD-candidates
- CELSTEC Labs White Paper 2011
- CELSTEC PhD proposal
- CELSTEC referee review form
- CELSTEC Research Organisation
- CELSTEC Scientific Yearbooks 2006 through 2011
- CELSTEC Software 2006-2011
- EMERGO-games Brochure
- External European and National Funding
- Institutions and Publications in the Top 12 Journals during 2011 - Learning Sciences Researcher_Feb 2013
- Living Labs
- Midterm review Learning and Cognition programme
- Midterm review Learning Media programme
- Overview of National and International Collaboration
- OPO Brochure
- OU Yearbooks 2006 through 2011
- PhD Guide CELSTEC
- PhD Monitor CELSTEC
- Projects with partners 2006-2011
- Protocol OU CELSTEC Research Review
- SAITO Brochure
- Scientific Research Programme - Learning & Cognition
- Scientific Research Programme - Learning Media
- Scientific Research Programme - Learning Networks
- Technology Development White Paper