LEARNING SCIENCES AND BRAIN RESEARCH

Report of the Launching Meeting of Phase II

Royal Institution, London 29-30 April 2002

The Venue

The launching meeting of Phase II of the "Learning Sciences and Brain Research Project" was held at the Royal Institution, London, UK, 29-30 April 2002. The meeting was funded by the British Ministry of Education (DfES), the Lifelong Learning Foundation, the National Science Foundation (NSF), RIKEN Brain Sciences Institute, and the Japanese Ministry of Education, Culture, Sports, Science, and Technology (MEXT).

The Purpose

The purpose of this meeting was to:
1) forge a clear idea on substantive and specific research questions,
2) understand the synergies that could develop between the three networks in literacy, numeracy, and lifelong learning, and
3) define the operational plans for each network (future meeting dates and publications).

The Participants

Along with the network coordinators and their advisors, leading scientists from different countries attended as network members or as observers. Special guests included the Vice-Minister of China, Wei Yu and National Science Foundation Program Officers, Kenneth Whang and Michael Martinez. Members of the British Ministry of Education (DfES) and the Lifelong Learning Foundation were also present along with OECD-CERI staff members.

Opening Remarks

In her opening statement, Gail Cardew, Head of Programs at the Royal Institution explained that the purpose of the original charter of the Royal Institution was to "diffuse science for the common purposes of life", which she translated as, "doing science and communicating science."

The Royal Institution has a long history where discoveries came to light and science is pursued, thus their hosting this meeting by and at the Royal Institution was a nice fit with the educational goals of the OECD-CERI "Learning Sciences and Brain Research Project".

Richard Bartholomew, Divisional Manager of the British Ministry of Education (DfES), and another co-host of this launching meeting stated that the focus of interest and funding of his department concerns long-term and fundamental issues affecting education and skills rather than just short term policy work. He pointed out that CERI's brain project is a "key aspect of our own strategy of improving the connection between the evidence base provided by research in education policy practice and is relevant to our understanding about how people learn and learn best." He cautioned on orienting brain research too narrowly or too pathologically and called for attention to the interdisciplinary approach inherent in the collaboration between neuroscientists, cognitive psychologists, and educationalists. He cited statistics of poor learning among young children (in the UK): "around 7 milllion people do not have the basic level of numeracy and literacy". He called for a renewed understanding about successful learning strategies for the most disadvantaged groups of children and affirmed the need for brain research applied to educational practice. Bartholomew welcomed the network on life-long learning as a means for people to adapt their skills to the increasing pace of economic change. The benefits, he affirmed, are not only in labour market success, but are also found in prolonging employment and engaging in active learning. He recognised, as did Masao Ito that continued learning throughout the lifespan might play an important role in delaying the onset of degenerative brain disorders. He called for a shift in focus towards an increase in *healthy* life expectancy, not just for an increase in the number of years lived. Moreover he insisted on two key-points of the project: 1) understanding how all of us learn is more important than understanding pathological examples and 2) "interdisciplinary is absolutely crucial".

Around 7 million people in the UK do not have the basic level of numeracy and literacy

Jarl Bengtsson (right), Counsellor and Head of CERI, reported that over the last two years, the "Learning Sciences and Brain Research" project has received increasingly strong support from CERI's Governing Board and that most member countries rank it as their number 1 priority for CERI work in the next 3 years.Education is a very important part of OECD's activity and the Secretary General has repeatedly stated that "Education is the priority of priorities." OECD member countries know a great deal about the functioning of education, that is, the costs, organisation, and student results but, as Dr. Bengtsson stressed, they know very little about learning, how it takes place, and how unlearning and relearning happen in the brain. In researching appropriate gains for education, he firmly asserted that our research must be based on "hard" science, that we must be interdisciplinary in our approach and global in our co-operation with others. Due to the different disciplines, different cultures, and different traditions inherent in this project, there are, according to Dr. Bengtsson, three different outcomes for this endeavour: 1) discovering valid implications for policy and practice; 2) realising that research is too complex to provide immediately useful data; and 3) recognising the potential of this research and the need for extended studies. Regardless of the outcome, this endeavour will clearly help us to understand the emerging role of neuroscience in educational practice.

