

Programme document

Learning Media Programme

Design, development, and use of networked learning media

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“Re-shaping the learning arena”

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CELSTEC – Centre for Learning Sciences and Technologies

Learning Media Programme

Design, development, and use of networked learning media

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Index

Management Summary	7
PART A. Programme Description.....	11
Preface	11
Introduction.....	11
Rationale.....	11
Non-instrumentalism as the Programme's core premise.....	13
Position of the Programme	15
General starting points	16
Programme requirements.....	18
Programme objective.....	18
Research, technology development and knowledge valorisation	18
External inputs	19
A priori considerations	20
Programme elaboration.....	22
Programme Themes	22
Theme 1: Immersive Media	24
Theme 2: Social Media.....	25
Theme 3: Mobile Media	27
Approach.....	30
Transversal co-ordination.....	30
Subsidiary disciplines, theories and methods	31
The CELSTEC Laboratory	33
The external environment	35
Relevant organisations.....	35
Urgent topics in society	37
Relevant Conferences and associations.....	39
Co-operation with internal and external parties.....	40
Organisation issues.....	43
Staff allocation	43
Programme organisation	44
Alignment within CELSTEC	45
Performance	46
Output targets.....	46
Quality assurance	48
Risk assessment The following risks are identified:.....	48
Start-up strategy.....	50
Relevance.....	51
References	52
PART B. Programme Management	57
Organisation details	57
Projects	58
Quality assurance	59
Consultation and review.....	59
Adjustments and mid-term review	59
Quality standards for research and development	59
PhD students policy.....	60
Internal reporting	61
R&O-talks	61
Knowledge sharing.....	61
Support structure of the CELSTEC laboratory	62
Cooperation	62
Awareness and information support	62
Media creation.....	63
Financial conditions.....	64
PART C. Appendix	65
Basic concepts: media and the learning arena	65
The learner's profile	65
Virtual environment.....	66
Pedagogy	66
Messages.....	66
Channels	67
Programme Boundaries.....	68
Appendix 1. Consultations.....	70

Management Summary

The Learning Media Programme is a new strategy programme within the Centre for Learning Sciences and Technologies (CELSTEC). This document provides the general framework for the activities that will be carried out under the authority of the Learning Media Programme. The Programme's goal is to establish innovative, challenging and pervasive ways of learning and teaching that exploit the opportunities of emerging digital media, media technologies and devices, which include wide band internet and mobile network technologies as well as user-generated content and a variety of new portable communication devices. It thus addresses the changing patterns of human functioning and communication as a result of these new media technologies and, more in general, the associated changing demands for learning and education in the knowledge society. The Learning Media Programme expresses the Open University's ambition to be a frontrunner in technology-enhanced learning, to enable rich media distance learning and to transform into an internet-based university, which core competence is electronic delivery of content and services to learners.

A basic assumption of the Programme is that human living and learning will be subject to progressing virtualisation, which allows and requires new modes of interaction, communication and knowledge creation accommodated with networked electronic media and devices. It will effect the seamless integration of learning, working and living and amplify non-formal learning (vocational training, courses, workplace learning) and informal learning (ad hoc learning at home or in public spaces, from relatives or friends, in daily life, without any legal foundation) supplementary to formal learning (arranged and accredited by the national authorities), in service of better employability, lifelong competence development and learner empowerment. The Programme conforms to contemporary views on learning and teaching that promote the empowerment and responsibility of learners to largely control their own learning. To this end, it will be necessary that the learning is highly personalised and specifically tuned to the learner's context and needs.

The Programme rests on the non-instrumentalist premise of substantivism which suggests that technology makes up an integral part of our lives and fundamentally alters the ways we perceive and experience the world and interpret it by attaching meaning to it. Consequently, learning, pedagogy and media cannot be treated independently, but mutually influence each other while enabling new ways of learning and teaching. This premise is reflected in the Programme's mission statement:

The Learning Media Programme is a key player in developmental research and valorisation of innovative, challenging and pervasive ways of learning and teaching that exploit the opportunities of emerging digital media, media technologies and devices, that anticipate current and future educational demands and needs, and create prototypical solutions for those.

The Programme will run for a period of 6 years. After 6 years the Programme will have established its reputation as leading research team in the domain of innovative learning media. This will be substantiated by the following results:

- a set of validated approaches, models and methods for innovative learning media and the associated working prototypes and services;
- scientific contributions with respect to learning media design, based on sound empirical evidence and theoretical foundations. This output will be in accordance with common qualitative and quantitative academic standards;
- the successful transfer and implementation of (a subset of) these findings in educational practice, inside the Open University as well as in external learning contexts;

- a solid network of people and partners representing the media research population, technology providers and societal parties that apply new media solutions for learning;
- a highly flexible and efficient media laboratory which acts as a media knowledge and innovation hub for the Open University and external parties.

The Learning Media Programme will cover research, development and knowledge valorisation. While R&D are primarily oriented at knowledge creation, valorisation is about exploiting the knowledge in service of practical application. When appropriate, R&D activities are positioned in a national research school (cf. SIKS) and conform to the associated quality requirements of staff, output and relevance. Valorisation comprises innovative services, which directly address urgent problems in society. On average 60% of the capacity will be assigned to valorisation, 40% of the capacity to R&D. By combining research, development and valorisation in the Programme, unwanted gaps in the knowledge value chain are avoided and synergy is amplified.

Because of its media nature, the Programme will adopt a content and communication perspective. The Programme addresses the meso-level and micro-level of the arrangement, the creation and delivery of learning content and the content-related transactions and communications between educational system components, learners, teachers and other actors. The Programme themes are 1) Immersive Media, 2) Social Media and 3) Mobile Media, which all hint strongly at rich media experiential learning and directly relate to the unmistakable trends of rich virtualisations of life, user-generated content as reinforced by web 2.0 approaches, and new portable devices serving user mobility and contextualised learning, respectively.

Theme 1: Immersive Media

This theme covers challenging, immersive and greatly involving environments, which mimic and mostly simplify real world complexity for learning purposes, or create absorbing non-existing realities for this. Immersive Media include virtual laboratories, virtual practicals, computational simulations, serious games and virtual worlds. They offer learners a safe and dedicated space for exploration, experimentation and practicing and they are known to be highly motivating and challenging because they place the learners in control, offer substantial freedom of movement and provide a lot of natural feedback. The co-ordinating research question of the Immersive Media theme reads: How can we improve the conditions for learning by incorporating rich, immersive media that simulate real world practices?

Theme 2: Social Media

This theme covers emerging modes of social media production, content sharing and content tagging according to Web-2.0 approaches. The abundant emergence of (free) web services allows users to combine various tools and resources into rich and personalised working and learning environments. So these new technologies enable learners to aggregate, monitor and combine information streams from various sources and use these for new ways of learning and reflection. This so-called web syndication and the associated mechanisms for tagging and annotation of digital content create new opportunities for expression of thoughts, communication and content handling and thus it procures radical changes in the ways individuals learn. Web-2.0 and the associated social software approaches put the user at the centre by fostering user-generated content and user-controlled activities. Accordingly, the social media environment of the future will enable learners to combine information, media and services in a new way for a rich, personalised and socially contextualised learning experience. The co-ordinating research question of the Social Media theme reads: How can we improve the conditions for learning by incorporating social media and rich media services for the exploitation of the collective expertise and creativity of learners?

Theme 3: Mobile Media

Handheld and mobile devices are a fast-growing market. Also, the devices combine various separate multimedia and networking functions: telephone, photo and video recording, playing music, PDA-services, uploading blogs, mobile tracking services. Mobile media are bound to pervade our daily lives; they are becoming a natural part of our social and physical environment and radically alter and extend human perception and human functioning. Many new devices like cell phones, laptops and PDA's have already become commodities and they open up a mixed reality by defining new representations of the world that extend the real life arena. Hence, physical reality and virtual life are getting more and more intertwined. The Programme aims to synchronise the new modes and extensions of learning that come within reach with the changing demands for personal and professional development. Mobile media for learning cover two fields of application: 1) the ubiquitous and cross media access to learning resources on the one hand, and 2) the contextualisation and personalisation of learning media on the other hand using context parameters as location, time, task, environment, or user information to adapt media for best learning support of the individual. Mobile media strongly support the intertwining of learning with daily life and work, and thus enable new opportunities for non-formal and informal learning, e.g. workplace learning. The co-ordinating research question of the Mobile Media theme reads: How can we improve the conditions for learning by incorporating ubiquitous, adaptive and contextualised mobile media?

The three Programme themes share many issues on both pedagogy and technology. These include adaptive learner support mechanisms which warrant effective and efficient learning, content portability standards which ensure cross media delivery and efficient search and retrieval options, and enabling technologies like GUI-design, 3D design tools and rich media authoring.

The programme will closely co-operate with the Open University faculties, the Ruud de Moor Centre, the IPO programme which addresses some implementation projects within the Open University, the OPEN Educational Resources project and other activities within the Open University that can be linked with learning media. Co-operation includes joint experiments, innovation and dissemination.

The launch of the Learning Media Programme is synchronised with the establishment of a media laboratory within CELSTEC: the CELSTEC Laboratory. It is part of the Learning Media Programme and will be managed accordingly. The CELSTEC Laboratory offers the technical infrastructure of dedicated media facilities for development, experimentation and demonstration of new media for learning. It will act as a knowledge hub and broker between parties and offers an open innovation workspace for joint projects and experiments with internal and external partners, for instance Open University faculties, research institutes, education providers, cultural institutions, technology and network providers and industry partners. The CELSTEC Laboratory thereby amplifies the networking role of the Open University, helps fund raising and stimulates innovations.

At the start in 2008 the Learning Media Programme will be run by 10 fte of CELSTEC staff. Half of this volume is covered by primary funding on behalf of the Open University; the other half is covered by external funding. The Programme assumes a percentage of 60% scientific staff versus 40% non-scientific staff, in particular technical staff. For the next years the Programme assumes to realise a stable annual growth of 15%, resulting in a redoubling of staff volume by year 6. This growth is necessary for lending the programme sufficient critical mass and robustness.

The Programme has projected ambitious, but feasible output targets which include external funding, scientific and professional papers, conference contributions, software prototypes, student internships, joint projects, workshops and services. Quality assurance of the Programme is pursued by a series of measures. These include consultation and external review of the Programme document, a mid-term self-evaluation

and mid-term review, internal project organisation, participation in accredited research schools (e.g. SIKS) and internal reporting within CELSTEC of progress.

During the first two years after the Programme's launch special measures are necessary to amplify the Programme's prosperous maturation. Priority will be given to establishing the CELSTEC Laboratory by arranging the infrastructure and by developing appropriate configurations, services and demonstrations. Also the Programme will build (inter)national R&D and valorisation networks. Soon after the start, network parties will be invited for a Programme launch symposium to be combined with the opening of the CELSTEC Laboratory. The invitation also holds for parties within the Open University. The Programme will undertake continued acquisition activities to warrant its continuity and envisioned growth. Finally, the Programme will develop workshops for each of the three themes and advertise these as its first valorisation offers.

In sum, the Learning Media Programme is the Open University's response to the promising developments and high expectations in new media technologies. Its added value is strongly associated with the systematic and structural effort to link new media technologies, tools and devices to innovation and improvement of learning. The Programme addresses societal learning needs that exceed the boundaries of the classroom. The sensible design of informal learning, work-place learning, contextualised learning and other modes of mediated learning is loaded with questions that need to be answered.

The Learning Media Programme thus makes available relevant knowledge and expertise both inside and outside the Open University and establishes the Institute's international reputation as an learning media frontrunner.

PART A. Programme Description

Preface

This document provides the general framework for the activities that will be carried out under the authority of the Learning Media Programme. Part A covers the general description of the Programme, part B deals with programme management and organisational issues and part C provides background information and elaborations.

An early draft version of the document has been made available for all CELSTEC staff and for other Open University departments, whose input and comments have been taken into account. A complete draft version of the programme document has been assessed by an external review committee with respect to its overall quality, appropriateness and feasibility. Members of the review committee are:

- Prof. dr. Matthias Jarke (RWTH Aachen, chair in informatics)
- Prof. dr. Jaap van den Herik (Tilburg University, chair in artificial intelligence)
- Prof. dr. Martin Weller (Open University, UK, chair in e-learning)
- Jérôme Verhagen/Jan Donders (Industriebank LIOF)

The reviewers were asked to deliver a brief, written report before September 1st, 2008. On September 16, 2008 the review committee met in Heerlen to speak with the Dean of CELSTEC, the Programme Director and the Theme Leaders of this new programme. In general, the comments of the review committee were quite positive: "a promising, exciting and ambitious new programme that will be of great benefit for the Open University". Also various suggestions for improvement were given; these are all addressed in this final version of the programme document.

Introduction

Anticipating the progressing virtualisation of learning by new media technologies, the Open University of the Netherlands launches its new Learning Media Programme, which will explore, develop, assess and valorise new concepts, tools, methods and practices of media-enhanced learning. Over the years, the Open University has built quite some expertise and reputation in mediated learning, which cover instructional television, computer-assisted learning, interactive video and virtual learning environments. The enormous expansion of new digital media and the associated great new opportunities for improving the conditions for learning are important motives for the Open University to combine and amplify its media efforts in a new Programme.

The Programme will be embedded within the Centre for Learning Sciences and Technologies (CELSTEC) of the Open University (the former Educational Technology Expertise Centre – Otec, which has adopted a new name by October 2008). The Learning Media Programme will start by September 2008, and like the other programmes within CELSTEC, it will run for a regular period of 6 years.

Rationale

The key motivation behind the Learning Media Programme is the increasing importance of knowledge in our society, both from a cultural point of view and an economical point of view. The knowledge society requires a higher level of education of the population as well as a continuous updating and upgrading of its knowledge and competencies. Intensified and flexible opportunities for learning will effect better employability, will improve the

innovation power in organisations, and it will stimulate social coherence and vital democracy through social inclusion and active citizenship.

Also, new attitudes towards learning (or information gathering altogether) emphasise self-regulation, personalisation, networked co-operation and critical thinking, which are easily linked with new media. This especially holds for new generations of learners, the so-called digital natives, who have grown up immersed in new communication technologies (Prensky, 2006). These new learners tend to use a variety of media (often in parallel) and are highly accommodated to individualised content, immediate responses and rich visualisations.

Challenging new opportunities for learning emerge through the ever-growing flow of new digital media, devices and technologies. These include wide band internet and mobile network technologies as well as a variety of new communication devices, new forms of interaction and visualisations of huge distributed or dynamically generated information spaces. Topical digital media are networked, smart, portable and personal (cf. Horizon Report, 2008). Today, digital media tend to remove the barriers of distance and time and enable individuals to take part in any event on earth (or even beyond) and to access vast resources of information and recorded events from the past.

But the true impact of digital media goes beyond the substitutive forms of communication and retrieval. Digital media are bound to pervade our daily lives and are becoming a natural part of our social and physical environment. This marks their existential significance: new media suggest to extend the human biotope, while they radically alter and extend human perception and human functioning. Many new devices like cell phones, laptops and PDA's have already become commodities and they open up a mixed reality by defining new representations of the world that extend the real life arena. Physical reality and virtual life are getting more and more intertwined. Rather than being considered supportive tools, the media have a vital and substantive impact on societal structures. Digital media enrich and enhance human culture as a whole by enabling new communication channels, new communication codes, new behaviours, new network patterns and new modes of expression (Westera, 2005).

Accordingly, these new technologies prompt major changes in all sectors of society. Education has to respond to these changes by adapting its business models, its technologies and its modes of delivery. It has to anticipate and explore new modes of knowledge creation and representation, and create new ways of learning and teaching that serve as patterns for 21st century education. The Learning Media Programme aims to address the changing demands of the knowledge society by exploring and developing innovative, challenging and pervasive ways of learning and teaching that exploit the opportunities of emerging digital media, media technologies and devices. It will work closely together with research partners, media technology providers and educational stakeholders to develop new insights, concepts, prototypes and solutions of mediated learning that amplify societal innovation.

Non-instrumentalism as the Programme's core premise

The main starting point of the Programme is the adoption of a non-instrumentalist, substantivist view on technology and the cogent discard of any media instrumentalism (Feenberg, 1991). According to this substantivist view media are by no means considered neutral, interchangeable instruments that just support human needs, but instead they are assumed to mediate the relationship of humans and the world they are living in. They are assumed to actively enable new modes of human behaviour and human learning: people change by their devices. It suggests that learning, pedagogy and media cannot be treated independently.

This substantivist view strongly opposes against the widespread notion of instrumentalism which has become superseded decades ago. Instrumentalism goes back to the era of the industrial revolution, when human craftsmen were increasingly replaced by machines, which allowed standardised mass production. In highly rationalised and controlled production processes, human workers were degraded from unique individuals to interchangeable workers, destined to be just a cog in the machine. Through this mass production, human individuals became more and more ignorant of the origin, composition and functioning of industrial products, be it food, clothes or consumer electronics. People were thus trapped in a pattern of passively fulfilling their material needs by ever-replaceable stuff that was abundantly available (Jaspers, 1931).

Many of these patterns can still be observed today: the inescapable way technology enters our lives and makes us dependent, our fixation on material needs and even the resistance of teachers who's well-respected role of craftsmen is gradually degraded to that of a cog in the machine (Heinich, 1984). Yet, it is widely accepted that this 19th century instrumental view on technology, which reduces humans to simple toolmakers and tool users, doesn't adequately describe technology's interaction with today's society (Hickman, 1990). Indeed, the idea of labourers in mass production differs significantly from the present situation of highly skilled and autonomous knowledge workers. Likewise, contemporary views on learning consider learning the active and involved acquisition and construction of knowledge by the learners rather than the apathetic absorption (i.e. instrumental consumption) of information.

