CAR Symposium 2022 - Presentation Abstracts

Presenter	Co-presenters	Title	Methodological focus	Abstract
Amanda Peters	Dr. Peta White, Dr. Jo Raphael	Problematising STEM Education: Policy analysis and impact in a Victorian context	The methodological focus is a strategic decision to explore findings from one methodological approach ('What is the Problem Represented to be? (WPR)) using an arts-based research (ABR) methodology. ABR supports and extends WPR, as it broadens the tools used to represent experiences, innovating educational research in policy analysis and practice.	How does STEM policy shape STEM education in secondary schools? A systematic methodology, the 'What is the Problem Represented to be?' (WPR) approach (Bacchi, 2009), is used to interrogate and question assumptions in Victorian STEM policy. How is policy realised in practice? Arts-based research (ABR) methodology is used to explore the experiences of STEM education stakeholders. The methodology creates a dynamic and emergent space to engage in the complexities of STEM education. Arts-based research provides the opportunity to broaden understanding and uncover the hidden, supporting the WPR approach of critical policy analysis. Reference: Bacchi, C. (2009). Analysing policy: What's the problem represented to be? Pearson.
Amrita Kamath	Dr. Gary Simpson	Co-researching in a Design Based Study: Exploring the Teacher-Researcher Collaboration	This presentation focuses on researcher-teacher collaboration in a design based study which explored effectiveness and applicability of guided inquiry in senior biology settings. The researcher and teacher describe the process of co-researching, and share contextual experiences, reflections, and key findings.	In this design based study, educational interventions were contextually enacted through interactions between teacher, researcher, and learners (Design Based Research Collective, 2003). The researcher and teacher co-designed a guided inquiry based lesson sequence which was implemented by the teacher, with the researcher observing and documenting the process. The sequence was collaboratively and consistently adapted after each lesson, infusing modifications to progressively factor in contextual influences, including student voice. A perceptible affordance of this approach is that theoretical products of design experiments have the potential for rapid pay-off, as they are built around issues faced by teachers in the course of their work, and as a result, are filtered in advance for instrumental effect (Amiel & Reeves, 2008; Cobb et al., 2003). From an epistemological standpoint, this study reflects a social constructivist research paradigm applied through a critical pedagogical lens, with the researcher and participating teacher working together to co-construct interventions.
Carly Sawatzki	Jill Brown	From pilot to scale: Can scholarly design compete on the free market?	While educational researchers are trained to generate and share robust empirical insights and design rigorous interventions, our ability to do so is increasingly at the discretion of power brokers and decision makers who define system and school priorities, as well as how these should be addressed.	While the Australian Curriculum includes finance-related content, schools typically view and enact financial education as a niche curriculum. Government support for teachers as financial educators has taken the form of free downloadable teaching resources. Strategic investments in educational research and teacher professional learning have been sparse. Deakin University's Economics + Maths = Financial Capability project was funded via a community grants program. Educational design research methodology was applied. The intervention we designed and tested was a course designed to boost teachers' curricular, content, and pedagogical content knowledge for teaching students about finance in Years 7-10. The course was competitively priced and offered on the free market via the School of Education's professional learning hub. In this presentation, we will examine the research experience, including the methodological tensions we confronted designing what we hoped would be a scalable program, as we ask, "Can scholarly design compete on the free market?"
Cassandra Tytler		The partisanship and performativity of creative practice research for EE: Questions around the methodology of editing interviews	In making creative practice research featuring interviews that are edited and exhibited as an audio-visual walk, how can the researcher be neutral? How can the work move beyond the singular subjectivity of the interviewer/editor when it is their choices as to what is heard and what is omitted?	An embrace of posthumanism in EE has supported grounded and embodied modes of practice-based research as a methodology. Emphasis has moved from representational knowledge to a celebration of affective encounters in place. Creative research is performative. Focussing on an art project undertaken at the Queen Victoria Market as a place-based methodology, this presentation questions the notion of agency of the artist/researcher in EE research and their neutrality in the process of presenting their creative research. Specifically, I look at audio interviews that I edited into a creative work and exhibited at the market. How can the researcher impartially present the interviews if they are edited down into a soundscape? From a posthuman perspective, how can the EE single-subject-researcher presenting creative work remove their partisanship? To connect with these methodological questions, I look to Mazzei's theorisation of a Voice without Organs alongside Harris and Holman Jones' manifesto for Posthuman Creativity Studies.
