

# ENGRAMMATA

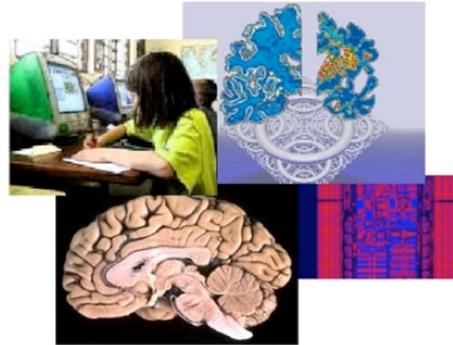
Educational Neuroscience Group for Research in Affect and Mentation / in Mathematics Education (ENGRAMME)

## ENGRAMMETRON

*Educational Neuroscience Laboratory  
Faculty of Education, Simon Fraser University  
Metro Vancouver, British Columbia, Canada  
Director: Stephen R. Campbell, Ph.D.*

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### TABLE OF CONTENTS

P1  
FROM THE  
DIRECTOR'S MIND  
Educational Neuroscience:  
Why bother?

P2  
OUTREACH

P3  
RESEARCH  
COLLABORATIONS

P3  
NEWS

P4  
VISITORS

P4  
PRESENTATIONS

P4  
CONFERENCES

## Educational Neuroscience: Why bother?

Pursuing educational neuroscience, neuroeducation, or neuropedagogy entails that educational researchers and practitioners engage the neurosciences in some manner or other. Some practitioners, recognizing the importance and value of so doing, and with little or no well-established alternatives, have in various degrees bought into various claims of what has come to be known as the "brain-based education" movement. There is a certain appeal and there are usually grains of truth to these claims, insofar as staying hydrated and eating well contributes to healthy brains. More critically minded educators, however, recognize that there is a grand gulf between neurons, studied in terms of physiological mechanisms, and learners, considered in more edifying psychological, social, and humanistic terms. Given the span of this grand gulf between education and neuroscience, the question inevitably arises: Why bother working toward bridging this gap? Is it, truly, still a "bridge too far" (Bruer, 1997). If educators are to take neuroscience and education seriously, it is helpful to address some common arguments for *not* doing so.

Byrnes (2001) presents three main arguments against the relevance of brain research to the psychology of cognition and learning. His first argument pertains to a computer metaphor, whereby brain is identified with hardware, and mind is identified with software. As educators interested in matters of mind, we restrict our consideration to the software-mind, independently of the hardware-brain. Byrnes then counter-argues that the computer metaphor is "anti-biological." Embodied views of cognition and learning are becoming more widely accepted, and these views entail *biological* foundations. Further, Byrnes suggests, interdependencies between software and hardware are much greater than commonly supposed.

A second argument against the relevance of neuroscience to psychology, and education more generally, is that these areas address different levels of analysis, and as such, they provide very different answers to the same questions. Byrnes illustrates this argument through the different kinds of answers that a physicist, physiologist, and psychologist attending a baseball game might provide to the ques-

tion “Why did [the pitcher] throw a curve ball?” Educational researchers are typically loath to reduce psychological questions to matters of physiology, let alone biology, chemistry, or physics. Byrnes, however, suggests there are important insights to be gained from studies seeking understandings of *interfaces* between different levels of analysis, and *especially* between psychology and physiology. One need not be a positivist or a reductionist to maintain that such interfaces must interrelate and interact in understandable and meaningful ways.

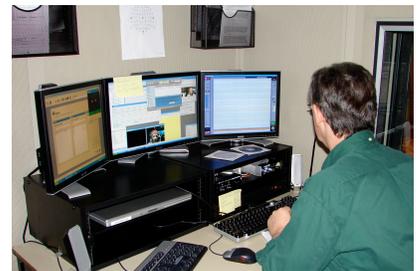
A third argument Byrnes poses for ignoring relationships between psychology and physiology, and neurophysiology in particular, is that too little is known about the brain at this point, and as brain science is in such flux, psychologists should just “forge ahead alone.” Byrnes, quite rightly, emphasises that psychology and the neurosciences have much to offer each other. This is a key point: psychologists, and educational psychologists in particular, have cognitive and psychometric models that can help guide physiological investigations in the neurosciences; and reciprocally, the results of those investigations, along with adopting and applying new methods in brain imaging, can help substantiate and refine models of cognition and learning developed by educational psychologists. Indeed, to paraphrase Byrne, collaborations between cognitive psychologists and neuroscientists have been “forging ahead

together,” resulting in the vibrant and rapidly expanding new field of cognitive neuroscience. Cognitive neuroscientists are deeply engaged in connecting cognitive function with brain and brain behaviour. Education can benefit greatly from these developments, and it seems untoward for educators and educational researchers to simply stand on the sidelines.