Technology, especially media technology, can no longer be considered a neutral and interchangeable instrument. It makes up an integral part of our lives and fundamentally alters the ways we perceive and experience the world and interpret it by attaching meaning to it (Heidegger, 1977). In fact, technology is assumed to mediate and give form to the relationship that individuals have with the world they are living in. Media technologies like the telephone, TV and the computer reinforce new patterns of behaviour, new codes of communication and new modes of living that wouldn't be possible without them: the substantive impact (Feenberg, 1991). This observation questions common educational premises that still claim pedagogy as the unique starting point and driving force of innovative teaching and learning. For example, the motto "form follows function" is still exemplary in education: educational technology is often regarded a mere instrument ("form") to meet pedagogical demands ("functions"). The motto goes back to the modernism of 1930s, which proclaimed that all products should be modelled after machines: simple and prepared for their function. It represents a rocklike faith in technology and it largely reflects the production chain idea of 19th century's instrumentalism. By now, however, the frugal, technocratic concept of "functionality" is no longer satisfactory to describe and understand the significance of technology. Methodologically, this signifies that pedagogy (or rather pedagogical design) can no longer be treated as an independent variable which one-sidedly determines the pursued media.

Similar problems underlie persistent debates on the effectiveness of media for learning (Clarck, 1983; Kozma, 1991). Learning from media is not self-evident. The media's effectiveness for learning may require well-considered instructional design and even then the effects may be difficult to demonstrate. Naturally, researchers tend to compare conditions of mediated learning with conditions of non-mediated learning in order to collect empirical data for support or failure. The call for comparative effect studies is obvious, but it easily involves concealed or implicit misconceptions of an instrumental nature, because comparative research tends to measure the changes that occur when replacing one medium with another. Based on a variety of comparative studies Clarck (1983) claimed that media do not influence learning under any conditions: "media are mere vehicles that deliver instruction but do not influence student achievement any more than the truck that delivers our groceries causes changes in our nutrition". Notwithstanding the untenable instrumentalist premise of this statement it took many years to settle the debate. There are two arguments for rejecting the statement, both of these are of a substantivist nature. First, it can be claimed that learning from one medium is not necessarily better or worse than learning from another medium, but is essentially different because of using different symbol systems for representation and addressing different senses. Second, for evaluating the role of media it is not sufficient to consider only their technical and functional characteristics; it is necessary to include their context of use and to consider their impact on the human experience (Heidegger, 1977). While misconceptions about media for learning often seem to reappear, various authors called on shifting the focus of the conversation: the focus should not be if, but how media affect learning (Hastings, 2005).

So, when considering pedagogy and media the question is: which is driving which? Today, it can by no means be maintained that pedagogy is leading. According to substantivism, pedagogy and media constitute each other, that is, they mutually influence each other (cf. figure 1).

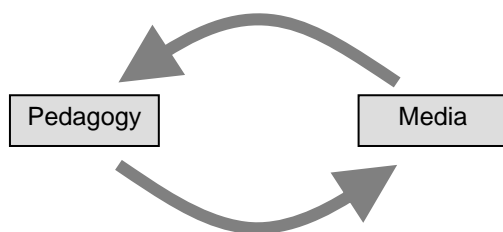


Figure 1. The substantive view: pedagogy and media constituting each other.

In all fairness, figure 1 does not quite catch the actual situation, since the abundant flow of new media tends to reinforce technology-push as the dominant innovation driver. Indeed, recent technologies seem to have induced various new pedagogical models, while, in reverse, pedagogy itself never really managed to provoke new technologies. This acceptance of technology push as a driving mechanism should not be mistaken for the adoption of technology determinism as the principal viewpoint of the relationship between technology and society. On the contrary, rather than adopting such one-sided and highly criticised techno-pessimist viewpoint, which considers humans the spineless victims of autonomic technological development, the Programme conforms to contemporary existentialist and phenomenologist views on technology, which start from the new opportunities that technologies may create and the notion that humans have substantial influence on and can take sensible decisions about the application (or rejection) of new technologies and their impact on social structure and cultural values. It is the Learning Media Programme's challenge to seize the opportunities that come with new media technologies, while keeping the right balance between pedagogy and media. After all, the success criteria of the Learning Media Programme will include both better learning and better media.

Position of the Programme

The Learning Media Programme is positioned within the Centre for Learning Sciences and Technologies (CELSTEC) and it conforms to the mission and ambitions of the Open University of the Netherlands. The mission of the Open University is:

1. to develop, provide and promote innovative higher distance education of top quality, in collaboration with networks and alliances,
2. to be the prime university for lifelong learning by addressing the wide-ranging learning needs of people during their course of life, plus the need to achieve considerable increase of the knowledge level of the community at large,
3. to play a pioneering role in open higher distance education and display leadership in educational innovation, both in the Netherlands and internationally.

The Learning Media Programme expresses the Open University's ambition to be a frontrunner in Technology-enhanced learning, to enable rich media distance learning and to transform into an internet-based university, which core competence is electronic delivery of services to learners (OUNL, 2006; Westera, 2006, 2007).

CELSTEC is an expertise centre in the domain of technology-enhanced learning. It aims to help improve learning by achieving better integration of learning with diverse contexts (home, school, work, etc.), better employability, better opportunities for the development of competences and talents in various stages of life, better support for learning and more appropriate assessment methods. As an expertise centre CELSTEC covers the following three basic functions:

1. Creation of new knowledge, technologies and services
2. Experimentation with new knowledge, technologies and services in pilots and trials
3. Sharing and dissemination of new knowledge, technologies and services

Its work is organised in four Programmes, one of which is the proposed Learning Media Programme. The CELSTEC Programmes share the same topic of technology-enhanced learning, but use different perspectives.

- The Learning Media Programme takes the perspective of digital media, focusing on development, deployment and maintenance of rich learning media as immersive virtual environments, contextual and mobile media, and sharing of media artefacts.
- The Learning Networks Programme focuses on the networking characteristics and the self-organising behaviours of large populations of users.
- The Learning and Cognition Programme takes a cognitive perspective by investigating the mechanisms that influence individual cognitive development.
- The Master Programme Learning Sciences hosts a legally accredited academic programme on CELSTEC's core expertise.

General starting points

The Learning Media Programme uses the following starting points for the appliance of digital media for learning.

Progressing virtualisation

The core assumption of the Programme is that human living and learning will increasingly be accommodated with networked electronic media and devices. New virtual realities will complement our daily lives and greatly enhance our mental horizons, while they open up an infinite and unprecedented reservoir of individuals, knowledge resources, environments and experiences. More and more entities of the physical world will be extended with sensors and display components to interact with humans more embedded in daily live activities and will allow new modes of interaction and knowledge creation. As has been suggested by the review committee it may be worthwhile to describe a so-called singularity after Kurzweil (1990): an envisioned fundamental breakthrough in science and technology that induces a breakdown of existing social structures and the position of man. Along these lines such a singularity for the Learning Media Programme would point at the full integration of media technologies with human existence, that is, the seamless integration of our senses and artificial sensing technologies, the seamless integration of the human mind and machine intelligence, and the seamless integration of human utterances and interventions in the world and artificial communicators and activators. Elaboration of these ideas are beyond the scope of this programme document, but will be addressed in the course of time.

Design paradigm

It is assumed that the efficacy of learning, be it formal, informal or non-formal, can be optimised by the appropriate design (or meta-design) of the learning environment and learning activities. Such design covers the determinants of learning, which include the learning context, learning content and materials, learning tasks and activities, mechanisms for support and feedback, the channels that are being used for access, representation and communication and the assessment of learning outcomes. The design paradigm is not to be mistaken for the educators' tendency to have full control over the learning and the learners: indeed, the term meta-design covers the design of favourable conditions for the emergence of learning patterns.

Empowerment of learners

Contemporary views on learning and teaching promote the empowerment and responsibility of learners to control their own learning. This especially holds for lifelong learners, or adults in general. To a certain extent it also applies for children and adolescents, because, in the information age, the ability of arranging one's own learning is a key factor for successful self-development and functioning. Increasingly, learners adopt an active role at defining their own development paths and devising their own learning tasks and learning materials. As a consequence, the design of learning contexts is shifting from closed, highly controlled and structured instruction to the (meta)design of optimal conditions for self-directed and personalised learning environments. In addition, empowerment makes great demands for personalised and adaptive learning design.

Ambient and informal learning support

Learning will increasingly be facilitated by a multitude of resources and channels that extend the confines of the classroom or the school buildings. In the knowledge economy, formal learning (arranged and accredited by the national authorities) will be complemented with non-formal learning (vocational training, courses, workplace learning) and informal learning (ad hoc learning at home or in public spaces, from

relatives or friends, in daily life, without any legal foundation). In view of employability, lifelong competence development and learner empowerment, non-formal learning and informal learning will gain relevance.

Personalised and distributed learning

The population of learners is assumed to be quite heterogeneous: learners may be very different with respect to their individual ambitions, age, motives, prior knowledge, pace and the preferred moment of studying. Learners are assumed to be largely responsible for their own learning process, be it that support is available when necessary to warrant effective learning and sufficient learning progress. Guidance, support and feedback will be mediated as such and may include online tutoring, peer coaching or automated routines to support the dialogue. Face to face contacts between students are very rare, because of the emphasis on mediated learning. The learning is highly personalised but it certainly does not occur in isolation: virtual classrooms and computer-supported collaborative work accommodate collective instruction, group work, teamwork or competition. Also, social networking, virtual communities of learners or the intertwining of learning and working enhance the social context of learning. Yet, the baseline is that the learning is largely independent and distributed, and the learners are highly empowered to decide upon their own learning strategies.

Programme requirements

Programme objective

The general long-term objective of the Learning Media Programme is to establish new methods for the arrangement of rich-media, multi-channel learning arenas that are efficient, versatile, flexible, challenging, adaptive, personalised, pervasive and context sensitive. Such learning arenas should have an integrating and co-ordinating function for their users, as they may combine various technical platforms, tools and devices, may use a wide variety of learning resources and incorporate different contexts and modes of learning (home, work, school, etc.; formal, non-formal and informal learning). Hereby the Programme addresses the needs of the knowledge society for better employability, innovation power and social coherence.

The Programme's mission statement reads:

The Learning Media Programme is a key player in developmental research and valorisation of innovative, challenging and pervasive ways of learning and teaching that exploit the opportunities of emerging digital media, media technologies and devices, that anticipate current and future educational demands and needs, and create prototypical solutions for those.

Within its six years lifecycle the Programme will have established its reputation as an expert in the domain of learning media. This will be substantiated by the following results. The programme has established:

- a set of validated approaches, models and methods for innovative learning media and the associated working prototypes and services;
- scientific contributions with respect to learning media design, based on sound empirical evidence and theoretical foundations. This output will be in accordance with common qualitative and quantitative academic standards;
- the successful transfer and implementation of (a subset of) these findings in educational practice, inside the Open University as well as in external learning contexts;
- a solid network of people and partners representing the media research population, technology providers and societal parties that apply new media solutions for learning;
- a highly flexible and efficient media laboratory which acts as a media knowledge and innovation hub for the Open University and external parties.

Research, technology development and knowledge valorisation

Programme activities cover both media research, media technology development and knowledge valorisation. While research and development are primarily oriented at knowledge creation, valorisation is about exploiting the knowledge in service of practical application. When appropriate, research and development activities are positioned in a national research school (cf. SIKS - Dutch Research School for information and Knowledge Systems) and conform to the associated quality requirements of staff, output and relevance. Output of research and development activities comprises scientific papers, conference contributions and established prototypes on behalf of the scientific community.

In contrast, knowledge valorisation involves the enhanced reach and impact of CELSTEC's innovative power for directly addressing urgent problems in society. In many countries, the notion of knowledge valorisation has been given high priority by political parties, governments and other social actors because of the rapid transformation of a product-based economy into a knowledge and services economy. This urgency especially holds for the Netherlands, which doesn't seem to be quite successful in converting its world-class scientific research into economic and innovative power of its industry. This so-called 'Dutch paradox' (OECD, 2006) severely obstructs national economic development and innovation, and it complicates finding solutions for complex social problems in the areas of health care, greying, integration of minorities, education and public security. The Learning Media Programme will accentuate its valorisation activities and contribute to creating solutions that meet the demands of the knowledge society.

By combining research, development and valorisation in the Programme unwanted gaps are avoided and synergy is amplified. New scientific insights are likely to become available for addressing practical problems, without any barriers. Conversely, societal problems and demands will serve as inspiring input for relevant research and development activities.

External inputs

To be able to decide upon the most relevant activities of the Learning Media Programme it is important to first consider its driving forces. Apart from the intrinsic motivations and ambitions of the staff, the Programme's activities are influenced by three different sources of inspiration (Figure 2).

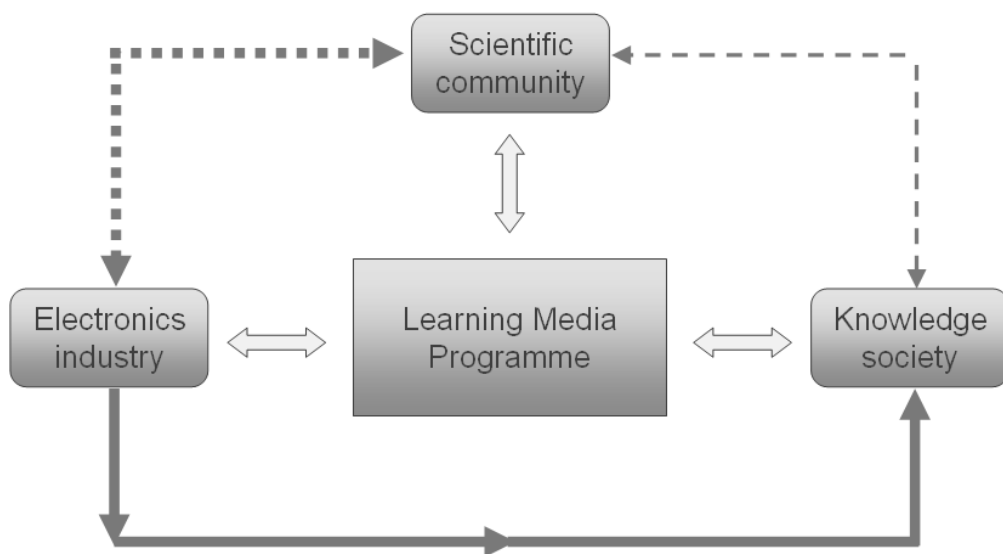


Figure 2. Three-sided external drivers for the Learning Media Programme

A dominant driver of learning media appliance is the electronics industry, including the network providers and the home entertainment industry. They are responsible for the flood of new digital devices, services and content, that directly makes their way to the markets (solid line). Examples would be video games, cell phones, laptops and internet services like YouTube, Facebook, GoogleDocs and Twitter.

Second, the scientific community devises new theories, models and approaches that are relevant for learning and teaching. Currently quite some research is involved with digital media, in particular in the area of human-computer interaction, intelligent agents, speech processing, computer literacy and technology-enhanced learning. In this area quite some

alliances between universities and industries exist (dotted line). The Programme will participate in the scientific community through papers, conference presentations and participation in one or more research schools.

Third, the demands of the knowledge society are a main concern of the Programme. Ideas and expectations are nurtured by the electronics industry and provide favourable conditions to create innovative learning solutions. These may support various modes of teaching and learning like classroom teaching, vocational training, distributed learning and learning communities. Interaction between the scientific community and society is known to be notoriously low (dashed line), especially in the Netherlands. As the Learning Media Programme aims to give high priority to valorisation, there is an urgent need for projects to address problems and demands. To this end, the Learning Media Programme (or CELSTEC as a whole) establishes a stakeholder network with representatives of industry and public institutions. Such measures establish the Programme's open innovation philosophy.

A priori considerations

The domain of multimedia covers a wide variety of branches and activities. It is closely connected with human thought, human expression, human communication and human culture at large. It ranges from marketing, commercial advertising, mass media and the role of sex, religion and violence, media politics and entertainment to film grammar, styles and genres, media economics, cultural studies and the internet. It cannot be denied that in all different media branches some learning may occur, but often the learning is an unintended by-product or takes the shape of veiled influencing or manipulation rather than well-considered learning and teaching. Below, we will discuss various considerations for restricting the Programme's scope.

Self-determined learning

The Learning Media Programme restricts itself to situations of learning that respect the self-determination of the persons involved, in particular with respect to their intentions to learn. Such restriction matches urgent needs of the knowledge society, cf. lifelong learning, employability and social cohesion. This still leaves a wide range of topics associated with media-supported knowledge acquisition and competence development.

Subsidiary technologies

The Programme has to bring about the seamless integration of various media technologies, platforms and devices to provide learners with the right functionalities and learning content and to let them arrange their optimal conditions for learning. The role of media technologies can hardly be underestimated. Media technologies cover a wide range of approaches that are crucial for the Learning Media Programme. These include web services, web semantics, language and speech technology, 3D-modelling, visualisation, search and retrieval technologies, mobile technologies, conferencing systems, agent technologies, content exchange and conversions, systems architecture and infrastructure design. The Learning Media Programme cannot be expected to excel in all these domains; yet, it needs to be well aware of emerging technologies, it needs to understand their functioning and it needs to be able to apply and integrate them in service of learning media solutions. The Programme will not only exploit such subsidiary technologies but it will also develop new technologies for achieving added value for education.

Compensating for the flaws of distance education

Until recent years, distance education focused on the production and delivery of codified educational content in books, readers, audiocassettes and video tapes. Consequently, the learning was primarily arranged as self-directed guided instruction and offered only scarce opportunities for social engagement, collaborative work, experimentation or field

work. Still, distance education is faced with many impediments in comparison with regular education. In particular, laboratory work, conferring work and location-based work are still highly underdeveloped. Because of its focus on emerging media the Learning Media Programme is assumed to create new opportunities for compensating for these flaws and to extend the distance learning arena with fully-fledged educational practices.