Most OECD member countries rank the Brain project as their number 1 priority for CERI work in the next 3 years

Research Agendas

All three-network co-ordinators originally proposed background information pertaining to what a general three-year work programme could include. After a day and a half of break-out discussions with the networks, their members and observers, the network advisors presented more specific plans of an agreed upon three year research agenda to the conference participants.

Each network proposed different research agendas pertinent to key aspects of educational practice, however common points (criteria) existed within all three in terms of:

- *target audiences (policy-makers, practitioners, parents, and other "end users"),*
- *population served (children, young adults—with the LLL network adding infants and the elderly to their agenda),*
- *remediation efforts (respectively, functional recovery of damage in the elderly, dyslexia, and dyscalculia),*
- *horizontal goals (synthesis of available data and the use of computer assisted technology: websites and software programmes)*

Lifelong Learning Network (LLN)

Due to changing demands from a societal and biological perspective, the time is right, according to Masao Ito (right), the LLN co-ordinator, to apply basic cellular neuroscience to the benefit of education.

Even with advancing age, brains are still plastic and open to learning and relearning

In order to implement this, he called for both a systematised knowledge base (to include definitions of terms and criteria for reliable results) and an open dialogue between policy-makers, educationists, and scientists (initially by FAQ's on the OECD website) in order to identify what they want to know. The goal of this network is to incorporate basic hard science into recommendations/directions for policymakers, educators, healthcare providers, and parents. It should also empower OECD to encourage funding from its member countries for research areas with an immediate private financial interest. *The research should be restrained to brain functioning in order to focus on interesting fields for the LLN*.
Their project is divided into 4 strategic and transdisciplinary areas:
1) infancy and early childhood;
2) childhood and adolescence ;
3) aging.
The basic concepts guiding this network are that the human brain develops through infancy and childhood to establish the conscious self, that brain growth continues through adolescence, and that even with advancing age, brains are still plastic and open to learning and relearning. The overarching issues pertinent to brain health across life span are: nutrition and drugs, stress management, physical fitness, emotional regulation, and sleep as they apply to brain function. Dr. Ito initially presented 10 major research topics, divided over the above stages. After breakout discussions, Takao Hensch, the network advisor, presented the three-year proposed plan:

Early childhood issues:

Topics	Associated researchers and their laboratories
• Sensitive Periods[1]	Takao Hensch, RIKEN Institute, Japan
• Speech-sound learning in Babies	Risto Näätänen, Univ. of Helsinki, Finland
• Environmental (Maternal, stress) Influences	Michael Meaney, McGill University, Canada

Adolescent issues:

Topics	Associated researchers and their laboratories
• Cognitive Control of Emotions	John Gabrieli, Stanford University, USA
• Learning of Art and Music	Manfred Spitzer, University of ULM, Germany
• Development of Sensorimotor Function	David Wolpert, UCL, UK
• The Formation of the Self	TBD

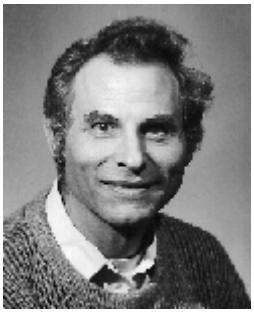
Adult-Survivor Issues:

Topics	Associated researchers and their laboratories
• Functional Reorganisation in Aged Damaged Brains	Hideaki Koizumi, Hitachi Advanced Research Laboratory
• Delaying the Brain Ageing	TBA
• Learning in an information-based aged Society	Art Kramer, University of Illinois, USA

Important dates for upcoming meetings and publications include: First network meeting in early December 2002 at RIKEN in Japan; Annual inter-network meeting in 2003 and 2004 culminating with a final activities report by March 2005.

