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Community-based environmental monitoring goes to school: translations, detours and escapes

Julianne Lynch[a], Efrat Eilam[b], Martin Fluker[c] and Naomi Augar[d]

[a] Faculty of Arts and Education, Deakin University, Warrnambool, Australia; [b]College of Education, Victoria University, Melbourne, Australia; [c]College of Business, Victoria University, Melbourne, Australia; [d] College of Business, RMIT University, Melbourne, Australia

Community-school partnerships are an established practice within environmental science education, where a focus on how local phenomena articulate with broader environmental issues and concerns brings potential benefits for schools, community organisations and local communities. This paper contributes to our understanding of such educational practices by tracing of the diverse socio-material flows that constitute a community environmental monitoring project, where Australian school students became investigators of and advocates for particular sites in their neighbourhood. The theoretical resources of Actor-Network Theory are drawn upon to describe how the project—as conceptualised by its initiators—was enacted as both human and non-human actors sought to progress their own agendas thus translating the concept-project into multiple project realities. We conclude by identifying implications for sustaining educational innovations of this kind.

Keywords: environmental monitoring; Actor-Network Theory; place-based education; community partnerships; innovation.

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Introduction

The purpose of this paper is to examine the implementation of a community-based environmental monitoring (CBEM) project in an Australian primary school, but to move away from conventional views of educational innovation, and indeed from the language popularly used to speak and write of implementation, and instead to trace how the initial concept-project was enacted and what work was involved in holding together the heterogeneous stakeholders. In doing this, further to providing insights into how this type of work can be done in and with schools, the paper contributes to contemporary understandings of environmental education innovations as contingent, dynamic assemblages that involve ongoing work to maintain the interest of diverse entities. To describe how the CBEM Schools concept-project came to be (and continues to emerge) at a specific school site, we draw on the conceptual resources of Actor-Network Theory (ANT). ANT provides a distinctive view of innovation that differs in important ways from other theories of innovation, offering a different ontological framing and better enabling us to see how innovation and change occur (Bigum 2000).

As explained by Latour (2005), ANT treats all entities as effects of ongoing work and, unlike many theories of the social, does not insist on boundaries between material, social and discursive realms. An educational innovation is an assemblage of material-social-discursive entities whose relations produce forces or agencies. It is only in relation that the character of particular entities emerge and it is only in relation that forces or agencies are produced. Within ANT, entities that act on other entities

are called actors, and interactions between actors form webs of relations that are dynamic, varying over time in terms of their character and durability. One might argue that the natural state of things is a movement towards entropy, with actors dispersing and actor-networks tending towards breaking down; ANT focuses on the work required to hold things together (Latour 2005). Bigum (2000) usefully contrasts an ANT-informed understanding of innovation with Everett Rogers' influential theory of the diffusion of innovation, wherein an innovation is treated as a stable entity whose degree of success or failure is explained by retrospectively attributing properties to actors who variously assisted or hindered the implementation of the innovation. In contrast, ANT offers a theory of *translation*, whereby the innovation changes as new actors are recruited, and—through their relations with other actors involved in the innovation—actors also change. However these are not linear changes from state *a* to state *b*, but—as is discussed below—manifest in a multiplying of realities. If an actor-network stabilizes or tends towards the singular, it is due to the normalization of ongoing work involved in performing a seemingly stable state (Callon 1986). In the description of the CBEM Schools Project that follows, we draw on these ideas by describing the relations between human and non-human actors involved in the project and the different realities that are performed. We draw on our observations and experiences over a two-year period to describe how actors act on one another and the agencies that are produced. We discuss how these relations produce translations in the project and in the actors themselves, and the work involved in extending the project over space and time. For the purpose of illustration,

we incorporate photographic data as well as excerpts of teacher interviews and student focus groups conducted as part of a larger research project. We conclude by identifying the type of work involved in propagating place-based educational innovations of this kind.