Addressing the needs of the knowledge economy

The demands of the knowledge economy prompt a radical change of the learning arena. Education providers have to adapt their business processes and adopt new modes of delivery to address the ever-growing demand for highly-skilled and up-to-date knowledge workers. It urges for highly smart, flexible and personalised learning opportunities that extend common classroom learning by accommodating incidental learning and workplace learning. Learning media are the carriers for improving employability, lifelong competence development and learner empowerment.

Programme elaboration

Programme Themes

The Learning Media Programme will be oriented at the pedagogical and user-centred design of mediated learning opportunities. Because of its media nature, it will adopt a content and communication perspective. It addresses the meso-level and micro-level of the arrangement, the creation and delivery of learning content and the content-related transactions and communications between educational system components, learners, teachers and other actors. This includes narratives, learning scenarios, learning tools, learning support and feedback mechanisms.

The Programme will direct its efforts at advanced media environments for learning. Emerging media and devices are destined to be intelligent, involving and personal tools rather than simple carriers of information. Users will increasingly be confronted with rich, versatile and media-enhanced environments in which learning is pursued or supported. Rich media environments – be it in formal or informal settings, be it extensive virtual realities or virtually extended realities - are supposed to combine different communication channels and modalities, and to offer challenging and dynamic learning contexts that often present or mimic real world situations, that display ambiguity, obscured problems and conflicting information and that offer large degrees of freedom to the learners (Westera, 2008).

The Programme will specialise in the adaptivity of rich media for learning. For learners it is essential that the media which make up the complex and versatile learning arena respond in a sensible way to the learners' preferences, needs and circumstances to optimise the conditions for learning. Learning media should include the tools and mechanisms to diagnose the student's condition, to track and assess learning progress and provide the right modes of guidance, support and feedback. That is, the learning arena should display the quality of being adaptive to changing conditions and demands. Such adaptiveness is not just a single aspect of a particular medium, but it is a unifying principle for any learning to occur and a key factor for accomplishing challenging, involving and personalised learning arenas. Adaptivity of learning media also breaks through the common a-symmetry of human-machine interactions which suggests that the user has to adapt to the machine, rather than the other way round. Since human learning is commonly considered a process of continuous change and adaptation, the media should be adaptive as well to serve the learner appropriately and to allow balanced interaction and dialogue. Learning is a cyclic process of convergent adaptation. Hence, adaptive learning media, in particular adaptiveness of media to learner contexts, learner profiles and learner performances, can serve as the Programme's co-ordinating theme; it suggests a focus on the controlled dynamics of the learning arena.

Three dominant trends can be identified that are of great relevance for the Programme. First trend is the ongoing virtualisation of life, which reveals itself in serious gaming, simulators, 3D worlds, avatars, rich visualisations and multi-user role-play. Many new opportunities for learning and practicing in virtual spaces are becoming within reach. Second, user-generated content as reinforced by web 2.0 approaches will greatly affect existing models of content creation. Third, new portable devices are rapidly changing the media landscape and enable new modes of mobile and contextualised learning. Taking into account the arguments and considerations so far, the Programme will cover three types of learning media which all hint strongly at rich environments for experiential learning: 1) Immersive Media, 2) Social Media and 3) Mobile Media.

According to Milgram and Kishino (1994) the usage of a medium can be mapped onto a mixed reality continuum which reflects the degree of virtualisation and which can be divided into augmented reality on the one hand and augmented virtuality on the other hand. In augmented reality the applied media support the user's experiences in the physical environment; this would usually be the case with mobile media, in particular when mobility or location-dependence of the users is included. In augmented virtuality the reverse applies: the virtual environment is dominant over the physical environment. Immersive media would be positioned in the augmented virtuality domain. The social media theme, however, uses a different dimension: human communication. Because human communication is of relevance for both the immersive media and the mobile media theme the social media theme is supportive to both. Below, taking into account that content and communication - in its widest sense - are the main carriers of digital media for learning, the themes' mutual positioning is represented (Figure 3).

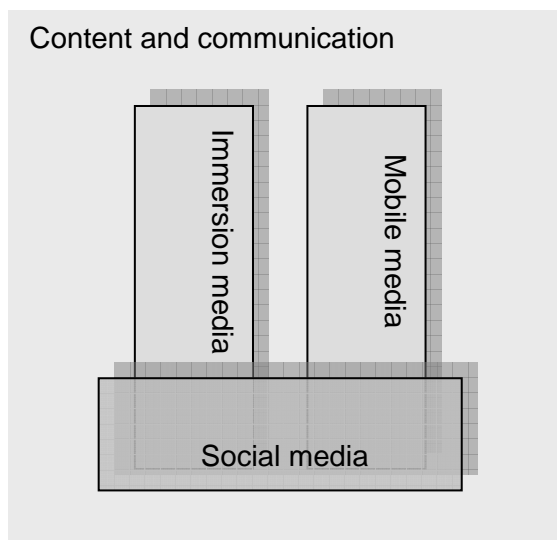


Figure 3. Overall positioning of the Learning Media themes.

It should be noted that the themes do not necessarily have separate pedagogical approaches. For instance, serious gaming or collaborative learning would be cross-theme approaches.

These themes are considered to capture the most promising trends and developments in mediated learning for the next few years. Below, the themes will be described in fairly general terms to allow sufficient room for demand driven research and for further specialisation after having established the Programme during the first two years.

The co-ordinating research question of the Learning Media Programme is framed as follows:

How can we improve the conditions for learning by incorporating emergent media technologies that enhance mixed-reality learning experiences?

This question establishes that pedagogy is the Programme's main assessment criterion, while media, devices and technologies are essential determinants and reinforcers. In particular, appropriate support mechanisms that scaffold the continuous adaptation of learners to changing circumstances are crucial for effective learning. Various information sources for adaptation are of relevance for each of the three themes, for instance the learner's profile, the learner's intentions and learning activities, actual time or the time

frame of relevance for the learner, and the abstract and concrete objects the learner engages with. The three Programme themes differ with respect to the dominant information sources for their adaptiveness. Immersive media emphasise learner behaviour and learner performance as the main inputs for adaptation. For social media the adaptation is largely based on the learner's relationships with people, inclusive its socio-cultural dimensions. For mobile media the adaptation mainly rests on the learner's location and location derivatives (e.g. demographical data, weather, height, history, time, type of soil).

The challenge to the Learning Media Programme is to extend the traditional educational settings of classroom teaching or resource-based deskwork with immersive media that allow safe experimentation, social media for content sharing, tagging and annotation, and mobile media for boundless flexibility and contextualised learning, respectively. Eventually, these main themes may easily be combined to produce fully-fledged educational practices.

Theme 1: Immersive Media

This theme covers challenging, immersive and greatly involving environments, which mimic real world complexity or create absorbing non-existing realities. Immersive media include virtual laboratories, virtual practicals, computational simulations, serious games and virtual worlds. They often combine realistic challenges with rich media resources, 3D-rendering and other lifelike components. Also, immersive media offer learners a safe space for exploration, experimentation and practicing and they are known to be highly motivating and challenging because they place the learners in control, offer substantial freedom of movement and provide a lot a natural feedback (Westera, 2008). As Immersive media address a whole range of cognitive, sensorial and emotional responses, they are likely to become immersive in kind and tend to support experience-based learning, situated cognition, inquiry-based learning and personalised learning-by-doing rather than information learning. They yield rich and involving learning arenas because of increased visualisation, challenged creativity and the options for supporting narrative.

Importantly, immersive media have become widely adopted by new generations of learners, the so-called digital natives (Prensky, 2006). Indeed, games are the most frequently used interactive media by children. Boosted by the successes of the video game industry, education is little by little adopting simulations and gaming as an urgent theme for addressing topical educational needs. Today, technology and costs need no longer be a barrier. Immersive media certainly address the changing competences needed in the information age: self-regulation, information skills, networked co-operation, problem solving strategies and critical thinking. Garris (2002) and Ma (2007) note, however, that many educational games concern repetition of cyclic content. This provokes persistent re-engagement, which tends to address lower level learning goals rather than higher level goals. In higher education immersive media have been widely used to support specified training needs in professional and vocational training, e.g. in military, medical and business training (De Freitas, 2006). But there is only little experience with immersive media in support of conceptual and higher level cognition. In response to the one-sided entertainment image of games, educators increasingly use the term "serious games" as to indicate that fun and its positive effects on motivation are not the main motives for using games in education (Serious Game Initiative, 2002; Michael, 2006). Especially in higher education, the mental mode of learning which reflects profundity, reflection, concentration and perseverance, seems to conflict with the mental mode of gaming which is commonly associated with amusement, violence and leisure. In higher education, the main objective of applying games is to engage learners in complex problem spaces where learners are challenged to develop relevant knowledge representations and the associated reasoning and problem solving strategies. To this end, learners are supposed to be confronted with ill-defined problems, that often allow

multiple solutions and require the application of necessary methodologies or tools and collaboration with fellow learners. While the development of complex immersive media is a challenge in its own right, the main challenge is how to warrant effective learning. This calls for a research agenda that links evidence on learning outcomes with immersive media design issues. This is well within scope, as immersive media offer many opportunities for tracking of user performance data that can be used for the assessment of learning progress.

The co-ordinating research question of the immersive media theme reads:

How can we improve the conditions for learning by incorporating rich, immersive media that simulate real world practices?

This can be explained further by the (exemplary) directional questions listed below: How can immersive media support the development of conceptual and higher level cognition? How can we effectively include the changing competences needed in the information age: self-regulation, information skills, networked co-operation, problem solving strategies and critical thinking? How do users perceive and appreciate immersive media for learning? How can we preserve learner motivation when simulations and games tend to become serious rather than fun? How can we exploit improved visualisation and 3-D representations for better learning? What are favourable conditions for learning in immersive environments? How can we use role-play and avatars to support collaborative learning? What design efforts are needed to warrant effective learning in complex, real life problem spaces? How can we reduce design complexity and the associated design efforts? How can we combine cognitive tools with immersive learning environments? How can we extend experiential and exploratory learning in immersive media with reflection and discourse?

Topical immersive media for learning offer a challenging and necessary option for enhancing distance education. It is essential to extend current production lines of content with these new kinds of media.

Theme 2: Social Media

This theme covers emerging modes of social media production, content sharing and content tagging according to Web-2.0 approaches. Web-2.0 and the associated social software approaches put the user at the centre by fostering user-generated content and user-controlled activities. It opens up new opportunities for active learner participation, self-directed learning and the exploitation of the collective expertise and creativity of groups of learners. In recent years, a new class of online tools and services have become available that allow the effortless creation and publication of rich content by the mass. Posting audio, video, photos or slideshows to the internet has become as easy as creating them. Examples would be content sharing services like GoogleVideo, Flickr, YouTube and Slideshare as well as content production services like Sketchcast, Jumpcut and SURFNET's Virtuele Snijmachine. As most of these services are available without any charge, millions of people is given a new creative outlet and a channel for expressing their opinions. It is estimated that currently over 100 million active blogs are available over the world. The number of viewers is even one magnitude up. Indeed blogs and bloglike services have become mainstream as tools for personal expression. The same holds for web-based collaborative workspaces, which range from simple document sharing spaces to real-time virtual conferences. Examples are Pageflakes, which offers personalised web pages and shared web pages, and Facebook which offers social networking and content sharing. All these web-based services enable the easy creation of collaborative spaces which can aggregate information from a variety of personal and

public resources and media like Flickr, YouTube, Twitter, Del.icio.us, MySpace and various web feeds for news and other information updates. The co-ordinating idea of such aggregation is that web content is made available for simultaneous publication along various websites through embedded references or through RSS/Atom web feeds which usually produce summarised information and a hyperlink to the original content. It displays the flexible use and reuse of web content objects, which is commonly framed web syndication.

Web syndication is pushed even further when abstract data from different sources on the internet are mapped onto each other in one single tool, to produce an aggregate representation. A popular example of such data mash-up would be geo-tagging: geographical data are combined with – say – demographical data or data about leisure facilities to produce a map that displays leisure options in the neighbourhood. Such mash-up is exactly what occurs in Google Maps, Google Earth as well as many car navigation systems. Data mash-ups provide rich visualisations that foster the understanding of the relationships between different dimensions and reveal new patterns and relationships. Various mash-up editors are freely available on the web (Google, Yahoo). Syndication and data mash-up technologies demonstrate the unprecedented power of the internet as a source of knowledge. The new type of applications working with rich, distributed, social media already have a variety of applications in informal learning and life-long learning. Furthermore the hybrid use of learning content is strongly stimulated by the open content movement which advocates the uncomplicated reuse of content under the creative commons licence. The impact of Web-2.0 on the business models of education providers can hardly be underestimated, because by putting the learner in the centre the content production line is largely reversed. The methods and media for structuring this process are essential for successful educational offers of the future.

While technology is not the true constraint anymore, social media will become mainstream, and millions of people will be involved in rich media production, new modes of media tagging or annotation and, possibly, in learning activities associated with it. This makes high demands to the media literacy of learners and teachers, with respect to information skills, creation and interpretation of rich media knowledge representations and the critical treatment for attaching meaning to it. This is essentially not about the operational skills that enable social media production, but about the underlying communication concepts that create meaning and significance. These concepts are strongly connected to the Dublin descriptors for communication and making judgements (Joint Quality, 2008); the Dublin descriptors provide a European framework for qualifications awarded to students in higher education. The challenge is to develop these extended media competences and incorporate them in curricula, courses and the associated assessments in a systematic way. New media literacy is a precondition for successful application of (social) media for learning. Media literacy is also an urgent priority both at the European level and the national level. The Dutch government has recognised the importance of media literacy and it has decided to launch a national media literacy expertise centre (Plasterk, 2008).

The co-ordinating research question of the Social Media theme reads:

How can we improve the conditions for learning by incorporating social media and rich media services for the exploitation of the collective expertise and creativity of learners?

Exemplary questions for the theme would be: How can we apply social media for competence development? How can social media become effective for group learning? What are basic media literacy competences for effectively dealing with social media and rich content creation? How can we exploit the potential of learners to mash-up free tools,

content and data of the internet in service of knowledge creation and competence development? How can web syndication and personalisation be combined for effective learning? How can data mash-ups be created and used to produce rich visualisations for learning? How can we conceptually describe and explain the diverse types of social media? How can we apply rich media content production by learners? What socio-cultural codes go with new social learning media? What are the conditions for applying user-generated content for learning? How can we design tagging mechanisms which produce best quality for learning and competence development? How can we co-ordinate the use of various social media for tailored learning scenarios? How can the quality of user-generated content best be warranted? How can we avoid too complex social media structures? How can we avoid students to get lost in the abundance of social media on the internet? What is the impact of open content and free web-services on education and its business models? How can social media integrate learning and living, and support informal and non-formal learning? How can we apply social media for workplace learning?

In sum, the social media track deals with the various dimensions of learner-generated content, content syndication, the aggregation of tools, content tagging and content annotation in service of learning.

Theme 3: Mobile Media

Handheld and mobile devices are a fast-growing market. The sales volume of mobile devices is over one billion per year. The Dutch mobile internet market increased over 30% in 2007. Current mobile phones include multimedia capture options, which enables the recording and playback of audio, full colour stills and video. They also act as personal digital assistants by covering calendars, contact databases, music collections and more. Mobile phones are increasingly used for postings to blogs, uploading location-based stills, accessing mobile tracking services to find friends or as a content presentation device for learning on the way. Current developments indicate the importance of embedded software which can be approached and upgraded through Open APIs (application programming interfaces) to offer additional services making the device more versatile. Mobile broadband will enable unhampered Internet access. And usability will improve further by touch-screen interfaces and high-quality displays.

Mobile learning is a fast-moving field which by its nature integrates with our everyday lives in a variety of ways. On the one hand content becomes accessible via mobile devices and ubiquitous information displays, on the other hand users can create media almost anywhere and at any time and share them in underlying services. This strongly links with the model of situated learning as introduced by Lave and Wenger (1991) which states the importance of knowledge acquisition in a social or cultural context and the integration in a community of practice. Learning in this sense must not only be planned and structured by a curriculum but also by the tasks and learning situations and the interaction with the social environment of the learner. This is often contrasted with the classroom-based learning where most knowledge is out of context and presented de-contextualized. On the one hand the process of contextualization and de-contextualization is important for abstraction and generalization of knowledge; on the other hand, in the sense of cognitive apprenticeship, it is sensible to guide the learner towards appropriate levels and contexts of knowledge coming from an authentic learning situation. Delivering and creating learning media in authentic learning contexts therefore is an underlying pillar of a new form of learning support we consider in the mobile media theme.

As the main objectives the Mobile Media theme will enable the 1) ubiquitous access to media and media creation facilities and 2) the contextualised adaptation of media for situated learning.

The first option is strongly connected with cross platform delivery in service of portability and location-independent learning. It extends common models of distance education with convenient and flexible access to digital content and communication through various channels. Topical examples include the use of e-book readers as a high resolution presentation medium that can be used while travelling, spoken instructional texts for mp3-players or disk media to be used when driving a car, and the use of cell phones for uploading notes to course blogs or making appointments using a shared calendar. Due to the incommensurability of media, the pursuit of multi-channel content delivery greatly affects content production chains. Simply applying text-to-speech software for converting printed text into spoken words will not produce appropriate learning materials because of the very different channel characteristics. Likewise, the conversion of regular print to e-books is anything but straightforward because of technical constraints of e-book readers as compared to print (display size, navigation, tables, graphs, colours). The challenge is to redesign the basic content production chains in such ways that they anticipate various delivery channels.