Literacy and Reading Skills Network (LRS)

Initially, Mike Posner (right), the LRS network co-ordinator, presented the different kinds of information the literacy network will use to establish a viable research agenda for the next three years. The major goals of this network serve to help children acquire literacy by:



Newly available brain imaging tools will enable us to see how one brain area communicates with another in carrying out the tasks of reading

- *Synthesising literacy and comprehension information*—both brain based and behavioural—from many laboratories;
- *Developing working models* and performing meta-analysis on that information;
- *Implementing web-based learning tools* for the widest possible group of users.

The goals of this network are ambitious. However, Dr. Posner believes that due to the new tools and methods available for probing the acquisition of the skill of reading, it will be possible to carry

[1] Dr Ito insists on the following issue: What is the difference between a critical period and a sensitive period? To give an answer to this question, please refer to the publication untitled "Understanding the Brain - Towards a New Learning Science", OECD, 2002.

out the proposed programme. Some of the proposed tools include functional imaging through PET and fMRI along with scalp electrical recordings (EEG), and diffusion tensors (looking at the diffusion of water on white matter pathways *in order to see white matter connections between grey matter areas*). *Using these tools has one purpose, which is to see when the brain areas become activated for tasks (easier and fairly complex) of reading, come "on-line" and when they're involved in a task. Actually, for Dr. Posner, "it will become a very important tool to see how one area communicates with another brain area in carrying out the task of reading".* The development of working models is important because correctly matching what real brain networks do with a simulated network will allow researchers to model various kinds of activities which may potentially help children to learn to read. Dr. Posner stated that developing software for educators is beneficial in helping them understand more clearly what they are doing when they teach.

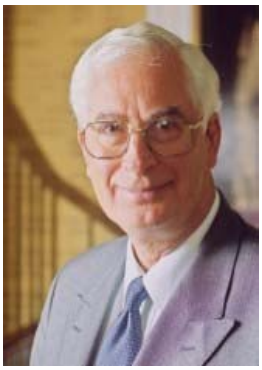
After the breakout sessions, Bruce McCandliss, the network advisor, reported that the overarching goals of the literacy network are: 1) dissemination and 2) innovation. According to him, literacy could be one of the areas in education, where there could be the most meaningful exchange at the very basic issues in practice and science. The general guidelines for this network are to continually focus on brain mechanisms as they pertain to literacy and to ensure the utility or accessibility of this information. The target audience includes policymakers as well as educators, curriculum designers, parents, and children. Dissemination also involves discussions of established points of agreement in the literacy literature but also non-consensus points in the scientific literature with a focus on the misconceptions and myths surrounding neuroscience and its impact on education. This network will have three foci, each including the study of integrative models linked to brain mechanisms and interventions linked to brain imaging, specifically:

- How the Skilled Brain Reads. Subtopics include phonology, semantics, and visual processes with attention to the impact of different writing systems on different brain pathways.
- The Biological Bases of Dyslexia. Subtopics include phonology and visual processes applied to visual words; physiological bases and functional networks with a concentration on the role of experience in education to impact change, once again with a focus on different writing systems.
- How Literacy Develops in the Brain. Subtopics include phonology and decoding (early screening and intervention), development of visual specialisation and brain plasticity, *as well as* learning an orthography in *a second language*.

To meet the goals of this network, Dr. McCandliss stated that there would need to be a co-ordination of research results written by science writers geared toward making these materials accessible. Additionally, web designers would be needed to design multi-tiered content (targeted for different audiences) contributed by the network scientists to ensure an interactive and continually updated content. Also, concrete definitions could be given here to give people a sense of critical elements that differentiate a dyslexic from a non-dyslexic reader, as well as examples of intervention tools in scientific literature, to help educators get a feeling for these things. This could then lead to further open questions. As a dissemination of this information is needed all over the world, it would initially be in English, and later translated for end users in other countries.

