

Contemporary Approaches to Research in Mathematics, Science, Health and Environmental Education Abstracts 2013

- George Aranda **Translating Across Methodologies: Neuroscience and Education** Educational Neuroscience is an emerging scientific field that seeks to bring together a number of disciplines with the aim to explore the interactions between biological processes and education. Neuroscience has already provided insights into neural mechanisms related to reading, numerical cognition, attention and related disorders. Further research may provide insight to neural 'learning markers', that identify processes not observable behaviourally, and early identification of potential learning difficulties. But to explore more complex processes, such as replicating classroom environments; learning over longer periods; incorporating sociocultural influences – new research methodologies will need to be created. This paper will explore the underpinnings of Educational Neuroscience and the methodological challenges faced by this emerging field.
- Frances Burton **The mathematics visible to pre-school educators in their settings: using mixed methods in a case study** This research explores the visibility of mathematics with pre-school educators from Victoria. This is a work in progress report on the proposed methodology. The project begins by surveying all educators in Victoria to find their views: • on the place of mathematics in pre-school • on the mathematics visible in the new frameworks documents, the Victorian Early Years Learning and Development Framework and the Early Years Learning Framework (DEECD, 2009; DEEWR, 2009) and • on the mathematics visible in their practices The survey will be followed by observations and interviews with individual educators as cases. This report outlines the mixed methods used in case study.
- Edgar Caballero-Aspe **A Learning Framework with an Action Competence Approach** This paper will present the proposed framework: 'educative experiences for action competence'. Experiences are essential for growth as they offer a clear path to reconfigure our brain and perception of our existence. Experience it's at the core of this learning framework and its interrelation with seven aspects: knowledge, emotions, actions, embodiment, social networks, connections and reflections, are carefully discussed. The framework pursues the creation and recreation of a network of relations between the aspects for environmental education programs. The aspects give principles for researchers to evaluate environmental education (EE) experiences. These principles can also be used to design EE programs.
- Coral Campbell **Kindergarten Participation Project - data crunching and reluctance** The Geelong Kindergarten association, in partnership with the City of Greater Geelong, the DEECD and Deakin University , was interested in discovering whether there existed any participation issues at Geelong kindergartens and if so, what was causing this . Attendance records kept by the kindergartens, were analysed for 13 kindergartens, over 2 years. Questionnaires and in-depth interviews were conducted with parents and kindergarten practitioners. The data reduction was simple compared to the attempts to engage parents and kindergarten teachers in further research requirements.

Fabio D'Agostin	The Interface Between Mathematics Lesson Theory and Lesson Implementation	This presentation covers a crucial aspect of a project which investigates student emotional responses to mathematics classroom tasks. Advocates of valuable mathematics classroom tasks emphasise properties which include the desire for peer collaboration, debate, challenge, inherent activity interest and authenticity. While a teacher may provision a lesson for these characteristics, how may they be successfully implemented? Can prior planning incorporate all necessary considerations? The recent experience of a teacher/researcher in addressing these problems is the subject of the report.
Brian Doig	Better reporting of assessment results.	This presentation will demonstrate the use of Wilson's Ordered Partition Model for enabling more refined reporting of students' assessment results. While the OPM is relatively new, it is based on the well-established Rasch model. Three approaches to reporting these data will be considered, and the advantages of each discussed.
Joseph Ferguson	Collecting and Managing Multiple Video Data Sources for Visual Semiotic Analysis of Science Students' Reasoning with Digital Representations	The paper will discuss the way in which multiple sources of video data, in conjunction with specific digital means of data management, were used to collect and manage the data necessary to conduct a visual semiotic analysis of science students' reasoning when using digital representations. Students explored natural selection by reasoning with digital representations through the use of NetLogo, a type of multi-agent based computer-modeling software. Camtasia Studio, a type of screen capture software, was used in conjunction with web cameras and tripod-mounted cameras to capture students' use of NetLogo. This data was then modified, through the use of video editing and management software Camtasia Studio and Studiocode, into a form that enables visual semiotic analysis of students' reasoning.
Susie Groves	Finding evidence of learning	There is a long history of using pre- and post-tests to try to find evidence of learning. Various statistical tests are applied to the resulting test scores, with frequent debates about what constitutes significant (as opposed to statistically significant) results. This presentation will look at some other ways to find evidence of learning that have been used in various research studies.
Linda Hobbs, Coral Campbell, Jenni Contrill	Using Vimeo to recruit participants for research	A study is underway to explore how teacher education programs prepare teachers to be adaptable. It is part of an agenda examining issues around teaching out-of-field in secondary schools. The study involves students and teacher educators from university courses in Victoria and New South Wales, some of which service predominantly off-campus student cohorts. Part of the methodology was to address the students personally, however this is not possible for off-campus cohorts. It was therefore decided to develop a recruitment video that explains the project, but also acts as an awareness-raising tool. This presentation will explore the reasoning and processes involved in developing the video, and present some of the outcomes of using such recruitment tools for research.