The second option refers to contextualised media for learning (De Jong, 2008). Here, the mobile devices are assumed to incorporate the relevant context variables to procure enriched realities based on the seamless integration of reality and virtual extensions. GPS-enabled smart phones and ambient technologies call for new approaches of learning that incorporate virtual representations and address the sensible adaptation to continuously changing user contexts. These approaches exemplify the pervasive nature of new media technologies while they support meaningful interconnections between educational resources and real world objects both by enhancing the user context with relevant data and by involving user context data. From the perspective of situated learning (Lave, 1991) several requirements for new learning tools can be stated, for instance: use authentic problems, allow multiple perspectives, enable learning with peers and social interaction within communities, enable active construction and reflection about knowledge in learning situations.

In context-aware computing a variety of notions of context have been discussed and automatic possibilities for context detection, context matching and sensor tagging have been researched. Context-aware computing together with ubiquitous and pervasive techniques can result in systems that adapt to the user's identity, preferences, location, environment and time (Zimmermann, 2005). User context data may include data of the user environment (GPS-location and location derivatives like historical or demographical data, weather, time, speed), social setting information (work, holiday, home and many more), biofeedback data (like skin resistance, blood pressure or heartbeat) and continuous interaction data (e.g. exertion interfaces, force feedback). Conversely, context tracking technologies may recognise the learner's presence and respond in a personalised way. So in turn, mobile devices may also act as stimuli for the real environment to support the learner. The ultimate challenge of using mobile media technologies is to exploit real world, context-based experiences as effective opportunities for learning by offering contextualised and personalised learning support. This certainly hints towards enhancing the opportunities for non-formal and informal learning, i.e. workplace learning. For building contextualised learning support on the one hand new infrastructures for contextualisation are necessary. On the other hand methods for analyzing and designing context specific tools for learning support are important. Third from a human computer interaction perspective new methods of interacting with ubiquitous and contextualised media and learning experiences need to be researched.

The co-ordinating research question of the Mobile Media theme reads:

How can we improve the conditions for learning by incorporating ubiquitous, adaptive and contextualised mobile media?

More detailed exemplary questions for this theme would be:

What are the implications of cross-platform delivery for the content production chain? What are the implications of content conversions from one modality to another? How can multi-modal content delivery produce better learning experiences? How can mobile media support the integration of learning and working? How can mobile media support new scenarios of blended learning and competence development in context? How does ubiquitous access to media change learning experiences distributed in time, space, and community? How can mobile media enhance learning from real-life, location-based experiences? What are effective scenarios for context-based learning? How can mobile media be used as integrative sources in mixed realities for learning? What kind of mash-ups and service orchestration patterns can be developed to support contextualised learning? How do learners appreciate learning with mobile and personalised media? What new forms of human computer interaction are efficient for supporting learners with mobile access? How do we use context data for adaptation and personalisation? How do users adapt to the constraints and new opportunities of mobile devices?

In sum, the mobile media track is about mobile and ubiquitous access and distribution of media as enablers of mixed reality and personalised learning by taking into account user context data.

Approach

Transversal co-ordination

The three Programme themes share many issues on both pedagogy and technology. Also, they are likely to be combined in order to create rich learning environments. The common denominator of the themes is the question how new media technologies can extend and improve learning. Three separate categories of co-ordination are identified and explained below: learner support, content-related technology standards and emerging learning technologies.

Learner support

Since openness, self-governance, freedom of movement of learners are important principles of the envisioned learning arena, the effectiveness of learning may be at stake. Pedagogical support will be necessary to preserve the effectiveness, attractiveness and efficiency of learning. This support covers the primary functions of education: structuring of the learning arena (i.e. through content sequencing, learning scenarios and learning strategies), assessment issues (i.e. tracking of performance and progress) and support (i.e. support strategies and feedback). All three are closely linked with the adaptiveness of the learning arena. Indeed learner performance tracking produces the required inputs, while learning scenarios and the associated support and feedback mechanisms are the primary subjects of adaptation. Directional questions would be: What are the determinants for successful learning scenarios that co-ordinate the use of versatile media? How do we develop appropriate learning scenarios? How can we avoid the complexity pitfall which is associated with rich media and authentic learning tasks? How to design pedagogical scaffolding in service of effective learning? What types of feedback are effective in immersive environments? How can we arrange affordable support models in the virtual environment? How can we arrange self-adaptive models for guidance? How can we assess learner progress in learning media? How can we apply user behaviour data to content adaptation? How can we effectively assess the performances of learners?

Content specification, annotation and interoperability

Learning technology standards, content encoding standards and content exchange standards, in particular open standards, are of great importance for the Learning Media Programme. Conformance to agreed standards is necessary for enabling cross platform delivery of learning content. It also supports the separation of content and delivery platform thus avoiding unwanted vendor lock-in, restricted access and proprietary dependencies. Across the world various parties are working on (open) content repositories and the technologies to link these together to produce an immense reservoir of content. Naturally this is all about preferred standards for content exchange, but it also concerns the accompanying metadata that are necessary to ensure efficient content search and retrieval. The metadata issue is gaining more and more interest because of the increased use of rich media content and the explosion of user-generated content. To this end, methods for automated metadata generation are highly topical. These include speech to text analysis, optical character recognition techniques and spidering of underlying databases.

Enabling Media Technologies

Also, the themes share various media technology issues, which include infrastructure, development platforms, exchange standards, integration technologies, interfacing with legacy systems, database design, content retrieval methods, system intelligence and specific tools and technologies that can be acquired for experimentation. Co-ordination also involves technology scouting, system configuration, authoring tools and support tools, user data and context data aggregation, web services and distributed systems,

workflow support and location tracking. For the learning media GUI-design is of great importance. This will include interaction codes, 3D design tools and platforms, accessibility requirements, rich media creation, avatar representation, sound and vision techniques and possibly some advanced HCI technologies, like gesture recognition, accelerometer controllers, facial expression, tangible interfaces or dialogue systems. On many occasions this will be combined with usability testing.

Subsidiary disciplines, theories and methods

The Learning Media Programme has a strong multidisciplinary nature and rests on a wide variety of disciplines, which include pedagogy, cognitive science, computer science and media science. These disciplines share the lack of a predominant, widely accepted paradigm. The domain of pedagogy is highly fragmented, as it displays a series of theoretical notions and approaches about the ways humans may learn. The Programme conforms to contemporary views on learning, which take cognitivist, affectivist and (social) constructivist positions for active, involved and meaningful learning. Rich media learning is multi-sensory in kind and supports experiencing, exploration and communication and collaboration with others. It rests on models of competence-based learning, discovery learning (Bruner, 1961; Papert, 1980), situated cognition (Resnick, 1988; Lave, 1991), experiential learning (Kolb, 1984), inquiry-based learning, problem-based learning, problem-oriented learning, independent learning and social learning theory (Bandura, 1977). Constructivism (Piaget, 1950; Bruner, 1961) has emphasised the importance of the learning context: the so-called acquisition hypothesis states that how we learn determines what we learn (Schank, 1995). The significance of this hypothesis is that learning is approached in a non-instrumental way. Since learning and context are considered inseparable, the context should be right to achieve effective learning. This hypothesis is the basis for the notion of authentic learning environments which assumes real-world complexity and role adoption by learners.

Even more than pedagogy and computer science, the discipline of media science displays a large number of perspectives and theories. It spreads over linguistics, history, sociology, anthropology, electro-magnetism, gender studies, visual arts, informatics and many more. Relevant theories are communication theory (Shannon and Weaver, 1949), cybernetics (Wiener, 1948), media equation theory (Nash and Reeves, 1996), expectancy violations theory (Burgoon, 1978), proxemic theory (Hall, 1966), narratology (Saussure, 1916), film theory (Andrew, 1984), critical culture theory (Adorno, 1991), the alienation thesis (Jaspers, 1931), technology determinism (McLuhan, 1964), semiotics (Peirce, 1982), game theory (Nash, 1950), devices theory (Borgmann, 1984) and Aristoteles' catharsis theory (Clarck, 2001).

The creation of new learning media solutions presupposes high levels of expertise on ICT, computer science and adjoining disciplines. Although the Learning Media Programme is not a technology developer per se, it heavily rests on software engineering, web technologies, knowledge engineering, agent technology, network technology, distributed systems, computational models, system-interfacing and system integration and human-machine interaction, in particular interaction design and graphics design. Frequently the Programme will adopt new technologies and tools for appliance in the learning arena. The aggregate use of such methods and technologies requires substantial knowledge about the underlying mechanisms and algorithms, but does not urge the Programme to transform into a speech and language research or expertise programme. In many cases, new computer methods and technologies will be scouted, explored and assessed for sensible application within the Learning Media Programme.

The Learning Media Programme conforms to scientific standards both with respect to its applied methods and the substantiation of its claims. It develops and substantiates scientific theories, models and frameworks as well as proofs of concepts and solutions associated with new modes of mediated learning and teaching. The Programme will apply and develop methods and tools for instructional design, content authoring, content management, systems design and system modelling, software development and system interfacing. Its methodologies include UML (Booch, 1999), ADDIE (Leshin, 1992; Dick, 1996), ARCS Model of Motivation Design (Keller, 1987), user-centred design methods, system dynamics (Wiener, 1948), usability testing (Rubin, 1994), rapid prototyping (Tripp, 1990) and extreme programming (Beck, 2000). At more specific levels the Programme applies dedicated tools for content creation, 3D modelling, system interfacing and system integration. For software development tools and platforms the Programme complies to CELSTEC policy which prioritises JAVA-based and PHP-based software development frameworks.

Even though evidence-based research is very common in education, the Learning Media Programme will not adopt a common evidence-based research perspective because of its reactive, delayed and confirmative nature. The overall ineffectiveness of educational research has been frequently criticised (Bates, 1995; Clarck and Estes, 1998; Kaestle, 1993; de Bie, 2002; Kearsley, 1998; Kaufman; 1998), exactly because of its confirmative role, which makes it lag behind educational practice: teachers often have improvised and established good educational practices long before educational research verifies its successes. Instead, the Learning Media Programme will aim at a design-based research approach (Burkhardt & Schoenfeld, 2003) to connect theoretical frameworks and new approaches with relevant learning contexts. Certainly, design-based research goes with collecting scientific evidence, but its positioning is different. It positions research in the so-called Pasteur-quadrant (Stokes, 1997) as to indicate the importance of combining usability objectives and theory objectives. It involves short cycles of development and evaluation within realistic contexts as well as the parallel assessment of usability and impact to help optimise and preserve the conditions for learning. It establishes the accent on practice-oriented research in service of societal problems, it aims to close the gap between research and practice and to amplify valorisation, and it addresses the short life-cycles of new media technologies and devices. It also accounts for the notion that the effectiveness of learning is greatly dependent on context parameters. Again, this points at the substantive, non-instrumentalist approach of technology. According to the Design-Based Research Collaborative (2008) the promise of such work is achieving a) novel learning and teaching environments, (b) developing theories of learning and instruction that are contextually based; (c) advancing and consolidating design knowledge; and (d) increasing our capacity for educational innovation.

Three types of learning media research are envisioned:

- 1) State of affairs surveys
The use of new media technologies will be surveyed in order to provide a topical overview of adoption and trends (for instance RSS, mobile connectivity, digital television or Web-2.0). Surveys may include general data about market penetration and sales, but will mostly focus on the domain of education and learning. They may cover institutional strategies, policies and practical experiences.
- 2) Media technology assessment
Emerging technologies, tools or devices are scouted and evaluated for their educational potential. Examples would include separate technology types (speech tools, tagclouds, i-phones, etc) as well as platforms. When appropriate technologies are configured or linked with existing tools in order to establish the technical boundary conditions and constraints. Outcome will be a factsheet or a simple demo.

- 3) Development of proofs of concept
Promising technologies are being contextualised by linking it to a particular educational setting, problem or domain. While incorporating theoretical frameworks these technologies will be investigated according to the following methodological steps: a) designing a case model of proper educational use, b) developing a tuned application or working prototype, c) perform a (possibly double blind) user-centred experiment, d) evaluate the case model and e) report on it.

For innovations to become successful it will be necessary to include organisational issues next to pedagogical and technological ones. Organisational issues include management and staff development approaches, and new processes and structures that break through the existing production chains, as may be the case for media production in social web, for instance. Likewise, impact metrics for new media approaches (i.e. web-2.0) will be researched.

The CELSTEC Laboratory

The launch of the Learning Media Programme is synchronised with the establishment of a media laboratory within CELSTEC: the CELSTEC Laboratory. It is part of the Learning Media Programme and will be managed accordingly. The CELSTEC Laboratory offers the technical infrastructure of dedicated media facilities for development, experimentation and demonstration of new media for learning. But it goes beyond the level of technical facilities by establishing the Learning Media Programme's role as a state of the art inspirer and innovator. To this end the CELSTEC Laboratory supports the following tasks:

- **Incubation**
The generation and expression of new ideas for learning and teaching with digital media. This includes appealing mock-ups and proofs of concept that are tested and evaluated for feasibility and applicability.
- **Research and technology development**
The CELSTEC Laboratory will enable 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, i.e. wideband internet, mobile networks and consumer electronics, the CELSTEC Laboratory keeps track of new media opportunities for learning.
- **Sensibilisation and dissemination**
The CELSTEC Laboratory will also be used for displaying state of the art technologies, concepts and practices for media experts, educators and possible user groups through seminars, showcases and workshops. It thus establishes the Open University as frontrunner in technology-enhanced learning.
- **Open innovation workspace**
It will offer the opportunity joint projects and experiments with internal and external partners, for instance research institutes, education providers, cultural institutions, technology and network providers and industry partners. It thus may act as a media knowledge hub and broker between parties. The CELSTEC Laboratory thereby amplifies the networking role of the Open University, helps fund raising and stimulates initiative and entrepreneurship.

The CELSTEC Laboratory will be branded as an independent media research laboratory. It chooses to support an open content and open source software approach for its products rather than a proprietary model. New tools and technologies that have been developed will preferably become available under free or low budget open source licences. Naturally, the CELSTEC Laboratory may also use and investigate closed-source software products, but it will neither take the position of its dealer nor its representative. Spin-off revenues will be raked in through workshops and external projects and services, provided that these match the OU-Lab's research focus and the developed expertise.

The external environment

Various organisations, associations, funding programmes and conferences are of relevance for the Programme.

Relevant organisations

Note that the inventory given below is incomplete.

- **NWO, the Netherlands Organisation for Scientific Research**
This organisation is the main body for influencing the course of Dutch science by means of subsidies and research programmes. It has a pivotal role between industry, society and research. It works closely together with Kennislink, the organisation which aims to further the valorisation of research outcomes. It offers many types of funding for research projects. NWO's Educational Research Programme, however, doesn't match the Learning Media Programme too well, while there are only little opportunities for learning media research. The CATCH programme which deals with cultural heritage can partly be associated with education, as it aims to develop new knowledge and software tools associated with digital content. Incidentally, NWO-subsidies for grants and specific topics may be of interest.
- **European Technology Platforms, FP-7, Econtentplus**
At a European level research institutes and industry partners are working together to define and realise a joint strategic research agenda with respect to social, scientific and economic challenges. The platforms provide inputs for European research and valorisation programmes and the associated funding. Topical key areas of relevance for learning media are Embedded Computing Systems (Arthemis), Mobile and Wireless Communication (eMobility), Networked and Electronic Media (NEM), Networked European Software & Services Initiative (NESSI) and Smart Systems Integration (EPoSS). The 7th Framework Programme is a research programme which covers the media-related theme of digital libraries, digital content and e-learning. The eContentplus programme has a more practical focus; it is highly relevant for the Learning Media Programme because of its focus on educational content. Although the eContentplus programme will be closed in 2008, the Learning Media Project has already acquired projects funding until 2011.
- **European Regional Development Fund (ERDF)**
The ERDF aims to strengthen economic and social cohesion in the European Union by correcting imbalances between its regions. One of the ERDF-funded programmes is the Operational Programme South 2007-2013 which applies to the Dutch provinces of Zeeland, Noord-Brabant and Limburg. The Operational Programme South addresses R&D investments, innovation and collaboration between research institutes and enterprises. Also ERFD supports innovations carried by cross-national collaboration in the Euregion Maas-Rijn, Flanders Netherlands and Germany-Netherlands (Interreg-IV).
- **Stichting Technische Wetenschappen (STW)**
Technology Foundation STW subsidises applied research, while bringing together from the start researchers and potential users of the outcomes of that research. Its aim is to support innovation of society. Best opportunities for learning media projects are in the Open Technology Programme; this programme funds projects that combine high quality research and high utilisation chances. Also, STW provides valorisation grants.

- **SenterNovem**
This is an agency of the Dutch Ministry of Economic Affairs which aims to promote innovation in service of positive effects on the economy and society as a whole. It acts as the Dutch Liaison of the European Union and its funding programmes. But it also offers separate funding for activities in the area of technology, energy, environment, export and international cooperation. Occasionally, funding covers educational themes.
- **IIP Create**
In the Netherlands the National Innovation Platform has assigned six national key areas for economic development. These include Flowers & Food, High-tech Systems, Water, Chemistry, Pensions & Social Security and Creative Industry. These areas all share a focus on innovative information and communication technologies. So far, education is not a separate key area. The Creative Industry area addresses various relevant topics like multimedia, gaming, social software, artificial intelligence, mobile media and ambient technologies, serving both entertainment and education. Hence, the Learning Media Programme has decided to participate in the national ICT Innovation Platform CREATE, which is an alliance of industry partners, research institutes and user groups in the domain of creative media. The Platform aims to develop a joint research agenda in service of societal innovation, including education. Eventually, the research agenda is supposed to be adopted by the Netherlands Organisation for Scientific Research (NWO) which steers the course of Dutch science by means of subsidies and research programmes. This would open up new funding options that conform to the Learning Media Programme. Also, the IIP Innovation Platform CREATE offers the right channel for demand driven research and innovation.
- **SURF and SURFNET**
SURF is the collaborative organisation for ICT in higher education. It promotes innovation and co-operation between higher education institutes. It chairs the National Action Plan E-learning (NAP) on behalf of the Ministry of Education. One of its daughter companies is SURFNET, which develops and operates the national SURFnet6 network and which provides innovative services in the areas of security, authentication and authorisation, group communication and video.
- **EADTU, European Association of Distant Teaching Universities**
This is the representative organisation of both the European open and distance learning universities and of the national consortia of higher education institutions that are active in the field of distance education and e-learning. EADTU organises world conferences and initiates innovative European projects which often address urgent topics of distance learning.
- **Kennisnet**
Kennisnet Foundation is a public body that provides ICT support to schools, looks after their interests and promotes innovative approaches of education with ICT. Because of the susceptibility of young learners for new media and devices, Kennisnet may be an interesting party for co-operation. Together with SURFNET, Kennisnet operates a joint innovation programme which covers new media, virtual worlds and games. The programme hosts the Games2Learn community which promotes the knowledge sharing on educational games and simulations.
- **Teleac/NOT**
This is the public broadcasting organisation for educational media in the Netherlands. As a broadcaster Teleac/NOT increasingly orientates on innovative cross media platforms and content. Importantly, Teleac/NOT and the Open University have agreed on strategic co-operation, especially in the area of mass media, mass personalisation and lifelong learning.