Concept-project

We use the term *concept-project* here to refer to the CBEM Schools Project as it was first conceived by its initiators—largely, the authors of this paper. The CBEM system involves the installation of fixed wooden or stainless steel posts at particular geographical locations judged by the posts' sponsors to warrant environmental monitoring. The top of each post is cut at an angle (to form a camera cradle) specific to its location. Instructions on each post ask people walking by to use their own camera (e.g. an iPhone) to take a photo of the given scene and then to email it in to a particular email address for inclusion into a publicly accessible web album—a distinct album for each location. Over time, the visible changes occurring to each location being monitored can be observed (see Figure 1 for examples of photos from the two web albums referred to in this paper). The web albums are housed in an online file system that allows subscribers to also post comments in relation to particular photos. These comments are publicly available, together with metadata that accompanies photographs, such as the date and time the photo was taken, file size, exposure, number of pixels, and camera type.

The CBEM Schools Project emerged from a research collaboration between researchers with diverse disciplinary backgrounds but a shared interest in engaging

young people productively in the health of their communities and the environment. Martin is the developer of the CBEM system, with a background in nature-based tourism. In his work to extend the CBEM system to many sites across Australia, Martin has engaged with many land-managers who have sponsored posts in particular locations of interest to them; thus central to his interests are the motivations of land-managers and the value they might derive from their sponsoring of posts. Related to this is an interest in the motivations of those passers-by whose work is critical to the success of the CBEM system—what leads them to stop and to participate; what values do they derive? The others of us, drawing respectively on backgrounds in curriculum innovation and technology (Julianne), information systems (Naomi) and environmental education (Efrat), have contributed to this systems move into schools as part of the project we refer to here as the CBEM Schools Project. Julianne is passionate about teacher and student empowerment and building opportunities for schools to interact with their communities in agentic ways, believing that this type of work promotes engagement and achievement for diverse students, together with associated gains for individuals and communities. Efrat has worked for a long time in the promotion of sustainability education, working with schools and agencies to build opportunity for the construction of knowledge and attitudes that serve the health of local ecosystems. Naomi is a researcher of information systems and has a keen interest in exploring the role of social media in student learning and community building and understanding how productive connections between students and experts in the field can be established and maintained over time. So already, the CBEM

system is being pushed and pulled—as are we—as we seek to connect with and bend each other and the system to our own purposes.

The CBEM Schools Project was conceived as an opportunity to engage young people in activities that would enhance their appreciation of natural environments, raise their awareness and understandings of environmental issues, develop their sense of responsibility and advocacy for the environment, promote school engagement and achievement, and ultimately contribute to societal change and environmental health. It was imagined that school students could use CBEM posts installed in their local areas, together with the growing photo collections, as a foci for teaching and learning activities that would be supported by 'experts' from local land-management authorities and other relevant groups. Students might visit the posts, contribute photos, visit the online photo collections, contribute online comments about particular photos, and in other ways study the online collections as part of their school learning.

However, this description of the concept-project is a discursive artefact—even amongst our small team of collaborators, drawing on our diverse backgrounds and interests, we are more inclined than indicated by this abstract description to provide a variety of descriptions of the project than to speak in unison. But discursive material also acts, and the description of the CBEM system and of the 'schools' project has been put to work in this and other documents (grant applications, award nominations) in an effort to sustain and direct the project. Thus the description offered here of the concept-project is our initial discursive move in a paper that constructs a narrative of detour and return—how the project is translated and multiplies, but also how it returns

value commensurate with some of our hopes and imaginings. This approach is consistent with Latour's (2005) treatise on Actor-Network Theory, where he describes the research report as a 'laboratory' and characterises a good ANT account as one that offers 'a provisional staging of the connections it has managed to deploy' (p. 139).

As curriculum work, the project can be positioned as cross-curricular, offering potentials for learning in domains such as science, geography, and civics, as well as drawing upon and servicing areas such as literacy, numeracy and information and communication technology (ICT). As a 'schools' project, the project aligns with numerous approaches to curriculum and pedagogy that serve as rationales for its design. Such rationales and their associated aims have important discursive force within educational innovations as they are mobilized by advocates in an attempt to attract other actors and to translate their interests such that they align with the aims of the project (Latour 1987). We call on and appropriate three approaches to curriculum and pedagogy here in order both to characterise and to justify the work of the CBEM Schools Project: place-based education (Gruenewald, and Smith 2014), community-school partnerships (Sanders 2006) and mobile learning (Pachler, Bachmair, and Cook 2010). These are tags for heterogeneous but axiologically cognate networks of ideas, texts and bodies in educational practice and research. Each of these networks is said to respond to what are understood as deficiencies in more traditional approaches to classroom teaching and learning, and each of them also promises opportunities for developing new skills, knowledges and dispositions, thus representing a broadening and enriching of traditional curriculum.