Linda Hobbs, Jeff King, Mellita Jones, Gail Chittleborough , and others	Science Teacher Educator Partnerships with Schools (STEPS): Developing an Interpretive Framework for the primary science teacher education	The STEPS project responds to international concern about primary teachers' lack of science knowledge and confidence to teach science, and recent questioning of the effectiveness of traditional approaches to teacher education. The project reviews and builds on established, innovative and successful practices at five universities, to develop and promote a framework supporting school-based approaches to pre-service teacher education. This paper will outline the processes involved in developing an Interpretive Framework, which will be a key outcome of the project. The Interpretive Framework identifies key elements to assist teacher educators in planning, implementing and sustaining school-based approaches to teacher education.
Brendan Jacobs	Implementing a QUAL-qual methodology using a prism metaphor for the CHAT triangle.	When researching multifaceted tasks such as explanatory animation creation, CHAT is well positioned to capture the dynamic nature of evolving artefacts in pivotal moments of convergence, when the same artefacts can function as both tools and objects in different contexts. Morse and Niehaus (2009) identified two conditions in which a QUAL-qual design is appropriate: 1. To obtain two different perspectives on the same phenomena. 2. To obtain different levels of analysis (p. 110). This presentation will involve concrete examples of recontextualisation, using digital data from children's explanatory animations, to show how the intrinsic sophistication of the CHAT model can be used to problematise multifaceted tasks.
Leissa Kelly	Swimming upstream: Stories from a decade of working with Marine Educators	In this paper I discuss how narrative methodology informed by a framework of aesthetic understanding was used to investigate and understand the role of marine educators in influencing practice and policy in public belief and actions. In doing so, I explore how the necessity to extend the research timeline had a beneficial outcome by allowing the marine educators to be interviewed on a number of occasions, thereby enabling a longitudinal perspective to be developed. By talking to each of the interviewees over the course of a decade, the evolution in their thinking about education and their understandings of the marine environment were explored.
John Kusznirczuk	Approaching an understanding of higher-order thought by describing syncretic thought	Higher-order thinking, an important pedagogical concept, features in well-known accounts of the psychology of learning and development (e.g. Piaget's genetic epistemology and Vygotskii's genesis of higher mental functions). It is therefore reasonable to expect educators to be able to describe just what higher-order thinking is. To help contribute to this ability, a narrative approach to understanding higher-order thought, by describing what it is not, is demonstrated using narrative examples of syncretic thought. These examples reveal the operation of syncretic thought, a kind of thinking that precedes and conditions the possibility of higher-order thought, in recognisable narratives drawn from personal experience.

John Kuszniczuk	Operationalising the ZPD as a semantic space	Vygotskii's zone of proximal development (ZPD), as an object of pedagogical knowledge, risks losing its explanatory power if it is not understood in relation to the rest of his work. This presentation reports on research that aims to mitigate that risk by demonstrating the possibility of the ZPD's operation in a natural example of a generic episode of middle-school mathematics classroom interaction. This presentation demonstrates a methodology aimed at providing educators with a critical vocabulary based on a systematic and transparent organising principle that plausibly links theory and practice in support of their understanding of a complex and powerful principle.
Llewellyn Wishart, Anne-Marie Morrissey, Liz Rouse, Julianne Moss & Caroline Scott	Greening childcare outdoor spaces for children's learning and wellbeing.	This research investigates the effects and challenges of greening an outdoor learning space for young children in a childcare setting. In this study a Mosaic methodological approach is being deployed. A mosaic methodology refers to an assemblage of mixed multiple methods and participant perspectives including those of the researchers. In this study, data collection methods trialled in a prior study continue to be appraised and problematised. The presentation will highlight some of the methods used to capture pre and post greening impacts such as child behaviour mapping and tracking and collaborative consultation between childcare centre staff, landscape designers and researchers.
Esther Loong	Primary school teachers' pedagogical use of ICT in mathematics	It has often been said that it is not the technology but teachers' effective use of technology available in classrooms that mattered. Mathematics teachers have to consider what counts when technology is used - to get quick and accurate answers or to improve the way student learn mathematics. In this presentation, data from a project looking at three primary school teachers' use of ICT in mathematics will be discussed. Two theoretical frameworks- the 'mathematics teacher TPACK development model' by Neiss et al.(2010) and the 'learning with and learning from ICT'framework (Ringstaff & Kelley, 2002) will be used to analyse the data .
Mark McCrohon, Ly Tran	Towards a Digital Methodology for Qualitative Research	As digital natives enter the arena of qualitative research, there is a need for a methodology that allows researchers to analyse qualitative data in a manner similar to quantitative data. To date there has been little work done on the development of a qualitative methodology capable of operating in real-time. An aim of this paper is to demonstrate how a digital methodology could produce real-time qualitative analysis on participants engaged in structured or semi structured in-depth interviews. This paper expands on the framework developed to conceptualise data gathered for PhD research into Chinese International Student Perspectives of Academic Integrity.
Theodosia Prodromou	A cross-national analysis of a teaching experiment mathematics	The research will take place in junior and secondary schools in Italy and Australia. Teachers will be trained to use mathematical software to teach Mathematics. Research will be undertaken to explore students' experiences after they have been taught how to create and then manipulate geometric constructions using mathematical software and the impact of the software on students' mathematical learning and motivation. Design research methodology will be used together with the "meta-didactical transposition" model (Aldon et al. 2013) that is characterized by five intertwined

features: the institutional aspects, the meta-didactical praxeologies, the double dialectics, the brokering processes, and the dynamic between internal and external components.