- ELIG, European Learning Industry Group (<http://www.elig.org/>)
The European Learning Industry (ELIG), is an open industry group with members representing the ecosystem for 21st century learning solutions. ELIG seeks to promote innovation in learning, knowledge creation and dissemination throughout Europe. The Open University is member of ELIG.
- IMS Global Learning Consortium (<http://www.imsglobal.org/>)
IMS GLC is a global, nonprofit member association that provides leadership in shaping and growing the learning and educational technology industries through collaborative support of standards, innovation, best practice and recognition of superior learning impact. CELSTEC is member of IMS.
- JISC (<http://www.jisc.ac.uk/>)
JISC manages research and innovation programmes in the use of innovative e-learning R&D to build knowledge, develop services, infrastructure or applications, and provide guidance and leadership.

Urgent topics in society

The Learning Media Programme's goals match with various urgent problems and needs of society. From the perspective of learning, education and expertise development a number of issues demand urgent address.

- Knowledge workers
The knowledge economy demands continuous and flexible upgrading of its workforce. This urges for increased opportunities both in regular education and lifelong learning. Also larger participation rates of women at the workplace is pursued. These include workplace learning, informal learning, improved mobility learning and contextualised learning.
- Dropouts
Secondary and tertiary education suffer from severe dropout of learners. Ambition of social partner institutions (representing, the government, the education sector and the industry sector) is to reduce this dropout by achieving higher rates of learners which have acquired basic qualification levels and an increased throughput from secondary education to higher education.
- Minorities
Improved integration of immigrant minorities requires new approaches of content presentation. This includes primarily basic skills, for instance Dutch language skills, in order to avoid a social divide.
- Social coherence and citizenship
Flexible learning opportunities as well as informal and non-formal modes of learning are assumed to improve social cohesion.
- Deficit of teachers
In the years to come the deficit of teachers will increase to unacceptable levels. The Ruud de Moor Centre of the Open University contributes to solving this problem by applying educational technologies to create flexible learning opportunities. Contributions of the Learning Media Programme can be arranged through co-operation with the Ruud de Moor Centre.

- **Quality of teachers**
Quality of teachers needs to be improved; many teachers don't meet the required professional standards. Here also co-operation with Ruud de Moor Centre is indicated.
- **IIP Creative industry**
On a national scale the creative industry has been assigned priority. The Learning Media Programme has joined the Ict Innovation Platform (IIP) Create to contribute to the promotion of new mediated modes of learning.
- **IIP Health support**
Innovation and expertise development are highly urgent in the domain of health care, because of increased greying, new technologies and the need for cost reductions and prevention. Like Create, Health support has officially been approved as an Ict Innovation platform.
- **IIP Intelligent communication**
The domain of intelligent communication has been labelled national priority. It emphasises hardware and infrastructure. As an IIP it covers the development of research programmes and innovation in a public-private alliance of stakeholders, and is promotes better learning opportunities for future workers in the domain.
- **IIP MAIS – Mobility**
This national priority focuses on ict solutions for improved traffic mobility. Distance working is one of the options considered; this includes web-based virtual mobility solutions.
- **IIP ICT Security & Privacy**
This national priority procures structural improvements for safe virtual access and communications.
- **Water management and sustainability**
Environmental issues are highly topical in particular energy production and use, greenhouse effect control, waste reductions, sea level rise.
- **Science workers**
On a national scale too little children choose for hard science and technology like chemistry, biotechnology, physics and mathematics. New modes for learning and treating science and technology are required.
Innovation initiatives of the Learning Media Programme may quite well be directed to one of more of the listed domains.

Relevant Conferences and associations

There are many conferences on emerging media, media technologies and devices. These cover issues of marketing, social impact, psychology, news gathering, film and gaming among others. In many cases, there is only very little attention to education. Conversely, regular conferences on ICT in education increasingly pay attention to media, media technologies and devices. A list of relevant leads for the Learning Media Programme is given below:

- **ECGBL European Conference on Games Based Learning**
An annual conference which covers the full potential of game-based learning, especially issues of game-based collaborative learning, game design and domain-based game applications.
- **Online Educa Berlin**
Europe's largest conference on e-learning, which increasingly covers tracks on learning media.
- **Ed-Media**
A world conference on educational multimedia, hypermedia and telecommunications organised by the Association for the Advancement of Computing in Education (AACE).
- **ICALT International Conference on Advanced Learning Technologies**
This annual conference is one of the leading events in learning technologies research.
- **ECTEL European Conference on Technology Enhanced Learning**
This conference provides a forum for researchers of various disciplines to come together and discuss achievements and challenges in technology-enhanced learning. CELSTEC will be co-organiser of the ECTEL 2008 at Maastricht.
- **Where 2.0 Media**
A US conference on location aware technologies.
- **Mobile Learning Conference**
An annual research conference of IADIS (International Association for Development of the Information Society).
- **DIVERSE Developing Innovative Video Resources for Students Everywhere**
An annual international conference which title reflects its initial focus on video for education. Currently, the conference also addresses video conferencing and other synchronous communication technologies, such as text and audio conferencing, and image-based technologies such as virtual reality.
- **Educause**
This is the American non-profit organisation for the advancement of ict in higher education. It organises an annual conference which covers a wide variety of topics, many of which are of relevance for the Learning Media Programme.
- **ALT-C Association for Learning Technologies**
The UK Association for Learning Technologies organises an annual conference which specially focuses on learning media.

- EDEN-conference European Distance and e-Learning Network
This conference has a special focus on e-learning and distance education and frequently addresses learning media, besides more general topics such as digital divide, employability, e-competences and lifelong learning.
- AERA American Educational Research Association
A wide-scope educational conference, often addressing emergent media technologies.
- ISAGA
Annual conference on simulation and gaming. ISAGA is the international organisation of scientists and practitioners developing and using simulation, gaming and related methodologies. SAGANET is the Dutch association for gaming and simulation professionals; it is a collective member of ISAGA
- ECEL Future European Conference on e-Learning
Conference combining cutting edge e-learning research and best practices.
- SURF-onderwijsdagen
An annual national conference on ict innovation in Higher Education.
- VOR
Dutch Association for Educational Research. It offers individual memberships to researchers.
- CAWO
Dutch Association of University Media Centres. CELSTEC is member of this association.

Co-operation with internal and external parties

The programme will closely co-operate with various internal and external parties.

Internal parties include the Open University Faculties, the Ruud de Moor Centre, the IPO programme which addresses some implementation projects within the Open University and LEX (conferencing centre), while working on joint problem solving, experiments and innovation. CELSTEC and Ruud de Moor Centre have already agreed to combine their multimedia production facilities to establish a shared multimedia support service. This is separate from the Learning Media Programme. Various staff members are combining the work in CELSTEC programmes with part-time participation in Open University projects outside CELSTEC. The strong association between media and content also offers engaging opportunities for co-operation with the OPEN Educational Resources project. With respect to research, the work of the Learning Media Programme may be linked with NELL, the Netherlands Laboratory of Lifelong Learning which co-ordinates all lifelong learning research of the Open University according to a research school-like model.

External parties may include a variety of research centres, universities, schools, public institutions and industry partners.

For the arrangement of co-operations inside the Open University the following model is used to describe the innovation process chain (figure 4). In many cases, the model also applies to co-operation with external partners.

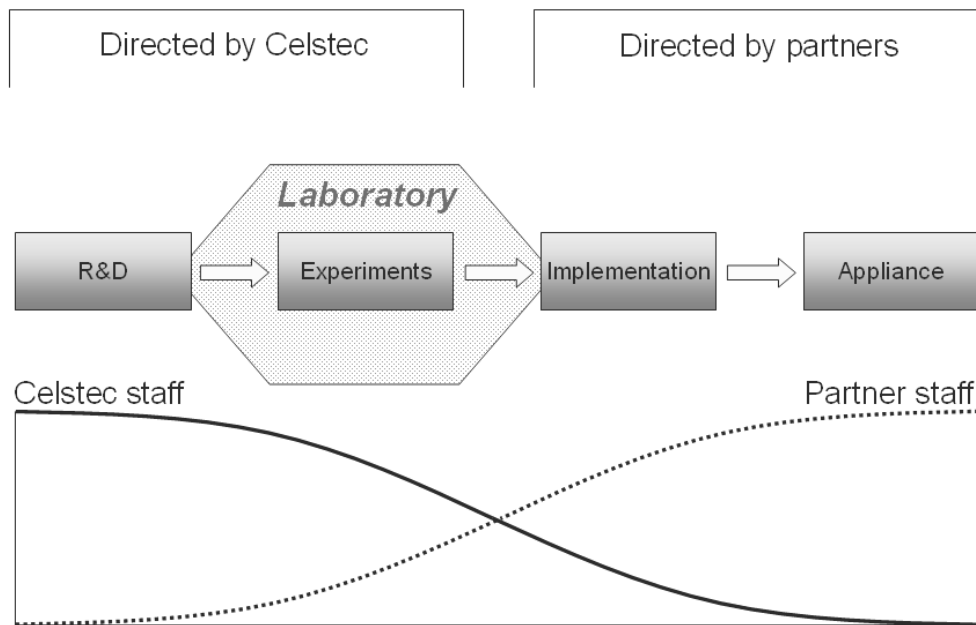


Figure 4. The innovation chain model of the Open University.

The innovation chain is considered to comprise four separate stages each of which has different characteristics. The first two stages emphasise knowledge creation and are directed by CELSTEC. The last two stages cover the appliance of this knowledge and these are directed by the receiving partners. CELSTEC’s main contribution is in the first two stages; its contribution tends to fade out in the subsequent phases. For partner staff the reverse applies. This gradual shift of staff contribution during the process is supposed to amplify smooth transfer and innovation.

The first stage of this process involves typical R&D activities covering the basic questions of the programme. At this stage a wide range of approaches and technologies will be explored, developed and assessed. These include the creation of new ideas, the conceptualisation of new learning and teaching modes, and technology scouting.

The second innovation stage covers small-scale scientific try-outs and experiments for the assessment of working prototypes or proofs of concept. Here co-operation with other partners will be frequent, which is in accordance with the design-based research paradigm. The co-operation will be linked with the CELSTEC Laboratory which will serve as a shared workplace for CELSTEC staff and staff of other Open University departments and external parties.

Stage three of the model covers the implementation of new approaches in the faculties or at other parties. Such implementations require substantiated decisions by these parties to adopt and assimilate new learning solutions. In contrast with the first two stages which are being directed by CELSTEC, this implementation stage is managed and directed by the receiving partners. Yet, CELSTEC staff will still be involved during this stage in order to preserve and disseminate the expertise of the previous stages. Inside the Open University stage three is currently covered by the IPO programme.

Finally, stage four is the stage of operational use: new solutions have become available as robust services by the education provider. At this stage, the involvement of CELSTEC will have been faded out. As figure 4 demonstrates, the innovation model is highly symmetrical with respect to the responsibilities of CELSTEC and other departments and with respect to the associated fading of personnel efforts.

In conjunction with the innovation model the following modes of co-operation with Open University parties are envisioned, most of which relate to stage two or stage three of the model:

First, Open University staff is invited to participate in the Learning Media Programme. This way the Programme offers new opportunities for Open University staff to professionalise and specialise in a particular topic, which fits in the Programme. Naturally, participation in the Programme requires conformance to its aims, constraints and procedures. Such participation may concern stage one or stage two of the innovation model.

Second, Open University departments may agree to carry out a valorisation project in co-operation with the Learning Media Programme for solving some urgent media-related problem or for the elaboration of new ideas, models or tools that have been developed in the Programme. Or Open University departments may want to participate in experiments of the Programme that may be of interest for their innovation strategy. When appropriate, departments may help define the characteristics of such experiments. In accordance with the design-based research paradigm, the departments provide a realistic context with staff and students for testing purposes during the course of the experiment. Such model is likely to yield a win-win. Note that experiments are always temporary in nature; after conclusion the experimental infrastructure will be dismantled. These types of co-operation refer to stage two of the innovation model.

Third, the Learning Media Programme will organise or participate in colloquia and meetings on behalf of Open University staff in service of knowledge dissemination, debate and the generation of new ideas. This activity may be positioned in either stage two or stage three of the model.

Finally, the Learning Media Programme will support implementations via consultancy, project participation and dissemination of knowledge. This would cover stage three of the innovation model. For a great deal this is currently arranged via the IPO programme. Various members of the Learning Media Programme participate in IPO, especially in the IPO-multimedia project and the new IPO virtual learning environment project (social media, mash-ups and technology scouting). For co-ordination with IPO, the Programme director of Learning Media is a member of the IPO steering committee. But also various implementation activities outside the IPO-programme may be linked with the Learning Media Programme (situation 2008): the Web-2008 project which aims to create a multimedia portal for the Open University, the LLL-services project which procures the development of specific learning support services, the Ruud de Moor Centre which develops content and services for teacher training, the Multimedia production centre which is a joint activity of CELSTEC and Ruud de Moor Centre, the computer department (ICTS) which is responsible for the campus network infrastructure, the OpenER project which produces and delivers open learning content and the project "Student Centraal" which aims to create user-centred services concerning a study at the Open University. The programme chair will proactively communicate with project officials in order to check the options.

Organisation issues

Staff allocation

At the start in 2008 the Learning Media Programme will be run by 10 fte of CELSTEC staff. Because of long term obligations of CELSTEC to the IPO Programme, only very few CELSTEC staff will be fulltime available for the Learning Media Programme. Therefore the total number of faculty will be between 15 and 20. As has been agreed upon in the CELSTEC budget of 2008, half of the staff will be funded by the Open University's primary budget; the other half of the staff will be funded by external resources. This may seem a tough task for a new programme, but as a matter of fact, acquisition of external media projects by CELSTEC has been anticipated in previous years. Therefore, several externally funded projects will be available from the start and initial funding of all 10 fte will not be too difficult.

For the next years the Programme assumes to realise a stable annual growth of 15%, resulting in a redoubling of staff volume by year 6. This growth is necessary for lending the programme sufficient critical mass and robustness. It also assumes a percentage of 60% scientific staff versus 40% non-scientific staff (in particular technical staff). Table 1 displays the development of staff volume over the years.

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Scientific staff (fte)						
Internally funded (fte)	3.0	3.4	4.0	4.5	5.2	6.0
Externally funded (fte)	3.0	3.4	4.0	4.5	5.2	6.0
Sub-total scientific staff (fte)	6.0	6.8	8.0	9.0	10.4	12.0
Non-scientific staff (fte)						
Internally funded (fte)	2.0	2.3	2.6	3.0	3.5	4.0
Externally funded (fte)	2.0	2.3	2.6	3.0	3.5	4.0
Sub-total non-scientific staff (fte)	4.0	4.6	5.2	6.0	7.0	8.0
Sub-total internally funded staff (fte)	5.0	5.7	6.6	7.6	8.7	10.0
Sub-total externally funded staff (fte)	5.0	5.7	6.6	7.6	8.7	10.0
Total (fte)	10.0	11.4	13.2	15.2	17.4	20.0

Table 1. Development of staff volume over the years.

Note that table 1 suggests that internal funding and external funding increase at the same rates. Coherent growth of internally funded staff is necessary in order to be able to attract appropriate (inter)national experts to fixed staff positions, to build a sustainable core expertise and to warrant appropriate support for PhD students and other temporary staff. CELSTEC has agreed with the board of the Open University that the internal funding of CELSTEC will be made flexible by indexing it to the total volume of scientific staff of the Open University, that is, it will grow (or decrease) proportional with the total volume of scientific staff. At the time, however, it is uncertain whether internal funding of the Programme can be incremented according to the ambitions (cf. risk assessment section below).

According to CELSTEC policy on average 60% of all capacity will be used for valorisation tasks and 40% of the capacity will be allocated to research and technology development.

Programme organisation

The three main themes described above are the basis of Programme organisation. Indeed, the organisation structure should give maximum support to their development. Because of the Programme's limited size during the first years, however, it is proposed to combine the themes and the associated groups of specialists during start-up. Also during the first years faculty will have to adopt various roles. After two years the organisation will gradually conform to the envisioned organisation chart reflected in figure 5.