Chris Eames	Sally Birdsall s.birdsall@auckland.ac.nz	A critical realist approach to climate change education	Developing young people's agency for addressing climate change is a crucial imperative of our times. We considered that this might be possible using a critical realist approach to conceive the 'problem' of climate change as an interplay between structures and agency (Cornell & Parker, 2010; Rafe et al., 2019).	We were concerned with how could secondary teachers work with their students to examine the structures that they see as fundamental to climate change and how, through climate change education, their agency could be developed in ways that are hopeful, mitigative and adaptive. Structures in this sense may be seen as global and national (macro) such as climate science and IPCC reports, or government policy; community (meso) such as transport options, school policies and student organisations; or individual (micro) such as household energy use, or values. Student agency can be thought of as situated practices or the capacity of individuals to take action over time upon these structures (Archer, 1996). It is very clear that young people are worried about climate change and want to help but also that they don't know how. We will discuss how a critical realist approach led to design and evaluation of a teaching intervention.

Colleen Vale	Lihua Xu, Wanty Wadjaja, Joe Ferguson, Amanda Berry, Jan van Driel, Jinny Kim	Designing an Adaptive Expertise Video Survey Instrument	The methodological problem is the design of video-based items for a questionnaire to map the development of teachers' adaptive expertise. The issues concern identifying contingency moments, relating these to theories of adaptive expertise, choosing question type and designing multiple-choice options, testing for validity and ethical issues.	Whilst video-stimulated interviews are used quite regularly in qualitative research in education, video excerpts (clips) for items in questionnaires are only just beginning to emerge in the research of teachers' knowledge and practice. The aim of our ARC project is to investigate the development of primary teachers' adaptive expertise in interdisciplinary mathematics and science. As part of the mixed methods research design, we will use a video survey instrument to map primary teachers' adaptive expertise. Teachers will complete this questionnaire at the beginning of the project and then at the end of the project. The video recordings of a sequence of three interdisciplinary mathematics and science lessons designed and trialled for the project were the source of video excerpts for the questionnaire. We discuss the way in which we brought together theories of adaptive expertise and contingency moments to select video excerpts and design items for an online questionnaire.
Efrat Eilam		Developing a Green Paper for climate change curriculum development	The methodology involves systematic literature review of climate change education peer-reviewed literature and content analysis of national curricula and other grey literature in selected countries. The primary methodological challenge is synthesising grey literature and academic literature to derive evidence-based recommendations for policy development	The Green Paper is being developed on the backdrop of Israel Ministry of Education announcement that beginning in September 2022, climate change (CC) is a core topic in school curriculum from F-12. Additionally, in Years 8 and 10, CC will be taught as a subject on its own, with 30 hours allocated in each of the two Year levels. In preparing for the role out, the Ministry of Education published a tender calling for the development of a Green Paper as a basis for policy development on CC education. This Green Paper development project forms the background for this presentation. Here I present some initial findings from the data analysis, with particular focus on a few selected gaps that were found in CC education conceptualisation. For example, the gap in CC conceptualisation by the IPCC and UNESCO, and other gaps that are conflated by acute lack in empirical evidence
Gahyoung Kim	Kongju Mun	The Issue-Concept Map (IC map) as an instructional tool for exploring students' understanding on socioscientific issues	The methodological problem is the considerations when adapting the Issue-Concept Map to understand students' conceptual change on socioscientific issues. The considerations concern selecting an applicable SSI; analysing between concepts, ideas, and information; figuring out the reasoning for the concept change; constraining ideation by the guided concept map.	Concept maps are widely used in education to investigate conceptual changes and misconceptions, however, SSI, which has a complex nature, mainly uses multiple-choice, true or false, or Likert-type instruments rather than concept maps. While general science education focuses on scientific knowledge, SSI education additionally emphasizes learning about causes and effects and optimal solutions by multiple dimensions related to issues. We introduce the Issue-Concept map developed by extending the characteristics of SSI to the existing concept map. The Issue-Concept map guides students to consider the causes, effects, and countermeasures of SSIs from personal to societal and global contexts. Also, we discuss the considerations when applying the Issue-Concept map based on 2 previous research of students' conceptual understanding of climate change and fine-dust issues.