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Gruenewald and Smith (2014, 24) define place-based education as 'a community-based effort to reconnect the process of education, enculturation, and human development to the well-being of community life', wherein engagements with local phenomena are used as vehicles for countering student disengagement, developing empowering learner dispositions, and stimulating student involvement in community improvement and community building. Gruenewald (2003, 7) described a critical pedagogy of place characterized by objectives of both *decolonization* and *reinhabitation*, where decolonization is about 'identifying and confronting the ways that power works through places to limit possibilities for human and non-human others,' and reinhabitation involves pursuing 'the kind of social action that improves the social and ecological life of places'. This understanding of place-based education is consistent with the model of school-community partnership advocated by Uzzell (1999) who argued that symbiotic relationships between schools and their communities is a desirable model for environmental science education because it provides students with opportunities to act in relation to actual environmental problems, and to appreciate the complex issues involved. Thus these approaches are invested with hopes of supporting attitudinal change and the development of action-competence (Jensen, and Schnack 1997), where students are prepared to act for both societal and personal change. Agentic links with community, where both school and other community members practice a willingness to act in support of shared undertakings, are seen by Sobel (2004, 36) as a critical element of effective place-based education, where academic achievement, environmental health, and what he

refers to as 'vital communities', are mutually supportive requirement of a successful project. Thus school-community partnerships of a particular type have become a signature characteristic of contemporary place-based education, whose more obvious aims centre on academic achievement and the health of environment. In particular, Sobel (2004) argues that it is the dynamic tension between these three agendas that sustains and progresses successful place-based education.

Within environmental science education, community-school partnerships have long been considered desirable in terms of resourcing teaching and learning and enhancing the authenticity of students' work and, through this, supporting student engagement, improved learning outcomes and behavioural change (Fein et al. 2012). Within science education more generally, school-community partnerships have been identified as a potential response to student disengagement and negative attitudes towards science education, supporting better understandings of the nature of contemporary scientific practices and science-related professions (Tytler et al. 2008), as well as an appreciation socio-scientific issues and ethical considerations (Witz, and Lee 2009). These approaches to curriculum and pedagogy engage with traditional and new curriculum domains by focusing on places that are familiar to students, on how those places are or might be understood and used, and on engaging students in critical questions around where their imaginings and usages of various places come from, how they are shaped, and whose interests such imaginings and usages serve. This type of engagement is intended to support students' development of more textured understandings and awareness of the world they live in—materially, socially,

politically and economically—but they are also often aligned with a desire to transform curriculum and pedagogy, where educational reform is understood to be 'as much a problem of articulating the school with the public sphere as of changing what goes on within its walls' (Nespor 2000, 40).

Community-based monitoring projects are located at the nexus of place-based learning and community-school partnerships, bringing together the potential affordances—and also the complexities—of both. Existing research on CBEM projects—largely positioned within the *citizen science* literature—tends to focus on attempts to measure impacts and outcomes serving the purpose of project evaluation and the development of effective models. Impacts and outcomes of concern usually relate to participants' learning, attitudes and behaviours, as well as potential broader societal and environmental conservation effects. For example, Thornton and Leahy (2012) used a social network analysis—deployed within a post-positivist pragmatic approach—to measure the increase in social capital produced by a CBEM project. In regard to school-based projects involving community participation, most studies focus on learning outcomes, particularly in relation to intergenerational learning, attitudes and behavioural changes (Ballantyne et al., 2001; Sutherland & Ham, 1992; Vaughan et al., 2003). Other studies have proposed models for such school-community environmental engagement (Mogensen and Mayer, 2005; Guevera, 2006). These studies are consistent with broader funding and research trends focused on identifying the *effects*—particularly in relation to student outcomes—of educational interventions and initiatives. In contrast, in this paper we attempt to engage in a very different

undertaking, where our concern is not what 'effects' the CBEM project might have produced or how such effects might be reproduced, but how the project itself unfolded and multiplied and what might be learnt about curriculum innovation and how such projects *behave*.