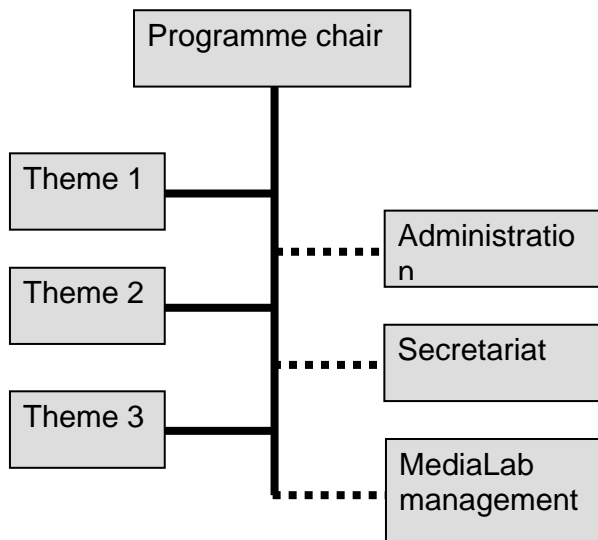


Figure 5. Organisation chart of the Programme

The Programme is led by the Programme Chair who bears the overall responsibility. Each of the three Programme themes are led by an (associate) professor, who is responsible for management and further development and deepening of the track by defining new projects and services, expanding the network, generating exposure, acquiring new funding and achieving agreed output. Besides full professors and associate professors, programme staff comprises IT-developers, assistant professors, PhD students and graphics design specialists. Staff members are allocated to the themes on a semi-permanent basis by taking into account available expertise, career ambitions and project needs. Occasionally, it may occur that faculty is temporarily allocated to more than one theme.

The general facility unit of CELSTEC provides support to the programme by arranging the Programme's secretariat, the administration and the CELSTEC Laboratory management. Although the CELSTEC Laboratory is a dominant carrier for the Learning Media Programme, it will also be facilitating other CELSTEC programmes.

Alignment within CELSTEC

The general organisational structure of CELSTEC is displayed in figure 6.

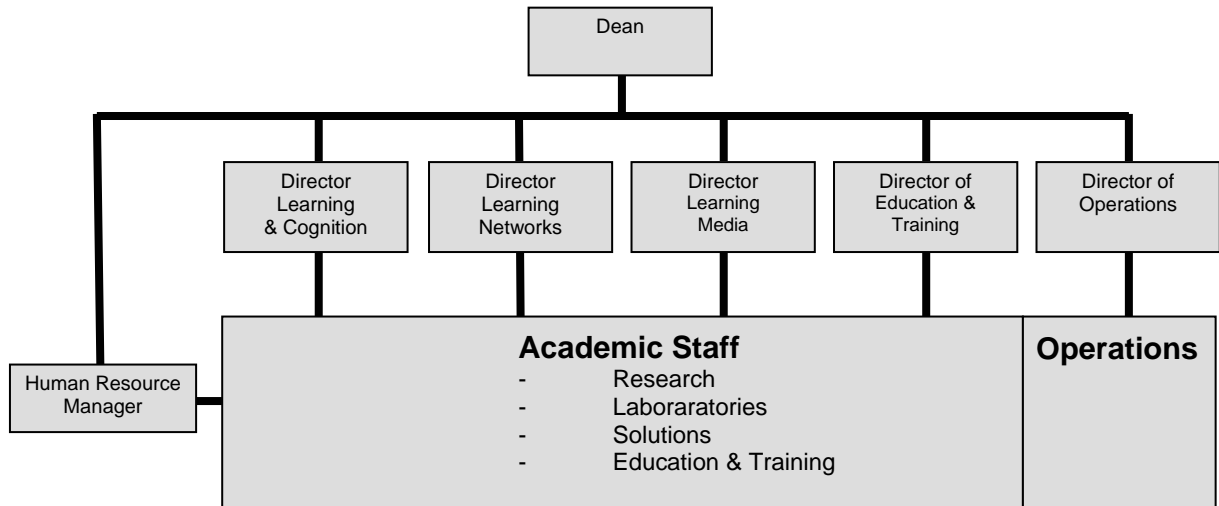


Figure 6. CELSTEC's organisation chart.

The Learning Media Programme is one out of four CELSTEC programmes (as explained in the introduction section, the other 3 programmes are the Learning Networks Programme, the Learning & Cognition Programme and the Education and Training Programme). Staffing of the programmes is arranged via a shared capacity group which is co-ordinated by the human resources manager. Additionally, the operations unit provides administrative and secretarial support. For co-ordination between the programmes various mechanisms exist. At the level of research, technology development and valorisation separate co-ordinators are responsible for the alignment of activities, shared policies and shared procedures. Programme directors and co-ordinators have regular meetings, which are chaired by the dean of CELSTEC. When appropriate the capacity manager and the head of operations attend these meetings.

In addition to projects and activities that are positioned in the CELSTEC programmes, part of the CELSTEC capacity is used for projects with a transcending or integrated nature, combining expertise on learning media, learning networks, learning and cognition, and education curricula. This mechanism furthers the coherence of the work within CELSTEC.

Also, all CELSTEC programmes contribute to the IPO Programme which procures the implementation of educational services of the Open University Faculties. This contribution amounts up to 11.5 fte (in 2008) and can be considered valorisation of CELSTEC expertise.

Performance

Output targets

From its launch, the Learning Media Programme will emphasise its valorisation and technology development activities. Accredited research will be expanded in the course of the years. This does not affect the scientific ambitions of the Programme, however, and eventually it will comply with shared output standards in the scientific community. In the first two years after the launch investments are necessary for the establishment of personal expertise, theme projects, instrumentation, networks, track records and reputation. By year three, output performance is assumed to match common standards. The output comprises scientific, peer-reviewed journal papers about approaches, models and methods for innovative learning media and the associated working prototypes and services; also, contributions to scientific conferences, professional journal papers and presentations will be realised. Performance indicators for valorisation are less standardised, but can be expressed by taking into account the valorisation activities that are listed in the established CELSTEC policy document "The New CELSTEC" (CELSTEC, 2008). According to this policy, valorisation includes the following activities:

- **Dissemination: the propagation of scientific results**
In addition to scientific papers and conference contributions, dissemination comprises network participation (committees, boards), popularisation (presentations, columns, debates, interviews, papers, symposia), licences and students internships.
- **Assimilation: the promotion of external inputs to the Programme**
This includes consultations of external parties, visiting staff from industry and educational institutes.
- **Co-operation: creating added value by working together**
This involves strategic alliances with external partners, joint projects and facility sharing.
- **Incubation: impulses for entrepreneurship and business development**
This concerns contributions to new products and services.
- **Transfer: the handing over of knowledge and artefacts**
This involves courses, workshops and training sessions, innovation consultancy and participation in innovation projects.

Table 2 lists the quantitative output targets of the Learning Media Programme.

	Rate	Year 1		Year 2		Year 3		Year 4		Year 5		Year 6	
Scientific staff		6.0		6.8		8.0		9.0		10.4		12.0	
		Weight	Total	Weight	Total	Weight	Total	Weight	Total	Weight	Total	Weight	Total
Scientific papers	1.2	50%	3.6	50%	4.1	100%	9.5	100%	10.9	100%	12.5	100%	14.4
Professional papers	1.2	50%	3.6	50%	4.1	100%	9.5	100%	10.9	100%	12.5	100%	14.4
PhD diplomas			pm		pm		pm		pm		pm		pm
Conference presentations	3	50%	9.0	100%	20.7	100%	23.8	100%	27.3	100%	31.3	100%	36.0
Software products			pm		pm		pm		pm		pm		pm
Committees	0.5	50%	1.5	100%	3.4	100%	4.0	100%	4.5	100%	5.2	100%	6.0
Popular contributions	1.5	50%	4.5	50%	5.2	100%	11.9	100%	13.6	100%	15.7	100%	18.0
Student internships	0.2	100%	1.2	100%	1.4	100%	1.6	100%	1.8	100%	2.1	100%	2.4
Visiting guests	1	100%	6.0	100%	6.9	100%	7.9	100%	9.1	100%	10.4	100%	12.0
Joint projects	1	100%	6.0	100%	6.9	100%	7.9	100%	9.1	100%	10.4	100%	12.0
Facility sharing	0.5	50%	1.5	100%	3.4	100%	4.0	100%	4.5	100%	5.2	100%	6.0
Products and services development	0.2	50%	0.6	50%	0.7	100%	1.6	100%	1.8	100%	2.1	100%	2.4
Workshops and training sessions	2	100%	12.0	200%	13.8	100%	15.8	100%	18.2	100%	20.9	100%	24.0
Innovation consultancy	1	50%	3.0	100%	6.9	100%	7.9	100%	9.1	100%	10.4	100%	12.0

Table 2. Quantitative output targets.

In general, the output of the programme is assumed to be proportional to the number of scientific staff. The second column displays the suggested standard output indicators per fte. Two types of modifications have been carried out. First, output targets for reviewed scientific papers have been corrected for 40% R&D effort, opposed to 60% valorisation. Second, for some activities it is assumed that during the start-up period of year 1 and year 2, the output per fte is half the (standardised) output per fte. Workshop and training sessions, joint projects, visiting guests, and student internships will apply 100% rate right from the launch. PhD-diplomas and software products could not be specified at this stage. Because of the partial transfer of PhD-students from previous programmes the diplomas will only be partly on the account of the programme.

In addition to the output listed in table 2 the successful acquisition of external funding is a general performance indicator of the Programme. As has been indicated in table 1, external funding is estimated a stable rate of 50%. Primary funding will be allocated for the following types of activities:

- Special projects which accentuate the profiles of the themes
- Seed money for promising, but risky projects
- Contributions in partnerships
- Professionalisation
- Overhead (meetings, acquisition, proposals; to be minimised).

Quality assurance

The programme will conform to the quality assurance policies within Celtec that apply for research, technology, development and valorisation, respectively. Quality assurance of the Programme is pursued by a series of measures. These include:

- Consultation and review of the Programme description document
- A mid-term review (year 3) of the Programme, linked with a self-evaluation
- The options of intermediate adjustments of Programme strategy
- Project organisation
- Compliance with (inter) national standards for research and technology development according to the criteria of the Standard Evaluation Protocol of VSNU (Association of Universities in the Netherlands), NWO (Netherlands Organisation for Scientific Research) and KNAW (Royal Netherlands Academy of Arts and Science) (VSNU, 2003), which covers quality, productivity, relevance, vitality and feasibility.
- Participation in accredited research schools (e.g. SIKS)
- Peer-reviewed software artefacts
- Evaluation of customer satisfaction and partner satisfaction
- PhD students policy (evaluation of PhD plan and daily supervision)
- Internal reporting within CELSTEC of progress
- R&O-talks (Results and Personal Development talks)

As has been suggested by the review committee the creative co-operation of people within the Programme is of great importance. To amplify the (unbound) creativity of faculty the Programme will consider the option of offering 10 - 20% of time for exploration of any media-related topics ("fun projects" which would not require formal approval).

More details about quality assurance are presented in part B of the Programme document.

Risk assessment

The following risks are identified:

- **Swift outdateding of technologies**
The high rates at which new media technologies and devices are becoming available may easily effect outdateding of existing software tools and technologies. The CELSTEC Laboratory equipment as a whole is likely to become obsolete within one or two years.
Risk limitation measures include 1) stable and flexible basic CELSTEC Laboratory infrastructure design, 2) substantiated technology decisions based on profound technology scouting and comparisons, 3) the pursuit of incremental upgrading of the CELSTEC Laboratory rather than radical upgrading.
- **Constraints through security issues**
The CELSTEC Laboratory infrastructure may suffer from campus-wide security measures which oppose the proper application of new technologies, for instance mobile and wires services, ultra wide band media, tracking services, or the access or distribution of services which use specific ports and protocols.
The Learning Media Programme strives for open communication with the Computer Department (ICTS) to discuss solutions. If the security policies cause severe constraints for the Programme, it will jointly with ICTS pursue policy modifications

which maintain the overall level of security, but leave sufficient moving space for the Programme.

- **Technology adoption problems**
Emerging media technologies and devices may eventually be rejected by the consumer market, or their penetration and adoption may fall short, which reduces the opportunities for wide implementation or valorisation of project outcomes.
Approach: As far as possible the outcomes of the Learning Media Programme will be formulated at a conceptual level, describing the models and principles apart from a particular technology.
- **Limited primary funding**
The Programme anticipates a steady growth of external funding. It thus runs the risk of appointing too much temporary staff relative to regular staff. Consequently, problems may arise with the consolidation of expertise and with the coaching of PhD students and other temporary workers. Likewise, the sustainability of the CELSTEC Laboratory is at risk. The uncertainty of growth has been marked as a severe threat by the review committee, because the Programme will require a critical mass to fulfil its ambitions. It has been suggested to maximally exploit the opportunities to involve scientific staff of external departments, in particular staff members of Open University faculties, for which a financial compensation mechanism will be available. Exactly for the Learning Media Programme, with its orientation on content, the involvement of subject matter specialists covering content domains is highly valuable.
- **Limited valorisation**
Valorisation activities not only require sufficient products and services to be offered, but also a well established reputation and recognition as a learning media specialist. Consequently, valorisation income may fall short during the first years as it may demand more time than anticipated to establish its position.
The Programme addresses this risk by emphasising its valorisation activities in its start-up strategy.
- **Staffing problems**
Specific learning media expertise is not widely available: in particular the combination of pedagogy (instructional design), media development and media technology is scarce. Especially, in the case of temporary, externally funded projects staffing may be difficult, delayed or even impossible.
As is the case for CELSTEC as a whole, the Programme will take a proactive attitude to use personal and professional networks for addressing potential candidates.

Start-up strategy

Because of the Programme's explorative nature a sufficiently wide scope – as defined by the Programme themes – will be required. Yet, appropriate specialisation will be necessary in order to build coherent core expertise and establish a clear profile. During the first two years after the Programme's launch this profile will be developed. The review committee pointed at the option of mixed reality solutions, including real world sensors and acting, in view of mutual entanglement of physical and virtual reality. Especially in continuing education and training-on-the-job, this may quickly become very relevant, as some existing projects around Augmented-Reality indicate. Such profile also would strengthen the coherence between the three themes.

During the first two years special measures are necessary to amplify the Programme's prosperous maturation.

First, the Programme will establish the CELSTEC Laboratory by arranging the infrastructure and by developing appropriate configurations, services and demonstrations. To this end it will define (small) internal launching projects; it will also use student internships in the CELSTEC Laboratory as a amplification mechanism.

Second, because of the Programme's strong external orientation, it will build (inter)national R&D and valorisation networks. Network parties will be informed and involved during the Programme definition phase and are asked to comment on the draft version of the Programme document. Soon after the start, network parties will be invited for a Programme launch symposium which will be combined with the opening of the CELSTEC Laboratory. The invitation also holds for parties within the Open University.

Third, the Programme will put extra efforts in its external visibility. It will work together with the web-portal innovation project of the Open University and give priority to establishing external presence. It will use rich media solutions to establish its position as an advanced learning media specialist. Also the separate branding and positioning of the CELSTEC Laboratory is a priority.

Fourth, the programme will prioritise technology scouting by scanning new developments, tools, literature, devices and approaches. Such mapping of the state of the art serves the CELSTEC Laboratory projects, and is a requirement for establishing the Programme as a specialist in the field.

Fifth, the Programme will participate in externally funded projects. Participation in externally funded projects has been ensured from the start because of early anticipation of CELSTEC. This involves projects at a national level as well as European projects within the eContentPlus Programme and the Framework Programme-7. Yet, continued acquisition activities will be undertaken to warrant continuity and growth of the Programme.

Sixth, in order to be successful in valorisation, target groups and innovation types will have to be made more explicit. In accordance with the joint valorisation strategy of CELSTEC at least two professional areas will be considered, both suffering from severe quantitative and qualitative problems: teaching and health care.

Finally, the Programme will develop workshops for each of the three themes and advertise these as its first valorisation offers.

Relevance

The Learning Media Programme is the Open University's response to the promising developments and high expectations in new media technologies. Without any doubt new media will find their way to education and learning, while they will provide learners with unbound access to rich media content, multiple channel communication and contextualised and personalised learner support. Although many new media technologies are being introduced in educational settings already, there is only little research directed to empirical evidence for its effectivity. The Programme's added value is strongly associated with the systematic and structural effort to link new media technologies, tools and devices to innovation and improvement of learning. It will not be sufficient to build an interesting game which pleases its players but does not contribute significantly to the improvement of learning outcomes or learning effectiveness.

The Programme addresses societal learning needs that exceed the boundaries of the classroom. The sensible design of informal learning, work-place learning, contextualised learning and other modes of mediated learning is loaded with questions that need to be answered. It is the Programme's ambition to understand and develop the ways that media technologies extend and improve learning.

The Programme seeks to develop and configure new arenas for learning. It will incorporate new subsidiary technologies which effect intelligent processing of user data, new modalities of human-machine interaction, e.g. visual interaction modes, language technologies and smart dialogue, and new models of content aggregation and synchronisation. Also, the Programme will co-operate with parties in adjacent domains, especially the domain of computer gaming, for the bidirectional exchange of complementary expertise.

Due to its positioning within CELSTEC, the Learning Media Programme may profit from the availability of a substantial group of technology-enhanced learning experts which cover both cutting-edge R&D as well as the achievement of practical solutions. Also, CELSTEC has built its experience on design and development of educational media ever since the launch of the Open University in 1984. Moreover, because of its extended national and international networks, CELSTEC provides a solid base for the Learning Media Programme to build an external network of partners.

The Learning Media Programme thus makes available relevant knowledge and expertise both inside and outside the Open University and establishes the Institute's international reputation as an learning media frontrunner.