Much has been gained from quantitative, qualitative, and critical studies in education, and one must not neglect the value of such research in improving our understandings of teaching and learning in general, and teaching and learning *in situ*. Having said that, however, when data and ideas from educational research consists of field notes, questionnaires, audio and/or visual data, “talk-aloud” reports, and our theories and models of teaching and learning neglect the embodied nature of being, one may consider how much more value might be gained from more closely attending to mind, brains and bodies, *in toto*, in teaching and learning? Methods and tools of cognitive neuroscience and psychophysiology are now available for educational researchers to seek and provide new empirical insights in this regard. Members of ENGRAMME believe the time has come for education to inform and be informed by the neurosciences in disciplined ways. My Canada Foundation for Innovation funded Educational Neuroscience Laboratory (the ENGRAMMETRON)

serves as a central hub for ENGRAMME — a Social Science and Humanities Research Council of Canada funded Strategic Research Cluster. Collaborative projects and pilot studies ranging from metacognition and concept formation to math anxiety and biofeedback using state-of-the-art methods such as electroencephalography (EEG) and eye-tracking are now underway.

In this, the inaugural issue of our newsletter, ENGRAMMATA, we indicate ways in which we are pursuing these ends. I hope readers will find the information herein accessible, relevant, and of interest. Please stay tuned for our next issue, and do not hesitate to contact myself, or the lab's outreach coordinator, Kate Patten, if you would like more information or would like to become involved in some way.



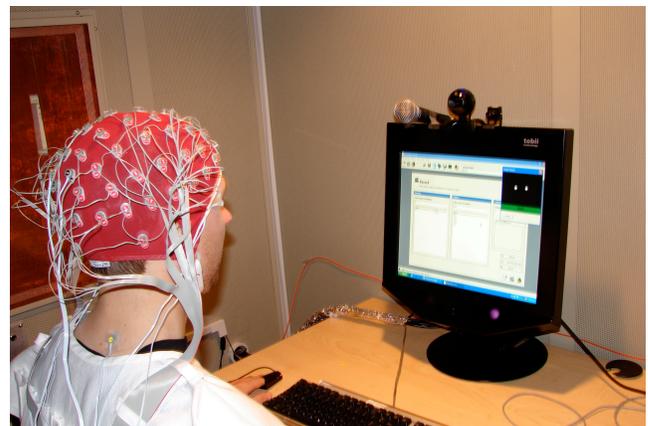
— Stephen R. Campbell, Ph.D.

#### References:

- Bruer, J. T. (1997). Education and the brain: A bridge too far. *Educational Researcher*, 26, 4-16.
- Byrnes, J. P. (2001). *Minds, brains, and learning*. New York: Guilford Press.

## ENGRAMMETRON REACHES OUT

ENGRAMMETRON's outreach includes Open Houses for the public and educators; private tours for visiting ENGRAMME members, and colleagues from industry and academe; presentations and workshops by members of the Educational Neuroscience Laboratory (ENL) group; this newsletter; 2 websites, one for educators and the interested public, and another for ENGRAMME members, and eventually to come, an on-line academic journal. Workshops available are listed on our website; to access a description of workshops, select “Outreach” and then “Looking for a workshop in Neuroscience?” To access the website, go to [www.grammetron.net](http://www.grammetron.net) Educators and any interested others may access various articles, bibliographies, and links when clicking on “Outreach” and then “Resources.”



Collecting data in the ENGRAMMETRON, using eye-tracking, skin conductance response, and EEG

## RESEARCH COLLABORATIONS

### Dynamic and Complex Relations Between Metacognitive Judgment and Metacognitive Control in Self-Regulated Learning

- Li Sha (Ph.D. Candidate)

This study investigates whether and how the relation between learners' metacognitive judgments of learning (JOL) and metacognitive control in a self-regulated learning (SRL) process is moderated by student motivation, epistemological beliefs, and other factors. It tests all three key components of SRL - metacognition, motivation, and behavior, and exemplifies a new approach for SRL researchers to overcome some limitations of traditional methodologies for investigating how learners engage with information. By using gStudy software that unobtrusively collects detailed trace data about learners' cognitive operations, alongside eye tracking technology, we capture SRL as an event, as opposed to an aptitude. Specifically, eye tracking technology provided in the ENGRAMMETRON enables us to accurately measure how learners select items for restudy and allocate time to those selected items while they studied a mathematical topic - the Division Theorem. It is almost impossible to obtain real-time observations of learning behaviours by the techniques that were traditionally employed. This study also provides an opportunity to enhance current models that relate JOLs to study time allocation by taking other variables, such as motivational beliefs, into account.

### ESL Anxiety Research

- Dr. Shoaleh Bigdeli

In this cross-sectional case-study, perceptions of ESL anxiety articulated by three educated professional Iranian women upon their immigration to Canada were investigated. Participants' subjective personal report or self-report of anxiety, was measured through ESLANX questionnaire (Farsi and English versions). At the same time, physiological changes in participants were observed, and, EEG (electroencephalography), ECG (electrocardiography), respiration, and GSR (Galvanic Skin Response) were recorded, and analyzed to assess these changes in the involved systems (e.g., skin, cardiovascular, respiration, endocrine, neurological, musculature, salivation, gastrointestinal, senses, and endocrine).