Numeracy and Math Skills Network (NMS)

Christopher Ball (right), the NMS network co-ordinator, opened up his session with a discussion of nursery rhymes. He stated that nursery rhymes could be considered "pre-school curricula" as they are learned by children before they enter the school system.



Nursery rhymes are often focused on numeracy rather than literacy ("1, 2 buckle my shoe; 3, 4 shut the door" etc.) Is it possible that numeracy might develop first in the brain, even though literacy is more widely researched than numeracy?

Nursery rhymes are often focused on numeracy rather than literacy ("1, 2 buckle my shoe; 3, 4 shut the door" etc.) and Sir Ball questioned if it is because of this that numeracy might develop first in the brain, even though literacy is more widely researched than numeracy. He stated that the overarching goals of this network would be transdisciplinary, strategic (in terms of desirable social goals), and global. More specifically, the network goals could be known by the 4 R's:

Relevance – to the end user: learners and school systems,
Rigor – by engaging in sound scientific inquiry,
Readable – by being accessible to the public as well as to media sources,
Results – in order to change the lives of children and adults.

Sir Ball posed three fundamental questions to reflect upon as this network starts its work:
1) How can we insure that the network is transdisciplinary, global, and strategic?
2) Can we succeed in making a difference to children and adults directly?, and
3) How can we be focused and inclusive?

After the breakout discussions, Stanislas Dehaene, the network advisor, summarised what the numeracy group had decided upon as their areas of research. Horizontal issues to be addressed for all goals include:
- up-to-date reports of the latest scientific knowledge *to have a good review for scientists and other groups*,
- a list of tentative educational consequences (as they become available),
- a list of open questions both from a scientific and an educational perspective, and
- new research proposals as identified by present research efforts.

The specific domains that this group will address are:

- The Developmental Trajectory of Numeracy. Combining adult research in mathematics with infant research on numeracy, this network will use both neuroimaging technology and psychological information to understand when critical changes occur and selective competencies become available. This point would also address gender and cultural differences, and the role of numerical experiences in the first years of life.
- A Taxonomy of Dyscalculias. Different types of dyscalculias exist in which the medical conditions differ. This group hopes to find and/or create the tools, which allow a differentiation of dyscalculias as well as those serving in a diagnostic intervention and rehabilitation capacity. This point would include research on the relationship between dyscalculia and dyslexia; and biological vs. social origins (maths anxiety, early brain insults).

- Evaluation and Design of Intervention Software. This would involve investigating school strategies, psychological and software interventions, the evaluation of an intervention (neuroimaging before and after the intervention) and training studies in adults.

The general learning strategies would have to be taking into account ("normal" learning, gifted learning) and the research on dyslexia would need to be taken further, taking into account genetics, epidemiological studies and the cerebral disorganisation. Dr. Dehaene also proposed to make available freely on the web, games that would present the new diagnostic and intervention software.

Special Presentations: Emotions, Learning, and the Brain

Two horizontal presentations were delivered on emotional competency. The first one, by Wei Yu, Vice-Minister of Education from the People's Republic of China, focused on the importance of cultivating emotional intelligence from a policy perspective.

With a focused attention on providing education for all, the Chinese Government now enrolls over 99% of their 300 million students in primary education. As such, their attention is now centered on making sure that education is both of high quality and well balanced *between emotion and cognition in the brain* and that their students grow to be successful citizens. The key to providing this, according to Wei Yu, is to encourage emotional competency as it provides both balance and quality. Success, as defined by Wei Yu, includes the cultivation of positive social interactions, the ability to endure hardship and pressure, as well as persistence in task completion—all emotional characteristics. As emotions have been shown to be related to early experience, Wei Yu appeals to the educational sector to engage in early emotional competency training. Research has shown that in China the majority of parents emphasise academic achievement over emotional competency.