Gen Blades		Decentring Phenomenologically	There are two (re)constructions in this postphenomenological study of walking. One was accessing intercorporeal 'field sites' of walking as embodied movements and intra/interactive moments with/in scapes of nature. The second was (re)visioning a pedagogy of walking as an ecopedagogy that was inductively drawn from the embodied movements. Broadly, an autophenomenographic approach was used and framed ecophenomenologically.	This presentation offers a (re)construction of 'decentring' drawing from the author's Phd study on embodied practices of walking with/in nature(s) as ecopedagogical. The methodological challenge of this study was how to access these elusive intercorporeal 'field sites' of walking as embodied movements and intra/interactive moments with/in scapes of nature. An autophenomenographic approach was used and framed ecophenomenologically as ways to explore how the subjectivity of the researcher/walker can be decentred in 'less' anthropocentric thinking about and, representing of, the 'nature' of walking in various environments, natures/scapes. Empirical 'scoping' of material, aesthetic and embodied dimensions were inductively identified and abductively assembled as descriptive interpretations of walking with/in scapes of nature. The 'findings' reveal the nature of walking as ontologically relational spatial practices, and as temporal events such as "wandering" and "wayfaring" in local places, or "bushwalking" along granite outcrops. It was found that these "encounters" can be a co-constructive process where walking, an 'eco-becoming of self that is ecopedagogical in nature, where you learn with/in/of nature.
Jen Mansfield	Kathy Smith	Methodological considerations when positioning teachers as co-researchers in development and implementation of a PBL framework for school-based STEM education	Teachers are often positioned as consumers of research and although they engage with personal inquiry into their practice on a daily basis, teachers are seldom formally positioned (or see themselves) as 'researchers'. This leads to teachers feeling anxious about whether they have the skills and knowledge to be considered co-researchers.	The "Exploring Problem based learning in STEM Education" project aims to develop (i) a pedagogical framework informing school-based STEM education and, (ii) produce evidence-informed exemplars of school-based PBL practice. To realize these aims, academics are working to position teachers as coresearchers to understand how principles of practice can be translated into a range of school-based settings. As coresearchers, academics and teachers would work together, equally generating and interrogating data to develop new knowledge. However, a number of issues have emerged in relation to breaking the entrenched role of teachers as consumers rather than generators of educational research. This raises questions about how teachers can be supported to; appreciate themselves as researchers; develop knowledge about, and skills for research; and, be empowered to take initiative as co-designers of the research process. These considerations are essential for actively positioning teachers as co-designers and coinquirers in any research project.