Place-based approaches to teaching and learning are not new, particularly within environmental science where the class field trip is a familiar school 'script' for interacting with and thus producing public spaces (Nespor 2000). However, new mobile technologies allow for additional modes and channels to play a role in the production of place, where relations across time and space, between people, and between people and objects (and increasingly, between objects and objects (Farman 2015)), bring with them new forces and new architectures of possibility. Herman, Hadlaw, and Swiss (2015) explore how the convergence of mobile communication technologies supports new sociomaterial practices that are more fluid and more dynamic, both materially and in terms of the imaginaries that surround and inform them, and Cumiskey and Hjorth (2013) posit new forms of presence, identity and place. These new mobilities to which we are subject can be also be harnessed in the service of decolonizing and reinhabiting processes. Pachler, Bachmair, and Cook (2010) offer theorisations of mobile learning, positing a new learning paradigm focused on learner-generated content, where users are actively engaged in generating their own contexts for learning. These developments bring with them new power relations, where users can create, collect, curate and publish their own content to

audiences of their own making, thus being positioned as active participants and producers of culture rather than merely receivers of it (Lessig 2008). Of particular relevance to the CBEM project is the increasing use of mobile photography, where digital images can be easily captured and disseminated, together with metadata about qualities such as location. Palmer (2012, 94) argues that this shift is characterised by understandings, not of photographs as primarily about representation, but of what photographs can 'do'. New concepts such as *participatory sensing*, where individuals use personal mobile devices to capture data about themselves and their communities (Shilton 2010, 132), have been developed to theorise the ways that ubiquitous mobile photography can be used to empower communities in ways aligned with Gruenewald's (2003) view of critical place-based education, that is, in the service of transformative projects of urban renewal, environmental action and citizen science. This potential has been appropriated within environmental education scholarship, where developments in digital technologies are seen as potentially supporting 'critical and action-oriented problem-based instructional practices' (Fauville, Lantz-Andersson, and Säljö 2014, 251).

In this paper, we mobilise these disparate but cognate networks of practices and ideas to help us to position and characterise a project where teachers and students work with individuals and organisations within their communities to engage in new ways with familiar locations; where mobile and online technologies are used to generate and disseminate data on these locations in support of teaching and learning;

and, where teachers and students are positioned as researchers and knowledge producers, as well as custodians of and advocates for the environment.

CBEM goes to school

Within Actor-Network Theory, all actors are actor-networks that emerge through the relations of constituent-actors—a human body is an actor-network of organs, which themselves are an actor-network and so on; a mobile phone is an actor-network of components/organs, which themselves are actor-networks and so on. It is possible for actor-networks to become more durable and to act in concert on other actors (Gershon 2010). The pre-existing CBEM system is an actor-network involving diverse physical materials (wood, steel, paint, plastic signage, the physical features of the location at which the post is installed), potential human bodies (as passers-by stop or do not to stop to take a photo), existing and potential digital material (the existing photo collections, digital files in transit, and future digital files that might be produced and submitted to the system), and non-human bodies (animals and plants and geological features that may or may not be captured in photographs or may act in other ways). Already strategies are in place intended to shape behaviours in desired directions (quickset cement to hold the post in place, layers of paint to protect the post from weather, attractive signage to gain attention of passers-by, stainless steel nails and glue to hold the sign in place, the angle of the camera cradle to direct photographs towards a particular scene, an automated email system that thanks contributors) because there is a risk that actors will disperse or will not play their intended role. And already, some actors are recalcitrant (a sign that comes loose or is vandalised, a

location that doesn't attract visitors, a bird that leaves unwanted deposits on the camera cradle, an image file that never arrives because of an uncooperative wireless connection). Bringing this system to schools offers promise, but the expansion of actors that this move requires also brings risks. There is work to be done to gain the attention and to shape the behaviours of new recruits, and through this work we are all changed.