James Scott

Formative assessment and ESSA in NSW

Purposive sampling using statewide ESSA data from NSW and effect size to select two groups of science teachers for further study. An online survey to ascertain the pattern of assessment practices (ranging from summative, to formative and metacognitive / assessment as learning) will be sent to each group. One group will be at schools where students have consistently achieved exceptional ESSA results, the other will be from schools where results are unexceptional. A third phase will consist of bounded case studies in a few selected schools using grounded theory to enrich /confirm findings from second phase survey. Questions will seek to establish if high achievement is associated with formative assessment practices and explicit use of the SOLO model which underpins ESSA.

David Symington,
Russell Tytler,
John Cripps
Clark

Speaking the Language of the Outsider

There are several audiences for the findings of research in education: fellow researchers, educators, those who develop and implement policy for education, and the community. In general the audiences which have the greatest impact on our work are the first two. These can be characterised as 'the insiders' and communications about our research reflect a shared understanding of education practices. Communication with the latter two groups needs to be different as the members of the 'outsider' communities generally do not have the same shared understanding of educational practices and purposes. In this paper we will explore methodological implications of these challenges from our research related to understanding school-community collaboration in school science programs, from insider and outsider perspectives.

Russell Tytler

Aligning socio-cultural, classroom perspectives on learning with neuroscience perspectives and findings

Neuroscience perspectives on learning are gaining increasing attention, but the translation of findings of brain-based research to complex classroom environments has received considerable critical attention. The challenges with aligning findings on learning generated from neuroscience with insights from classroom studies, and translating neuroscience findings into recommendations for classroom teachers, include; issues of scale and complexity; vastly different learning paradigms; disparate methodological and epistemological traditions; and disparate theoretical characterizations of learners and learning. Nonetheless, these are research areas that need to speak to each other if we are to develop our understandings of how best to support learning. This paper will explore the nature of the challenges faced in aligning these perspectives, and describe a research program within the newly funded Science of Learning Research Centre, which aims to achieve such an alignment.

Wanty Widjaja	Discourse analysis of students' working with traditional games to support mathematical learning	Discourse analysis has gained increased attention in mathematics education research. Ryve's (2011) meta-analysis of 108 journal article on critical issues involved in discourse analysis. The study highlights the need to situate research on discourse analysis in relation epistemological assumptions and academic traditions. Drawing attention to Ryve's study and research literature on discourse analysis, methodological issues involved in discourse analysis of a grade 4 Indonesian classroom will be examined. The study was situated in the context of adapting Realistic Mathematics Education in Indonesia known as PMRI in Indonesian classrooms.
Gaye Williams	Multi-camera and multiple perspective data capture enabling study of group composition	Multiple video cameras provide data on group interactions in primary mathematics classes, and these along with students' video stimulated reconstructions of group activity inform the research question: "How does the research design support an analysis of influences of group composition on student opportunities to learn?" This paper highlights benefits of the approach and limitations associated with design as an analyses is presented. The analyses show how group compositions can limit opportunities for group members to 'enter' the 'Space to Think', and how repositioning of group members within the same group composition can sometimes increase opportunities for interactions in that thinking space.
Fred Wright	A socioculturally informed approach to scaffolding CALD students learning.	Three mainstream Technical and Further Education (TAFE) teachers were recruited to participate in a socioculturally informed approach to scaffold Culturally and Linguistically Diverse (CALD) students learning in a mainstream TAFE course using a structured approach to asking questions. Specifically, Marion Blanks approach to asking questions was introduced to three TAFE teachers who were then asked to incorporate the questioning approach in their classes. Teachers were interviewed after a nine week intervention period and students were surveyed about their perceptions of the intervention in the classroom. The results of the study suggested the use of the levels of questioning supported the CALD students potential to develop higher order thinking about topic presented in class.
Yetti Zainil	A Conversational Analytical Study of Input-Output in EFL Classrooms	Although there has been numerous research reporting on the teacher talk and the role of it with regard to learners' learning a foreign language, its investigation from a conversation analytic stance using video recordings and stimulated recall interviews is rather limited, especially at the primary schools level. This study presents the findings of a study on the language used by teachers and its impact on the language used by students in EFL classrooms. Transcripts of classroom discourse were analysed. The classroom data presented reveal teachers' variation and frequency range in oral input and students' output. The results suggest that while not indicative of a cause-effect relationship, teachers might wish to consider encouraging quality of her target language use as well as quantity.