Jill Brown	Carly Sawatzki	Use of digital technologies to enhance teaching for, and learning by, out-of-field teachers of secondary mathematics	The research problem was to design a Course for out-of-field teachers of secondary mathematics to shift them along the continuum towards being in-field teachers of mathematics. A global pandemic shifted the delivery online. The Gibsonian construct of affordances, n a technology-rich teaching and learning environment, underpins the design-based Graduate Certificate.	Out-of-field teachers of mathematics are qualified teachers allocated to teach mathematics in Years 7-10 but the teachers are not qualified to teach secondary mathematics. Our focus with a design-based study is on the affordances of learning to teach mathematics embedded in the Course design. Following Gibson (1977) who invented the term, an affordance is "an opportunity for interactivity between object and actor" (Brown and Stillman, 2014, p. 113). Although our focus is in a technology-rich teaching and learning environment, the affordance is not the digital technology per se, but rather a potential relationship that exists in the environment (Brown, 2013). Focusing on methodological approaches we present the affordances existing, by design, in the teaching and learning environment provided in a bespoke course for out-of-field teachers of mathematics (Brown, Sawatzki, and Widjaja, 2022). We argue how these might support learning if perceived and enacted during the Course and subsequently in school.
Joseph Ferguson	John Cripps Clark	A Prometheus of our times: Watching 'Benjamin Franklin' to bridge the gap between Peircean philosophy and the science classroom	The extensive work of Charles Peirce has failed to gain significant traction in science education. This is despite Peirce being a practising scientist and writing always with the method of science in mind. Peirce thus has potentially much to offer science education, but due to the perceived gap between his idealist philosophy and the 'messy' realities of the classroom this has yet to be realised.	In our work as researchers and teachers of science education, we are always seeking inspiration to realise new perspectives on old problems. In particular, we have struggled to translate Charles Peirce's philosophical ideas on science inquiry to the practicalities of the science classroom. However, recently, as part of our habitual viewing of films as self-confessed cinephiles, we came across Ken Burns' documentary 'Benjamin Franklin. In watching this film, we realised that Benjamin Franklin embodied many aspects of Peirce's pragmatist semiotics that underpins science inquiry. As such, we propose that Benjamin Franklin can form a bridge between Peirce's idealist philosophy and the 'messy' realities of the science classroom. We argue that film is thus a powerful engine for methodological change in science education.
Linda Hobbs	Ann Osman aeosman@bigpond.com	Putting it out there: Criteria used to evaluate social research	This paper explores the methodological challenge that researchers face in deciding and communicating the criteria they want used to evaluate the quality of their research. This encompasses both what the researcher does to ensure their research is undertaken in a rigorous way and then how the criteria are communicated through peer review to the research community.	Researchers from different paradigms use different criteria to judge the quality of research. An important part of the HDR learning process is to interrogate and represent the criteria that a reader should use to determine if the research is quality, but to what extent do researchers continue to be explicit about these criteria. Quantitative research, for example, uses various forms of validity and reliability, compared with qualitative research that uses a range of terms such as trustworthiness, accuracy, relationality, dependability and confirmability. To what extent are these criteria made explicit or inferred in accounts of research reported in peer reviewed journal articles? To what extent do they matter in different research paradigms? And what work do they do? This paper reports on an analysis of articles from a range of journals to identify how the criteria for judging the quality of the research are represented - noting whether this was explicit, implicit or absent; and what is said and not said. Our analysis found that quantitative research explicitly uses the language of validity and credibility. Non-quantitative (qualitative, case study, etc) research tended to not use criterion-based language but relied on: descriptions, coherence, notions of accuracy, and alignment. The presentation will explore in what ways these criteria matter and the work that they do in ensuring quality research.
Margaret Jakovac		A netnographic exploration into the notion of 'success' about out-of-field STEM teachers	Netnography is the methodological focus - it is online ethnography that sees the researcher embedded to some extent (the depth is their choice!) in online communities discussing a particular issue. Netnography has yet to be harnessed to explore the out-of-field teaching phenomenon and neither through the lens of STEM, nor to scope for teachers' success stories. I am embarking on this research; baby researcher, very early days. Not quite in the PhD program yet.	My proposed research will look to extend this existing body of research about out-of-field teaching of STEM by exploring and analysing success stories through the lens of social media It will focus on a refined list of relevant Australian Facebook groups, commentary related to specific Twitter hashtags (using the tool Twitonomy to analyse), and specific 'Grey literature'. I will scrape online commentary to analyse Australian educators', school leaders' and scholarly insights into and tips for successfully teaching STEM out-of-field. Their perspectives will help define and elaborate upon teachers' perspectives/conceptualisations of success through the lens of capabilities, pathways and identities (Hobbs et. al 2022), signature pedagogies (Shulman 2005), teaching 'near field', across subject boundaries (Hobbs and Porsch 2022) and temporality to test Du Plessis' (2020) anecdotal finding that out-of-field teachers felt competent within three-to-five years. My approach acknowledges that social media 'offers unprecedented observations of societal dynamics' (ACOLA 2022:4).