References

- Adorno, Th.W. (1991) *The Culture Industry: Selected essays on mass culture*. London: Routledge.
- Andrew, D. (1984) *Concepts in film theory*. Oxford: Oxford University Press.
- Bandura, A. (1977). *Social Learning Theory*. New York: General Learning Press.
- Bates, A. (1995) *Technology, Open Learning and Distance Education*. London/New York: Routledge.
- Beck, K. (2000) *Extreme Programming Explained: embrace change*. Boston: Addison-Wesley.
- Bie, D. de (2002) *Het beperkte nut van onderzoek*. HBO-Journaal, 10, 40-41.
- Booch, G., Rumbaugh, J. & Jacobson, I. (1999) *The Unified Modeling Language User Guide*. Boston: Addison-Wesley.
- Borgmann, A. (1984) *Technology and the Character of Contemporary Life*. Chicago/London: University of Chicago Press.
- Bruner, J.S. (1961) *The art of discovery*. Harvard Educational Review, 31, 21–32.
- Burgoon, J.K. (1978) *A Communication Model of Personal Space Violation: Explication and an Initial Test*. Human Communication Research, 4, 129-142.
- Burkhardt, H. & Schoenfeld, A.H. (2003) *Improving Educational Research: Toward a More Useful, More Influential, and Better-Funded Enterprise*. Educational Researcher, 32(9), 3–14.
- Cassirer, Ernst (1923; 1925; 1929) *Philosophie der symbolischen Formen*. Berlin: Bruno Cassirer. Translated as: *The Philosophy of Symbolic Forms*. 3 vols. transl. Ralph Mannheim; (1953; 1955; 1957) New Haven: Yale University Books.
- Clarck, R. (2001) *The Literary Encyclopedia, Catharsis*. University of East Anglia, accessed online May 26, 2008 at <http://www.litencyc.com/php/stopics.php?rec=true&UID=170>.
- Clark, R.E. (1983) *Reconsidering research on learning from media*. Review of Educational Research, 53(4), 445-459.
- Clarck, R.E. & Estes, F. (1998) *Technology of Craft: What are We Doing?* Educational Technology, September-October, 5-11.
- De Freitas, S. & Oliver, M. (2006) *How can exploratory learning with games and simulations within the curriculum be most effectively evaluated?* Computers & Education, 46, 249-264.
- De Jong, T, Specht, M. & Koper, R. (2008) *A reference model for mobile social software for learning*, International Journal for Continuous Engineering Education and Lifelong Learning, 18-1, 118-138.

Design-Based Research Collective (2002) <http://www.designbasedresearch.org/>, retrieved April 7, 2008.

Dick, W., & Carey, L. (1996) The Systematic Design of Instruction (4th Ed.). New York: Harper Collins College Publishers.

Joint Quality (2008) Dublin descriptors: <http://www.jointquality.nl/>, retrieved April 18, 2008.

Feenberg, A. (1991) Critical Theory of Technology. New York: Oxford University Press.

Garris, R., Ahlers, R. & Driskell, J.E. (2002) Games, Motivation and Learning. Simulation and Gaming. An Interdisciplinary Journal of Theory, Practice and Research 33(4), 43–56.

Hall, E.T. (1966) The Hidden Dimension. Doubleday, New York: Garden City Double Day Press.

Hastings, N.B & Tracey, M.W. (2005) Does Media Affect Learning: Where Are We Now? TechTrends 49(2), 28-30.

Heidegger, M. (1977). The question concerning technology and other essays (trans. Lovitt, W.). New York: Harper and Row.

Heinich, R. (1984). The Proper Study of Educational Technology. Educational Communications and Technology Journal, 32 (2), 67-87.

Hickman, L. (1990). John Dewey's Pragmatic Technology. Bloomington/Indianapolis: Indiana University Press.

Horizon Report (2008) Horizon Report Edition 2008, Stanford: New Media Consortium and Educause Learning Initiative.

Jaspers, K. (1931). Die geistige Situation der Zeit. Berlin: Göschen.

Kaestle, C. (1993) The Awful Reputation of Education Research. Educational Researcher, 22(1), 23–31.

Kaufman, R. (1998) The Internet as the Ultimate Technology and Panacea. Educational Technology, 38(1), 63-64.

Kearsley, G. (1998) Educational Technology: A critique. Educational Technology, March-April, 47-51.

Keller, J.M. (1987) Development and Use of the ARCS Model of Motivational Design. Journal of Instructional Development, 10(3), 2-10.

Kolb D.A. (1984) Experiential learning. Englewood Cliffs NJ: Prentice-Hall.

Kozma, R.B. (1991) Learning with media. Review of Educational Research, 61(2), 179-211.

Kurzweil, R. (1990) The Age of Spiritual Machines: When Computers Exceed Human Intelligence, New York: Penguin.

Lave, J. & Wenger, E. (1991) Situated Learning. Legitimate peripheral participation, Cambridge: University of Cambridge Press.

Leshin, C.B., Pollock, J. & Reigeluth, C.M. (1992) *Instructional Design Strategies and Tactics*. Englewood Cliffs, NJ: Education Technology Publications.

Ma, Y., Williams, D., Prejean, L. & Richard, C. (2007) *A Research Agenda for Developing and Implementing Educational Computer Games*. *British Journal of Educational Technology* 38(3), 513–518.

McLuhan, M. (1964) *Understanding media: the extensions of man*. New York: McGraw-Hill.

Michael, D. and Chen, S. (2006) *Serious games: games that educate, train and inform*. Boston, MA: Thomson Course Technology.

Milgram, P. and Kishino, A.F. (1994) *Taxonomy of Mixed Reality Visual Displays*, *IEICE Transactions on Information and Systems*, E77-D(12), pp. 1321-1329.

Nash, J. (1950) *Equilibrium points in n-person games*. *Proceedings of the National Academy of Sciences* 36(1), 48-49.

OUNL (2006) *Strategie Open Universiteit Nederland 2006–2009, Groeien met leven-lang-leren*. Strategy paper, document U2006/4514, Heerlen: Open Universiteit Nederland.

Papert, S. (1980) *Mindstorms: Children, computers, and powerful ideas*. New York: Basic Books.

Peirce, C.S (1982) *The Writings of Charles S. Peirce: A Chronological Edition*. Volumes 1–6. Eds. Peirce Edition Project. Bloomington IN: Indiana University Press.

Piaget, J. (1950) *The Psychology of Intelligence*. New York: Routledge.

Plasterk, R.H.A. & Rouvoet, A. (2008) *Mediawijsheid, letter to the Dutch Lower House*, MLB/M/5242, April 19, 2008; last accessed May 26, 2008.

Prensky, M. (2006) *Digital Natives*. *Learning in the Digital Age* 63(4), 8-13.

Reeves, B, and Nass, C. (1996) *The Media Equation: How People Treat Computers, Television and New Media Like Real People and Real Places*. Cambridge MA, Cambridge University Press.

Resnick, L. B. (1988) *Learning in school and out*. *Educational Researcher*, 16(12), 13-20.

Saussure, F. de (1916) *Cours de linguistique générale*. Ed. C. Bally and A. Sechehaye, with the collaboration of A. Riedlinger, Lausanne and Paris: Payot; trans. W. Baskin, *Course in General Linguistics*, Glasgow: Fontana/Collins, 1977.

Schank, R.C. (1995) *Engines for Education*. New York: Lawrence Erlbaum.

Serious Game Initiative (2002) <http://www.seriousgames.org/>, last accessed May 26, 2008.

Shannon, C.E. & Weaver, W. (1949) *The mathematical theory of communication*. Urbana: University of Illinois Press.

Stokes, D.E. (1997) *Toward a New Research Paradigm. Pasteur's Quadrant: Basic Science and Technological Innovation*. Washington DC: Brookings Institution Press.

OECD (2007) *Thematic review of tertiary education in the Netherlands*. Accessed online May 26, 2008 at <http://www.oecd.org/dataoecd/24/31/38469224.pdf>

OUNL (2006) *Strategie Open Universiteit Nederland 2006–2009, Groeien met leven-lang-leren*. Document U2006/4514. Heerlen: Open Universiteit Nederland.

Van Gog, T., Hummel, H., Bruggen, van J., Kostons, D., Merriënboer, van J. and Koper, R. (2006) *CELSTEC PhD Guide*. Heerlen: Open University of the Netherlands, accessed May 26, 2008 at http://dspace.ou.nl/bitstream/1820/872/1/Updated%20CELSTEC%20PhDguide_2006_approved%20by%20MT.pdf

VSNU, KNAW, NWO (2003) *Standard Evaluation Protocol 2003-2009 for Public Research Organisations*, accessed online May 26, 2008 at <http://www.knaw.nl/publicaties/pdf/90000091.pdf>.

Westera, W. (2005) *Beyond functionality and technocracy: creating human involvement with educational technology*. *Educational Technology & Society*, 8 (1), 28-37.

Westera, W. (2006) *OU CELSTEC Laboratory*. Heerlen: Open Universiteit Nederland.

Westera, W. (2007) *OU-lab for Pervasive Learning Media*. Heerlen: Open Universiteit Nederland.

Westera, W., Nadolski, R.J., Hummel, H.G.K. & Wopereis, I.G.J.H. (2008) *Serious games for higher education: a framework for reducing design complexity*, *Journal of Computer-Assisted Learning*, doi: 10.1111/j.1365-2729.2008.00279.x, Accessed online May 26, 2008 at <http://www.blackwell-synergy.com/doi/abs/10.1111/j.1365-2729.2008.00279.x>

Wiener, N. (1948) *Cybernetics: Or the Control and Communication in the Animal and the Machine*. Cambridge, MA: MIT Press.

Zimmermann, A., Lorenz, A. & Specht, M. (2005). *Personalization and Context-Management*. *User Modeling and User Adaptive Interaction (UMUAI)*, *Special Issue on User Modeling in Ubiquitous Computing*, (15), 275-302.

PART B. Programme Management

Organisation details

The organisational structure of the Programme as explained in Part A (cf. figure 3) goes with a set of regular meetings for management, co-ordination and knowledge sharing. Basically, the following meeting types are envisioned (see table 3):

Meeting	Participants	Agenda	Duration (est.)	Rate
Programme management	Programme chair Theme leaders	Strategies, policies, approval of projects and proposals, co-ordination, staffing, acquisition, publicity, facilities, external relationships	60 minutes	Monthly
Bilateral management meetings	Programme chair Theme leader	Theme-related strategies, projects, staffing, acquisition, publicity, facilities, external relationships	30 minutes	Twice a month
Theme meetings	Theme leader Theme members	Projects, Activities, Needs, Proposals	30 minutes	Monthly
Programme Plenary	All participants of the programme	All relevant topics for the Programme	1 hour	Monthly
Seminar (webcast)	All participants of the programme; external visitors	Media specialist topics	1 hour	Monthly
CELSTEC Laboratory and technologies meeting	Technical staff and occasional internal stakeholders	Exploitation, function and development of the CELSTEC Laboratory	1 hour	Monthly
Bilateral staff	Programme Chair Individual faculty	Informal meeting about functioning	30 minutes	Twice a year

Table 3. Meeting schedule

Because of the formal decisions on projects and policies, minutes will be taken of the Programme management meetings. The minutes will be accessible for all members of the Programme. Note that the rates in table 3 are tentative and don't imply the impossibility of urgent talks. In addition to the meetings listed, various ad hoc meetings and project meetings will be necessary.

Projects

All productive activities in the area of research, development and valorisation will be carried out as projects (this does not hold for Programme meetings, external contacts, acquisition, writing of proposals, brainstorming and professionalisation). Project proposals may be initiated by all participants of the programme. The route to approval may differ for various types of projects (internal projects, collaborative projects, tender proposals, offerings), but in principle includes the following steps:

- **Initiation**
All participants are challenged to come up with new ideas. Ideas may concern either student projects, staff projects or collaboration projects. New ideas are captured in a short description (typically 1000 words) as to explain the core idea, the objectives, the motives, the envisioned outcomes and a rough estimate of the efforts needed. Complementary to this bottom-up procedure, the Programme management may occasionally ask faculty to produce a specific idea description. All ideas are registered in order to preserve eventual value.
- **Sharing and discussion**
Idea descriptions are subjected to plenary discussion, commenting and evaluation. This may take place in the programme plenary or in a virtual group space. In case of urgency, for example when external parties are involved, the latter option prevails.
- **Idea approval**
Theme leaders and the Programme chair are entitled to put an idea on the agenda of the Programme Management meeting for approval. This means that the owners of the idea are asked to elaborate a project plan. Again, urgency may compel to an ad hoc meeting.
- **Plan approval**
Project plans for external bodies conform to obliged standards. Internal projects use a prescribed format. The owner of the project plan registers it for discussion in the Management meeting, where it will be approved or rejected. Decision criteria are: the match with the Programme objectives and strategy, urgency/priority, quality, feasibility, available resources, cost. In principle, all projects are allocated to one of the Programme themes. In case of external obligations which involve contracts and billing an official offering will be necessary which requires the parallel approval by the Head of Facilities. After approval, project administration facilities will become available (registration of hours and budget).
- **Project monitoring**
During execution of a project, the monitoring of progress is the responsibility of the theme leader. Monitoring will be periodical and concerns planning, progress, quality, functioning and deliverables. The facility unit of CELSTEC provides administrative support; for instance, it presents overviews of hours spent and hours left.
- **Project evaluation**
After completion of a project the project manager, or the staff member who is responsible for the CELSTEC part of the project, provides a brief evaluation to the theme leader. In case of external customers, their satisfaction will be evaluated. Publicity and dissemination will be considered. Time booking entries in the administration will be closed.

Quality assurance

The programme will conform to the quality assurance policies within CELSTEC that apply for research, development and valorisation, respectively. Quality assurance of the Programme is pursued by a series of measures.

Consultation and review

Before the Programme starts, the Programme document will be subjected to a formal review by an external committee of outstanding experts in the field. During the preparation phase which precedes the review, a draft version of the Programme document will be discussed with CELSTEC staff, Open University departments and managers of Open University key projects. Also, a draft version will be handed to external parties which may have interests or expertise in the domain of learning media. These external parties may well become part of the external network that the Programme will bring about. All comments on the Programme document will be taken in consideration for improving the quality of the document. In case of a positive assessment by the review committee, the Programme document will be presented to the Scientific Committee of the Open University. Eventually, the Programme document will be approved by the dean of CELSTEC.

Adjustments and mid-term review

Interim modifications of the Programme may become necessary due to changing conditions, changing interests or a changing context. These modifications may include alternative themes as well as organisational issues. This requires an update of the Programme document and the associated approval of the Dean of CELSTEC. In case of big changes the review committee will be consulted. A mid-term review of the Learning Media Programme will be carried out by the review committee after three years of operation. This mid-term review will be largely based on a topical self-evaluation report of the Programme.

Quality standards for research and development

R&D-activities of the programme will be linked with one or more relevant national research schools (i.e. SIKS, ICO or ISED) or with NELL, the Netherlands Laboratory of Lifelong Learning which is a focused research programme of the Open University. Consequently, the R&D activities will conform to the criteria of the Standard Evaluation Protocol of VSNU (Association of Universities in the Netherlands), NWO (Netherlands Organisation for Scientific Research) and KNAW (Royal Netherlands Academy of Arts and Science) (VSNU, 2003). The Standard Evaluation Protocol prescribes an external research evaluation once every six years and a self-evaluation once every three years. It uses four main criteria for research quality assessment:

- **Quality**
This concerns a measure of excellence and excitement. It refers to the eminence of a group's research activities, its innovative potential and its achievements in the international scientific community.
- **Productivity**
This refers to the total output of the group, indicating the publicised results of research and knowledge. Usually, quantitative indicators (publications, citations, impact factor) are used for this, as has been established in physical and life

sciences. In social sciences and humanities, however, such quantification of output is known to be problematic. Alternative measures are explored by VSNU.

- **Relevance**
This criterion covers both the scientific and the technical and socio-economic impact of the work. Research choices are assessed in relation to developments in the international scientific community or, in the case of technical and socio-economic impact, connected with important developments or questions in society at large.
- **Vitality and feasibility**
On the one hand, this criterion measures the flexibility of a group, which appears in its ability to close research lines that have no future and to initiate new venture projects. On the other hand, it measures the capacity of the management to run projects in a professional and (cost-)effective way.

Consequently, all scientific research staff is required to obtain membership of a relevant research school.

For technology development the scientific output may not only concern journal papers and conference contributions but may also include specific software components that have separate value as a prototype or proof of concept in access to its instrumental function in experiments. Such software components will be made available to the open source software community in order to be tested and reviewed by peers.

Quality of valorisation

As valorisation covers a wide variety of activities it is difficult to apply uniform quality standards. In case of external services or joint projects with external parties, the Programme continues common practice of CELSTEC to evaluate its contributions by assessing performance and customer satisfaction. Dimensions of such evaluation are quality, communication, flexibility, reliability and management. Most subsidising bodies apply separate reviews to assess and maintain quality, which provides valuable feedback. Self-explaining quality indicators are available when new products or concepts are actually being implemented and used, when the outcomes of surveys effect changes, or when advice to third parties is acted upon.

PhD students policy

The Programme complies to the PhD students policy as described in the Personnel Plan Capacity Group 2008 of CELSTEC. It provides a guarantee for thesis work up to 50% or 60%, depending on the funding source. For the rest of the time PhD-students will be participating in other projects to be decided on by the Programme chair. PhD students are assigned a PhD supervisor and a daily supervisor who will provide frequent support. Also, each PhD candidate has a supervisory committee; this commission consists of the supervisor, the daily supervisor and researchers with expertise in the field of study. The initial appointment of a PhD student will be for one year only. After the first year of work an assessment will be carried out in order to decide upon the quality of the work and the chances of successfully achieving a PhD-degree. The assessment will be based on a plan for the PhD route, functioning and eventual output. In case of a positive assessment, the appointment will be continued up to a total of 4 years. More details can be found in the CELSTEC Ph-D guide (Van Gog, 2006).

Internal reporting

Twice a year the Programme will report to the CELSTEC management team about the progress made as compared with the agreed output and activities. To this end a report is drafted according to the matrix of table 4, which covers indicators for output, quality, external success and realisation for the activities in research, technology development, valorisation (inclusive education) and management.