Wei Yu acknowledges that various factors have contributed to the parents' almost exclusive focus on education, namely, rapid economic development, industrialisation, and the Cultural Revolution. Parents of today's school-aged children lost their educational opportunity during this time in history. Now that education for all is available, they are driven to pressure their children to achieve academically as a means of securing a better future. Wei Yu stated that over 13 million teenagers in China have suffered from different categories/levels of learning and behaviour disorders, presumably linked to the lack of emotional development. As such, China is eager to understand how research on emotional competency in education may be able to improve the lives of countless students.

A recent survey involving 13,000 students and their parents revealed that eighty percent of parents cited academic achievement as their major concern *whereas 80% of children denounced the emotional stress put on them by their parents*.

The second session, presented by David Servan-Schreiber (right), Professor of Psychiatry, University of Pittsburgh, School of Medicine, USA, focused on emotional intelligence from a scientific perspective.

The lack of emotional intelligence is a major deterrent to learning and social success

According to David Servan-Schreiber, emotional competency or intelligence refers to one's ability to self-regulate, that is, to restrain one's impulses and instincts, but also includes the capacity for compassion, and the ability to engage in co-operation. The lack of emotional intelligence, according to him, is a major deterrent to learning and social success. Emotional intelligence appears to be determined by the presence of attentive adults during development, and concerns the emotional input and attention that parents and teachers regularly give young children. Servan-Schreiber asserted that it might be possible to teach emotional skills to children who have had a lack of support and discussed a new experimental approach regarding the development and training of emotional skills. Given that emotions are linked to physiology and that physiology is trainable and re-trainable, he states that retaining physiology has the potential for improving learning and performance over the lifespan, via the emotions.

In resent research, the "emotional brain", controlling the autonomic system and hormone regulation was selectively activated at the exclusion of all other parts of the brain. This ability to selectively activate the emotional brain independently of any neocortical structures has opened areas for new research in emotional regulation. Servan-Schreiber stated that when the emotional and the cognitive parts of the brain work together, faster learning and improved performance are the result of this co-operation. To more fully describe this synergy, he introduced a new concept: physiological change as a guide to emotional development. The key concept here is that because the heart and brain are inter-connected, a change in one system influences changes in the other. The heart rate coherence (or the pattern of the heartbeat) affects the output of the emotional brain and changes, such as a decrease in blood pressure or an increase in beneficial hormonal secretion or even a decrease in reaction time have been reported. In other research, students receiving heart rate coherence training scored significantly higher on tests as compared with controls.

The ability to selectively activate the emotional brain independently of any neocortical structures has opened areas for new research in emotional regulation

Good coherence has to do with a regularly patterned variability in the heart rate (a sinusoidal pattern). Heart rate intervals are never the same between consecutive beats, though there is a pattern of constant acceleration and deceleration. This fluctuating pattern is actually crucial to survival as it enhances the organism's adaptability to physiological and environmental demands. Variability, states Servan-Schreiber, is associated with health and younger people have more variability, though it does decrease with age. However, variability can be trained which is important for cognition and learning. He asserted that the evidence linking emotional intelligence to physiology is strong and that the evidence that physiology can be retrained is suggestive, and finally, that the evidence that training physiology improves learning requires further research before any firm conclusions can be made.

Emotional development or competency was included as a special session because of its importance across the lifespan. Emphasis on emotional intelligence focuses on problem solving, conflict resolution, empathy, coping, and communication skills.
Recent research has shown that when the emotional and the cognitive parts of the brain work together, faster learning and improved cognitive performance results. This topic is a horizontal topic to all three networks. Though all networks are thematically different, it is anticipated that

Recent research has shown that when the emotional and the cognitive parts of the brain work together, faster learning and improved cognitive performance results

research on emotional competency will serve as a reference point encouraging cross-fertilisation of ideas and concepts among and within the networks.

Conclusions

The concluding session was held in two parts. Part 1 introduced proposed Internet and media use for network information dissemination, and part 2 featured commentary from guest speakers, their reflections as well as their notes of caution.