Melinda Kirk	Joseph Ferguson & Maria Capsalis	Working as a community of inquiry to enact design-based research for science education during 'challenging times'	Undertaking design-based research in science education has been further complicated by the methodological challenges, in particular disruption of timelines, protocols and available personnel, generated by Covid as a pandemic. This has significantly impacted school communities and research in schools.	We came together as a diverse team of educators and researchers committed to supporting and maintaining school science education and research partnerships, and quality science education. Collaborating to conduct inquiry design-based research, these partnerships have enabled us to productively negotiate the methodological challenges of disruption of timelines and available personnel that have been generated by the Covid pandemic. In doing so, we were able to collaboratively work together, researchers and teachers, to enact rich science learning sequences that generated equally rich student inquiry, and subsequent data. We argue that our commitment to inquiry as a collective, as a 'community of inquiry' working together in rigorous and flexible ways, enabled us not only to persist but also to succeed.

Peta White	Jo Raphael and Shelley Hannigan	Attuning with more-than-human voices: Experimenting with ways to de-privilege humans when refiguring education in uncertain futures	The desire to collaborate with colleagues in intentional and inclusive ways lead the improvisation and adaptation of a padlet (Map of the world) to enable 'events' to be pinned that represents our attunement activities. The events reflected (and attempted to represent) attuning with... We then collectively unpacked how these attempts at attuning could and perhaps should bring insight and changes in our practice in education.	A collective of education academics enacted regenerative education that experimented with multi-species thriving to re-focus practices in these challenging times. We de-privilege the human and employ the agency of attunement to more-than-human voices and recorded our findings embedded in a digital map. Attunement requires listening with more than ears, seeing with more than eyes, and connecting with hearts. We will consider how more-than-human voices guide us as educators. This includes kin of any kind. We ask what is needed now, what is needed next, and how might this attunement enable us to teach more inclusively? This presentation describes the unfolding inquiry with coinciding practices that explore the complexities and affordances for entanglements to reveal educational opportunities.
Peta White	Russell Tytler	Shifting Assessment Cultures in Science Education	Developing and validating tasks to assess science inquiry involves a complex of research aims. The presentation will focus on the implications of this complexity for the research design.	We will describe the methods used to develop, trial and validate science inquiry assessment (SIA) tasks in schools. This is complexified by the fact that targeted assessment of inquiry is not practised in primary schools, such that the project aims are complexified to include: development of valid instruments reflecting curriculum descriptors; validation in a practical sense of the possibility of organising and enacting inquiry activities, enticement of teachers to implement engaging inquiry activities; and attention to teachers' perceptions of inquiry skills and commitment to an assessment as distinct from an immersive inquiry program. We will describe the methods we used in response to these multiple contextual constraints on refining and validating the tasks.
Russell Tytler		Opportunities and Challenges with Longitudinal Study Designs	The methodological problem is that of constructing and meaningfully analysing longitudinal data in situations of complex learning environments and knowledge forms.	Longitudinal research is challenging due to the time frames involved and the challenge of maintaining consistency in focus and context across time. Yet the particular insights that can be explored longitudinally are valuable and in many ways unique. In this presentation i will review some of the challenges and methodological justifications associated with a number of historical studies i was involved with. I will present the challenges involved in analysis of longitudinal data in a current study of mathematics and science interdisciplinary learning, arguing that the forms of knowledge, in particular the balance of contextual vs abstracted, generalised knowledge and practice, frame analysis possibilities.