Qualitative and quantitative research methods (mixed methods) to gather and analyse these women's articulations of interacting in English as one of their means of social communication were applied. Physiological and psychological manifestations of ESL anxiety were explored and the participants' discourses of anxiety were employed as a tool to show the importance of a broad framework that considers anxiety from psychophysiological perspectives to understand the phenomenon of ESL anxiety. In conclusion, major tasks of ESL anxiety research are to establish interdisciplinary connections and to provide more evidence-based ground for educational research in this field.

### Using Simulated and Advanced Gaming in Biofeedback

- Xin Du (Masters Student)

This study tests the hypothesis that biofeedback can be learned in a gaming environment, and in a more fun and engaging manner than traditional approaches. To this end, we study the effectiveness of using a biofeedback-based video game, the *Journey to Wild Divine*, to learn biofeedback techniques. The aims of this study are to simultaneously investigate physiological and psychological states of someone playing this game, in order to learn biofeedback and to examine the effect of the game on players' performance. Those are: 1) how enjoyable and engaging the game is, 2) what are the effects of the game on players' physiological states and psychological states.



## NEWS

### Knowledge Network Feature

Nova Ami, a film director for the Knowledge Network, and her crew, John and Rich, spent a day and a half filming an upcoming feature on the ENGRAMMETRON. Here she interviews Dr. Stephen Campbell in his 'hunting tartan'. The program airs on **The Knowledge Network, February 18th at 7:00 p.m.**

## UPCOMING CONFERENCES

**AERA, March 24 - Mar. 28, 2008 New York, NY**  
**American Education Research Association Annual Conference in New York, Brain, Neuroscience and Education SIG**  
[www.aera.net](http://www.aera.net)

**CSSE, May 31 - June 3, 2008 Vancouver, BC**  
**Canadian Society for the Study of Education at the University of British Columbia, Vancouver, British Columbia**  
[www.csse.ca/Conference/Conference.htm](http://www.csse.ca/Conference/Conference.htm)

## VISITORS TO THE LAB

Francis Munoz, President, Crystal Signal, AB

Serge Brache, Engineer, PsiNaptic, AB

Dr. Michele Crockett, Assist. Professor, University of Illinois at Urbana-Champaign, IL, U.S.A.

Dr. Bruce MacIver, Assoc. Professor, Stanford University School of Medicine, CA, U.S.A.

Dr. Carol Kennedy, Principal Researcher, Fordham University, NY, U.S.A.

Dr. Alan Edmunds, Assoc. Professor, University of Western Ontario, ON

Dr. Laura Stewart, Assist. Professor, Louisiana State University, LA, U.S.A.

Dr. Russell Carson, Assist. Professor, Louisiana State University, LA, U.S.A.

Dr. Carolyn Kieran Sauvé, Professor, Université du Québec à Montréal, PQ

Dr. Pierre Pagé, Associate Dean of Research and Graduate Studies, Faculté des Sciences de l'Éducation, Université Laval, PQ

Dr. Anne Watson, Reader in Mathematics Education, Dept. of Education, University of Oxford, UK

Dr. John Mason, Professor of Maths, Education, at Open University, UK

Dr. Klaus Klein, Director of Health Education Research Unit, Educational Sciences, University of Cologne, Germany

Nova Ami, Director for *The Knowledge Network*, Burnaby, BC

## PRESENTATIONS BY ENGRAMMETRON PERSONNEL

**PMENA, October 25 - 27, 2007, Lake Tahoe, NV**

**Psychology of Mathematics Education — North America Annual Conference**

Presenter: Kerry Handscomb

Topic: Enactive Cognition and Spinoza's Theory of Mind

Presenters: Stephen R. Campbell, Kerry Handscomb, & Radcliffe Siddo

Topic: Demonstrating Mathematics Educational Neuroscience

**IMBES, November 1 - 3, Arlington TX**

**International Mind, Brain, and Education Society Conference**

Presenter: Kathryn E. Patten

Topic: The Somatic Appraisal Model of Affect: Paradigm for Neuropedagogy.

**Dept. of Education, University of Western Ontario, November 30, 2007**

Presenter: Dr. Stephen R. Campbell

Topic: Educational neuroscience: From concept to reality

Topic: Specifications and rationale for establishing an educational neuroscience laboratory



**Kate Patten and Dr. Stephen Campbell “wiring up” Nova Ami, film director for *The Knowledge Network***

## ENGRAMME PUBLICATIONS

ENGRAMME Newsletter

Educational Neuroscience Laboratory

Faculty of Education, Simon Fraser University

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