Part 1 – Internet and Media Use

In the first part, Emile Servan-Schreiber discussed how Internet and media resources could be best used for research dissemination. He affirmed that the target audience includes policymakers, educators, parents, and students. However, to reach this diverse audience with varying needs, Internet (web) use as well as media contacts will be crucial to successfully disseminating research findings. He suggested that high profile science journalists could be contacted and direct contact made with network advisors for information exchange.

Dr. Servan-Schreiber asserts that there is a strong need for science journalists/writers who would be willing to participate in network meetings and follow the process very closely. These people, whether freelance or associated with particular publications around the world, would be asked to write reviews on state-of-the-art research coming from each of the three networks. These reviews would be available on a dedicated website. However, as Dr. Servan-Schreiber points out, “there is no point putting up a website unless the media is alerted to it”, to make the website known to the public. So, he proposes that the science journalists/writers associated with the project familiarise themselves with the project in order to refer to it in other publications they may write for. Dr. Servan-Schreiber stated that the web should have multiple purposes, among them: 1) dissemination of information, 2) opening a dialogue between policymakers and educationalists, 3) use of a separate site for network members to engage in discussion amongst themselves, 4) dissemination of remedial software, 5) a site dedicated to “hoax busting” and FAQ’s. Furthermore, a regular chronicle about the project could be made available, specifically targeted to the press, about every three months.

Part 2 – Reflections and Cautionary Tales

Five experts were called to give their reflections, advice and concerns regarding the proposals presented during this two-day conference. There was overall praise for CERI’s project in terms of scientific content, educational implications, and collaborative goals for the future. Although each of the panellists offered various and different orientations for the successful launching of the three networks, there were three common points. The first one concerned emotional competency. Several of the speakers reiterated that the focus on active research in emotional competency was vital to the improvement of educational practice. A second focus concerned proposed network communication with policymakers. Panellists encouraged information dissemination to be specific and persuasive to the concerns and needs of policymakers in order to facilitate implementation of research findings into policy. The third point was a request for “trialing.” Experts thought that small-scale research conducted onsite would be useful for hypothesis testing and generation, to “see if the ideas work and to provide a persuasive argument for change”, instead of just making proposals that might work.

Other fundamental suggestions included focusing on an impact strategy. This involves devising a strategy for moving the concepts, potentials, and ideas generated from each network to the implementation phase. How to enact this suggestion was partly advanced by some of the other panellists when recommending that CERI reflect upon the basic obstacles facing educational change today. These include realising that political decisions of accountability do not necessarily include brain-based educational practices, that the very nature of information (textbooks) is intrinsically hard to change and thus, new information would not, or only with great difficulty, be included, and finally that the professional development of teachers has not served as a catalyst for classroom change. Successfully establishing this project and responding to educational challenges therefore depends, according to panellists, on establishing inclusive and mutually beneficial relationships with all partners involved in the educational process: policymakers, teachers, parents, and researchers. Additionally, understanding that there are multiple paths and approaches to solving some of education's more resilient problems, CERI must be rigorous in its methodology and as one panellist advocated, conduct systematic reviews in order to ensure research quality as an objective means of transferring brain research to educational practice.

Next Steps

The London launching meeting has successfully laid the foundation for the emergence of brain-based educational research protocols, tools, and results. Co-ordinating approximately two dozen laboratories and research centers around the world along with their associated staff and neuroscientists is an enormous and important task both for the individual network co-ordinators and the OECD-CERI Secretariat. Different cultures, political agendas, and languages all contribute to making this project initially challenging to manage. However, the promise of viable research, pertinent and useful to educational practice is strong. As such, the upcoming individual network meetings and advisory group meetings will be crucial to establishing, refining, and eventually redirecting research plans for the next 3 years.

In the establishment of any new joint, multinational venture, there are always concerns and obstacles that arise and must be addressed in order to advance successfully to the stated objectives. The panel of experts voiced some of these and other helpful comments have been offered to the Secretariat after the meeting. All of these suggestions are important and are being seriously considered however, as this is a work-in-progress, not all answers are known. As network meetings are held, reports will be generated and distributed so that all members of the project can see how neuroscience research can benefit educational practice.