	Research (accredited)	Technology development	Valorisation (incl. education)	Management
Output	Publications PhD diplomas	Innovative products	Projects/results	Personnel R&O Facilities
Quality	Rating/impact	Downloads Rating Conferences	Customer satisfaction Customer continuity Evaluations	Expertise level Staff changes Health Feedback
Success	Co-operations External funding	Co-operations External funding	Co-operations External funding	Contributions to OUNL
Effort	Budget vs. realisation	Budget vs. realisation	Budget vs. realisation	Input

Table 4. Standard matrix for internal reporting.

Also the Programme will yearly present and discuss its performance in a CELSTEC plenary staff meeting.

R&O-talks

The Programme will arrange yearly R&O-talks (Results and Personal Development talks) with each staff member to evaluate personal functioning, new tasks, career options, support measures, among other things.

Knowledge sharing

All staff participating in the Programme will apply the tools and techniques that are available in the CELSTEC Laboratory environment for sharing ideas and resources, reporting and working together. These techniques include the use of personal (video) conferencing, virtual worlds, web-based desktop services, podcasting, (internal) blogging, mobile learning services. Regularly, the toolset to be used by the whole team will be frequently updated to ensure topicality of techniques.

Support structure of the CELSTEC laboratory

The CELSTEC Laboratory will be an important backbone for R&D, incubation, demonstration and valorisation of new learning media technologies. The basic CELSTEC Laboratory infrastructure comprises Windows server, Linux Server and Apple OSX server facilities. These will be accessible for internal and external parties and serve as the core of the CELSTEC Laboratory's internal network. A variety of support facilities will be put in place, ranging from co-operation and awareness facilities, media creation and distribution workbenches, configuration and testing facilities, showcase facilities, future workplace facilities, rooms for end-user experiments and detailed feedback and user analysis.

Cooperation

The CELSTEC Laboratory will offer an integrated media creation and distribution infrastructure based on a Distributed File System allowing access to the media from any workplace in the lab and supporting file sharing and project work. Furthermore the CELSTEC Laboratory will offer synchronous co-operation facilities like audio conferencing, video conferencing and VOIP in special team room settings. Instant messaging facilities will be integrated with a notification mechanism in the laboratory. Table 5 displays solutions that will be used at the start of the Programme.

Co-operation	Solutions at start-up
Integration File Sharing	<ul style="list-style-type: none"> ● Internal file sharing via DFS, Integration with Active Directory ● Public Web-based file sharing with BSCW for Remote Access ● Public SURFGroepen for Partner Projects, Integration with Video Conferencing ● FTP access, WEBDAV access
Communication	<ul style="list-style-type: none"> ● Instant Messaging with Skype, AIM, and MSN, Jabber (Integrated IM Client) ● VOIP, Audio conferencing ● Group Video Conferencing Facilities in the Media and Team Rooms with fixed installations, ● Individual mobile conferences with headsets and laptops

Table 5. Co-operation facilities at the start-up of the Programme

Awareness and information support

The CELSTEC Laboratory infrastructure will be the basis for awareness support, information monitoring mash-ups and reflection support mechanisms. Based on an integrated portal the lab will enable users to monitor shared information streams and news feeds of relevant topics. A customised portal solution will furthermore allow the sharing of information in workgroups on different levels of granularity ranging from shared bookmarking systems to group blogs, and micro-blogging facilities (table 6).

Awareness	Solutions at start-up
Information mash-up	<ul style="list-style-type: none"> ● Internal Blog/ELGG infrastructure for remote working and project reporting ● Internal WIKI for shared document creation and documentation of developments, reviews and technology scouting ● CELSTEC Laboratory Events Calendar (N.B. integration with CELSTEC calendar)
Presence	<ul style="list-style-type: none"> ● Awareness Infrastructure like Team.sSpace
Shared resources	<ul style="list-style-type: none"> ● Flickr group accounts ● Social Reference System, BIBTEX, EndNote, APA Compliant, BibSonomy

Table 6. Awareness facilities at the start-up of the Programme

Media creation

The media creation and distribution facilities will support highly developed workbenches for new media development, ranging from podcast, vodcast production and learning object authoring, to serious game design and scripting (table 7).

Media creation	Solutions at start-up
Streaming repository	<ul style="list-style-type: none"> ● Windows Media Streaming Directories for Access by Windows Vista Media Center ● Internal Podcast Directory via iTunes ● Internal Vodcast Directory via iTunes and Web
Lecture webcasting	<ul style="list-style-type: none"> ● Lecture Room Recording via Lecturnity
Rich media authoring	<ul style="list-style-type: none"> ● Vodcast/podcast workbenches ● Game authoring and scripting workbenches

Table 7. Media creation facilities at the start-up of the Programme

Financial conditions

The Learning Media Programme has committed to achieve a continuous growth of its staff volume from 10 fte in year 1 up to 20 fte in year 6. The assumption is that primary funds make up a stable 50% of the budget. This implies that primary funds show a steady increase over the years from 5 fte in year 1 up to 10 fte in year 6.

Maintenance and upgrading of the CELSTEC Laboratory will require a yearly material budget for licences of software tools, infrastructure facilities, new computer hardware and new media devices. After the initial investments in the CELSTEC Laboratory set-up the yearly budget is estimated at k€ 6 per fte, mainly for hardware purposes (80%) and partly for software (20%). Table 8 displays the material budget projection over the years.

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
CELSTEC Laboratory software upgrades (k€)	7.2	8.3	9.5	10.9	12.5	14.4
CELSTEC Laboratory hardware upgrades (k€)	28.8	33.1	38.0	43.7	50.1	57.6
CELSTEC Laboratory total material costs (k€)	36.0	41.4	47.5	54.6	62.7	72.0

Table 8. Material budget for CELSTEC Laboratory maintenance and upgrading

Personnel cost of CELSTEC Laboratory administration and management are covered by the CELSTEC's Faculty Unit, as are secretarial support and administration.

PART C. Appendix

Basic concepts: media and the learning arena

Media are the carriers of content and communication. The term medium is a container: it covers a wide range of devices, platforms and channels that are being used for the creation, storage, distribution and representation of messages. Thus, digital media include word processors, camera's, hard disks, radio and TV receivers, cell phones, GPS-trackers, the world-wide web and many more. This great variety of devices, channels and variables is likely to produce substantial complexity in the learning arena: the envisioned multimedia environment for learners to perform their tasks. The general assumption is that the future learning arena combines a variety of rich media applications. To get to grips with the complexity of the learning arena a descriptive model of the learning arena is displayed in figure 7.

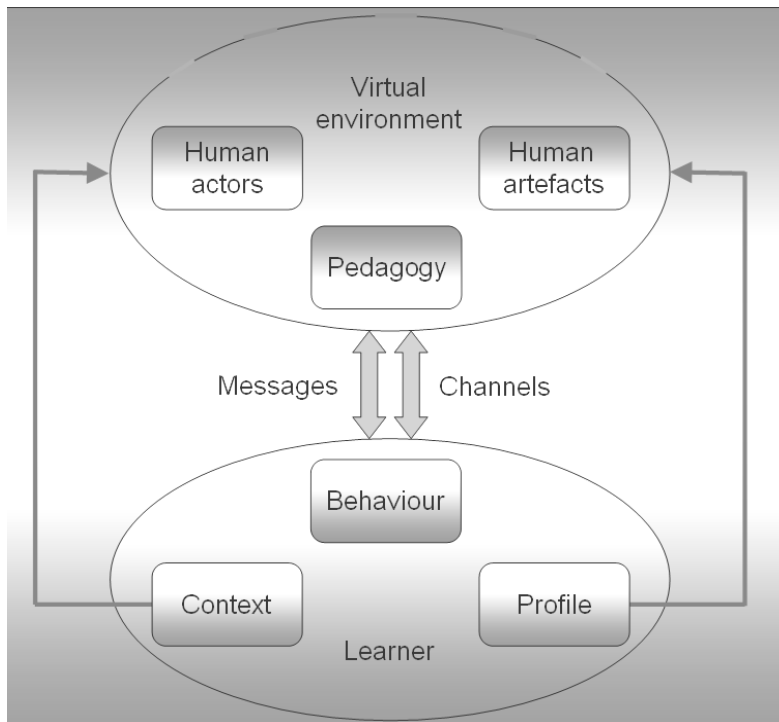


Figure 7. Descriptive model of the learning arena

The model's starting point is the individual learner on the one hand, and a (virtual) environment that supports learning, on the other hand. Below, the key concepts are briefly explained.

The learner's profile

Learner characteristics define the learner's personal, psychological conditions that are relevant for learning: capabilities, ambitions, intentions, attitude, expertise and the actual state of mind. These conditions may change over time. Learner profile information is be fed back to the virtual environment to enable adaptive and personalised learning.

Virtual environment

The learner accesses a virtual environment that is built out of objects. It is supposed to produce a meaningful context for learning. Two different types of objects are distinguished:

- Human artefacts
Human artefacts may be media tools, like a word processor or a webcam, but they also cover the reflection of human knowledge and human culture: scientific papers, a recording of a symphony orchestra, the 3 dimensional model of the Eiffel tower or specific educational content. By definition, all object representations and graphical sceneries in the virtual environment are human artefacts. This also holds for virtual representations of natural objects: the sea, the sky, a mountain, an elephant, a tree, characters, etcetera.
- Human actors
In many respects, learning is a socially embedded activity (Bandura, 1977). Learning is supported by communication with fellow learners, experts, teachers and others, all of which have their own personal characteristics.

Note that the virtual environment is essentially an open system that allows versatile interactions with the outside world.

Pedagogy

The objects in the virtual environment are imbued with pedagogy. Basic pedagogical functions concern:

- Learning content and tools
- Learning tasks
- Instructional strategies
- Learner testing
- Guidance, support and feedback

Messages

From a technical perspective, messages are the building blocks of communication (Shannon, 1949). However, messages differ fundamentally from data or information because of attached meaning, obscured intentions redundancy and noise: messages remain to a great deal implicit while they comprise emotional responses, nonverbal cues, cultural connotations and sub-symbolic signs. Understanding messages requires wisdom rather than intelligence. Rich learning environments are produced by the complex aggregate of messages, and their effectiveness is determined by their ability to provide involving learning experiences and generate ambient awareness rather than the mechanical exchange of messages.

Channels

The learner interacts with the environment through one or more channels. The channels may support different modalities and address different symbol systems (speech, vision, music, text, formulas, etc.) and senses. According to communication theory (Shannon, 1949) communication channels are always subjected to bias, noise and distortion, that is, mediated representations are due to produce a truncated view of the world. Consequently, one channel cannot simply be replaced with another channel because of translation losses. This notion is in accordance with the substantive view on technology and Cassirer's proposition of the incommensurability and the untranslatability of different channels and symbol systems (Cassirer, 1923).

Learner context

While learning is about insight and understanding, the learner should interpret messages in a meaningful way. As meaning is strongly related with context, the learner is not considered an isolated psychological entity, but a responsible human actor whose identity and mental state is closely connected with its socio-cultural and physical context. The socio-cultural context relates to the social or cultural frame of reference that defines the learner's position: i.e. at work, at home, on a holiday trip, in a courtroom or shopping. The physical context refers to place and time, and the associated material conditions that support or affect the learners functioning. It may make a great difference for the learner to be in a classroom, to travel on a highway by night or wander through the burning desert without any water. Learner context information is increasingly fed back to the learning environment to enable adaptive, context-sensitive and personalised learning environments. Rather than using static learner profiles for matching user needs, the emerging technologies for tracking real time context information (location, time, temperature, situation) as well as biometric records (heartbeat, blood pressure, skin resistance) offer new opportunities for integrating the physical world and the virtual environment and for developing new modes for learning and teaching.

Learner performance

The learner's responses imply a certain behaviour which can be judged against performance standards, expectations or impact. In turn, such data can be fed back to the environment. This adds to the opportunity for self-regulation of the system (Wiener, 1948). Indeed, feedback loops enable systems to become adaptive and to learn, because they can improve their functioning by learning from the consequences of previous performances. Naturally, this also holds for human learning.

Programme Boundaries

The scope of the Learning Programme and its themes have been described in fairly general terms to allow sufficient room for demand driven research and for emerging areas of interest. Additional remarks can be made to explain and establish the boundaries of the Programme.

The overall focus of the Programme is on media for learning. This relates directly to learning content and the content-related transactions and communications between the various persons involved. The Programme will devise and deal with various approaches of content structuring, content authoring, content presentation, content management, content annotation, content standards, content delivery and content sharing. By its nature, however, the Programme will not act as a content developer, nor as a content provider; instead it will create and disseminate new expertise in the field.

The aims of the Programme are pedagogical in kind. Starting from the media perspective the Programme will preserve the effectiveness, attractiveness and efficiency of learning by covering the issues of structuring, learner assessment, learner support and learner feedback. It will explore and create new scenarios for mediated learning and evaluate proposed methods, their impact and the feasibility of their designs.

The programme will develop new learning technologies, but in doing so, it will heavily rely on emerging technologies that may be of significance for learning. To a certain extent it will act as a technology integrator which combines cutting edge technologies into new learning arenas. It will scout and evaluate such new technologies and build sufficient expertise and understanding to work with these. The Programme will not necessarily produce robust, stable, affordable or scalable software systems meant for large scale implementations, because of its focus on pedagogical proofs of concept and working prototypes.

The core of the Immersive Media theme is the creation and mimicking of authentic and real world complexity for learning purposes. Yet, the Programme's focus is not especially on duplication and representation of all graphic, acoustic and symbolic details of reality. As has been demonstrated by Reeves (1996) only very little representational or technological efforts may be needed to provoke authentic responses amongst media users. A good example would be original computer games like Pac-Man which simple graphical interfaces achieves to arouse great tension and excitement of players, even when its "monsters" hardly look like monsters. Apparently, what counts is not realism or authenticity, but credibility (Westera, 2008). Since credibility is largely fostered by the situated learning content and problem case scenarios, the Programme will focus on these, rather than working on technical issues like smooth virtual character movement, 3D navigation devices or gesture recognition.

The core of the Social Media theme is content sharing, content tagging and content aggregation according to Web-2.0 approaches. The main objective is to incorporate web-2.0 approaches to boost active learner participation, self-directed learning and the exploitation of the collective expertise and creativity of groups of learners. The Programme particularly addresses the paradigm shift of user-generated content and the associated rich, personalised and socially contextualised learning experiences. This points at the media literacy topic as a necessary condition for social media learning. The Programme will preserve its content (media) perspective and will not focus on community building per se or on the content-independent networking patterns that underlie the behaviours of distributed learners. In addition, the theme description identifies asynchronous media as the main driver for social contextualisation. This suggests that real-time communication and virtual classroom conferencing are not central.

The Mobile Media theme reflects the seamless integration of media technologies with our everyday lives. The main issues here are ubiquitous access to learning resources and the contextualisation and personalisation of learning in authentic environments. It covers cross-media creation and delivery of learning content, as well as the adaptiveness of content and learner support functions to individual profiles, actual learner performances and the parameters that determine the learners' geographical and socio-cultural context. This contextualisation hints towards settings for non-formal and informal learning, i.e. workplace learning or learning on the road. As for technology, the Programme will need to develop system interfaces and tuned user-interfaces for mobile content presentation, but it will not bother too much with mobile network infrastructures and development of mobile hardware.

Appendix 1. Consultations

The draft programme document has been commented by various parties inside and outside the Open University. Comments have been taken into account as much as possible. Draft copies of the document have been sent to the following persons (table 9):

Name	Affiliation
Prof. Dr. Emile Aarts	Philips Research
Prof. Dr. Lex Bijlsma	Faculty of Computer Science, Open University of the Netherlands
Prof. Dr. Jan Borchers	Media Computing Group, RWTH Aachen University
Prof. Dr. Herman van den Bosch	Faculty of Management Sciences, Open University of the Netherlands
Dr. Rob Bruijnzeels	Vereniging Openbare Bibliotheken
Prof. Dr. Karin Coninx	Expertise Centre for Digital Media, Universiteit Hasselt
Dr. Bas Cordewener	SURF Foundation
Dr. Paul Dirckx	Fontys University of Applied Sciences
Dr. Tom Dousma	SURF Foundation
Prof. Dr. Eddy Flerackers	Expertise Centre for Digital Media, Universiteit Hasselt
Prof. Dr. John Gerrichhausen	Ruud de Moor Centre, Open University of the Netherlands
Prof. Dr. Jaap van den Herik	Institute for Knowledge and Agent Technology (MICC/IKAT)
Prof. Dr. Rene van Hezewijk	Faculty of Psychology, Open University of the Netherlands
Dr. Ben Janssen	Open University of the Netherlands
Dr. Simon Jones	Human Computer Studies, Universiteit van Amsterdam
Prof. Dr. Wim Lamotte	Expertise Centre for Digital Media, Universiteit Hasselt
Dr. Toine Maes	Stichting Kennisnet
Prof. Dr. Rob Martens	Veringa Chair, Open University of the Netherlands
Dr. Patrick McAndrew	Institute of Educational Technology, Open University UK
Dr. Jan-Kees Meindersma	Stichting Kennisnet
Dr. Pete Mitton	Learning Technologies Solutions, Open University UK
Dr. Irma van der Ploeg	Hogeschool Zuyd
Dr. Zsófia Ruttkay	Human Media Interaction, University of Twente
Dr. Pieter Rotteveel	CELSTEC Laboratory-Amsterdam, Hogeschool van Amsterdam
Dr. Robert Schuwer	OPEN Educational Resources, Open University of the Netherlands
Dr. Kathleen Schlusmans	IPO Programme, Open University of the Netherlands
Dr. Peter Scott	Knowledge Media Institute, Open University UK
Dr. Pieter Spohr	Stichting Nederland Breedbandland
Prof. Dr. Josie Tailor	Institute of Educational Technology, Open University UK
Dr. Marjan Vernooy,	SURF Foundation
Dr. Aart van der Want	Stichting Teleac/NOT

Table 9. Distribution list of draft programme document.

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