Sandra Wooltorton	Peter Reason	Cooperative Inquiry for Life	What would it be like to live in a world of sentient beings rather than inert objects? How would we relate to such a world? How might we listen to rivers, and learn to relate in ways that reveal ancient knowledges often occluded by the mechanisms of the West? Philosopher Freya Mathews suggests people are part of an intelligent and evolving cosmos, enabling experiential, conceptual, creative and practical responses to such questions. What are the implications for education of these questions and responses?	Cooperative Inquiry as a collaborative approach to living life as inquiry, has been in use since the late 1970s, published since the 1980s (Reason & Heron, 1997; Reason, 1988), and used in hundreds of qualitative research contexts. It is widely used for transformative purposes, to change social circumstances while developing new ways to address persistent issues. Recently, it has come into use as a post-qualitative research method (Hart & White, 2022; Kurio & Reason, 2022), one which allows for the re-centering of previously marginalized relational knowledges and voices, particularly the agency of place, river or Country (Wooltorton et al., 2021). In this presentation, we will introduce some studies, and offer up to date background philosophy, thinking and practice of Cooperative Inquiry as a collaborative approach to living life as inquiry. That is, a method for the sake of life, and as a method for life-long learning and place re-engagement.
Scott Jukes		Emergent environmental education inquiry: A methodology of thinking with things	Within the last decade there have been some challenges to conventional humanist qualitative inquiry (St. Pierre, 2011), inquiry grounded within paradigmatic structures (Gough, 2016) and overly prescriptive methodocentrism of educational research (Weaver & Snaza, 2016). These challenges confront an issue of overly dogmatic and dictatorial research methodology that closes off different and emergent research approaches. But what if we did research differently? I offer one possibility.	Within the last decade there have been some challenges to conventional humanist qualitative inquiry (St. Pierre, 2011), inquiry grounded within paradigmatic structures (Gough, 2016) and overly prescriptive methodocentrism of educational research (Weaver & Snaza, 2016). These challenges confront an issue of overly dogmatic and dictatorial research methodology. This presentation takes these challenges seriously, aiming to look beyond anthropocentric, paradigmatic and overly deterministic approaches to inquiry by thinking with things in the context of environmental education. I propose that one approach for doing this is to think with things; such as theory, concepts, landscapes, non-human species and materiality. This allows for different and unexpected possibilities to emerge. As part of this approach, I embrace the notion of 'follow[ing] the matter-flow' (Deleuze & Guattari, 1986, p. 479) within the given context of inquiry. I offer a practical example of thinking with a river to evoke the notion of open-ended inquiry.
Urban Eriksson	Jenny Hellgren, Elias Euler, Jennie Lundkvist	On Space and Time - The methodological issues of analysing students' conceptions of spatio-temporal scales when learning science	Video-audio interview data on students' spatio-temporal conceptions will be multimodally analysed inspired by a phenomenographic approach. Our methodological struggle lies particularly in interpreting the disciplinary gesturing that takes place between the participants. Very small nuances become critical in the communication between the participants, something that we have found to be hard to discern and interpret from the video data.	Learning science involves coming to appreciate and understand small and large scales in both space and time. Understanding of spatio-temporal scales have also been found to be a threshold concept in the natural sciences and geoscience. We have initiated a large international project aiming to investigate students' understanding of scales and how they express their thinking around these concepts. Presently, we are engaged in collecting video and audio data from semi-structured interviews with groups of expert participants. Our multimodal analysis draws on phenomenographic theory which posits that there are a limited number of qualitatively different ways of experiencing a concept or phenomena. From our efforts we have identified three types of modes used when discussing temporal scales: language, visualizations and gestures. Perhaps most interesting is the many different disciplinary gestures used in their communication. For the spatial scales, we have found five different strategies used in the disciplinary communication between the participants. These, and more, will be presented and discussed at the symposium.