Annex 1

LEARNING SCIENCES AND BRAIN RESEARCH

Launching Meeting of Phase II
Royal Institution, London, 29-30 April 2002

Draft Agenda

Monday, 29 April 2001

9:30 - 10:00 *Registration*

Session 1: 10:00 - 12:30 / Introduction (Chair: Bruno della Chiesa, OECD-CERI)

10:00 - 10:30 *Opening* : - Gail Cardew, Royal Institution, UK
- Richard Bartholomew, DfES (British Ministry of Education), UK
- Jarl Bengtsson, Head of CERI, OECD

10:30 - 11:00 Pr. Masao Ito, Director, RIKEN Brain Science Institute, Tokyo, Japan
on "*Brain Development and Learning Over the Life Cycle: proposed agenda of the network"*

11:00 - 11:30 Pr. Michael Posner, Director, Sackler Institute, New York City, USA
on "*Brain Development and Literacy: proposed agenda of the network"*

11:30 - 12:00 Sir Christopher Ball, Chancellor, University of Derby, UK
on "*Brain Development and Numeracy: proposed agenda of the network"*

12:00 - 12:30 *Plenary discussion*

12:30 - 14:00 *Buffet lunch*

Session 2: 14:00 - 18:00 / Discussion Groups (separate meetings of the three networks, with observers)

Japan coordinated network on "Brain Development and Learning Over the Life Cycle"
UK coordinated network on "Brain Development and Numeracy"
USA coordinated network on "Brain Development and Literacy"

18:00 - 19:00 *Buffet dinner*

Session 3: 19:00 - 20:00 / Horizontal Topic: "Emotions, Learning and the Brain"
(Chair: Michael Martinez, NSF)

19:00 - 19:20 Dr. David Servan-Schreiber, University of Pittsburgh, School of Medicine, PA, USA on "*Emotions, Learning, and the Brain, from a scientific perspective*"

19:20 - 19:40 Dr. Wei Yu, Vice-Minister of Education, Beijing, China
on "*Emotions, Learning, and the Brain, from a policy perspective*"

19:40 - 20:00 *Discussion*

Tuesday, 30 April 2002

Session 4: 9:00 - 10:00 / Discussion Groups (separate meetings of the three networks, without observers)

Japan coordinated network on "Brain Development and Learning Over the Life Cycle"
UK coordinated network on "Brain Development and Numeracy"
USA coordinated network on "Brain Development and Literacy"

Session 5: 10:15 - 12:00 / Presentations of the results of sessions 2 and 4 (Chair: Richard Bartholomew, DfES)
(for each network: 15 mn presentation + 20 mn discussion)

10:15 - 10:50	Pr. Takao Hensch, RIKEN BSI, Japan *"Brain Development and Learning Over the Life Cycle: results of the group discussions"*
10:50 - 11:25	Pr. Bruce McCandliss, Sackler Institute, New York, USA *"Brain Development and Literacy: results of the group discussions "*
11:25 - 12:00	Pr. Stanislas Dehaene, INSERM, France *"Brain Development and Numeracy: results of the group discussions "*
12:00-13:00	*Buffet lunch*

Session 6: 13:00 - 14:00 / Conclusions (Chair: Jarl Bengtsson, OECD-CERI)

13:00 - 13:10	Dr. Emile Servan-Schreiber, OECD-CERI *"Phase 2: proposed Internet and media work"*
13:10 - 13:20	*Plenary discussion*
13:20 - 13:45	*"General conclusions of the meeting, from a scientific and/or a policy perspective" (5 mn for each speaker)* Dr. Christopher Brookes, Lifelong Learning Foundation, UK Pr. Eamonn Kelly, George Mason University, VA, USA Pr. Hideaki Koizumi, Hitachi Research Group, Tokyo, Japan Dr. Kenneth Whang, NSF, USA Dr. Robert Mace, DfES, UK
13:45 - 14:00	*Final plenary discussion*