InTheDunes Primary School

InTheDunes Primary School is located in a regional city in Victoria, Australia. It is a large state primary school that is known for its specialist science program, which was established in 2012 in partnership with a university campus, and which has a focus on local marine, freshwater and estuary environments. *InTheDunes* was the first school to become involved in the CBEM Project, when in September 2013 Martin read about the school's science program in a newspaper article and then approached Julianne who was already working in partnership with the school. School and university partners in the existing science program employed (and were shaped by) a number of related discourses when characterizing the program, including a focus on student-generated knowledge and positioning students as burgeoning scientists engaged in *real* science. There was also an emphasis on students' use of digital tools (e.g., iPads) and their production of digital artifacts such as photographs, videos and blog posts as part of their science learning. Thus, there appeared to Martin, Julianne and the science teachers at the school that there was a good 'fit' between the CBEM project and the work and aims of the school. When asked in interview why she decided to become

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involved in the CBEM project, a science teacher explained: 'We were looking for a project that was community based and a *real* like project … and it's been really beneficial, the kids have loved it and we've got right into the community… We were looking for something to deepen the kids understanding of mainly our local environment' (Teacher interview, November 2013, italics indicates emphasis in audio recording).

In the final school term of 2013, a composite class of grade 5/6 students (one of five 5/6 classes running in the school at that time, with students aged between ten and twelve) became known as the CBEM class and was charged with the task of locating suitable sites for two new CBEM posts. This work coincided with the local council's release of a draft coastal management plan for community consultation, and this plan was taken up by the teacher and students as a source of information to consider in relation to their decisions about the location of CBEM posts. Numerous external parties were drawn into the work of these students as they considered and selected sites for their CBEM posts. Environmental officers from the local council visited the school to present about local coastal sites, accompanied the students on fieldtrips, and ultimately received a submission from the students on the draft coastal management plan. The local catchment management authority (CMA), emailed photographs to the students and suggested potential sites of interest and concern. University aquatic scientists accompanied the students on fieldtrips and provided their own views on the warrant for monitoring particular sites, their environmental features, flora and fauna, and related issues. And, Martin accompanied the students on a field

trip to potential sites to provide his advice on their suitability for installation of a CBEM post. This is already a sizable network of human actors—representing five complex and distinct organisations. The connections between these organisations are tenuous, with the overlap in interests varying. Some of the organisations have a clear warrant for their participation in the project; for example, the local council has an interest in community engagement and has specific employees whose brief includes environmental education. However, the work of other organisations is difficult to recruit; for example, the CMA's community engagement activities are underfunded and relevant personnel are scarce. The university has an explicit community partnership agenda that funds the participation of the aquatic scientists, but this is soft funding which may not be maintained over time; and, our own involvement is an investment in the progress each of our research agendas. Thus various sources of labor and resources were drawn upon with varying success.

Aside from environmental features of particular sites, other criteria were considered for the placement of posts, including proximity of the site to the school when bus-trips are expensive. In fact, money was an important actor within this network, with a university providing enabling funding which paid for the manufacture of the CBEM posts, a cost that would usually be outside of the school's budget and preclude the school's involvement. The process of site selection was also acted upon by the institutionalized processes and artefacts of school teaching and learning such that we see the teacher and students develop a list of criteria that then featured in a printed worksheet completed by students when they visited potential sites, generating

data to assist them in the optimization of such considerations as evidence of erosion, evidence of flora and fauna, and amount of foot traffic. The suitability of sites was also discussed by the teacher and the authors in terms of the frequency and speed of changes that might be captured in photographs—would changes occur quickly enough to maintain the interest of students and to support teaching and learning?

In November 2013, two new CBEM posts were installed at sites selected by the students. Both posts take advantage of existing forms and structures that provide for elevation, access and secure footing: one installed on a cliff edge adjacent to an existing walking path overlooking a river mouth; the other installed on an existing viewing platform near a walking path and not far from a car park, boat ramp and café, and overlooking a beach and dune area. The new posts were also supported by a media release and a subsequent press item, radio broadcasts and a website item with video footage. These materials were put to work by those people who were already invested in the project, intended to attract other potential participants who were necessary for the project's success. The first photos were submitted by these already interested people, who were keen to maintain students' interest by seeing the photo collections grow. Submissions by the public followed and, at the time of writing, 530 (river mouth) and 57 photos (beach) respectively have been received from 62 (river mouth) and 20 (beach) passers-by, evidencing repeat visitations as the work of camera-carrying people is recruited to the project. These data indicate one of the CBEM posts is more popular than the other, where attractions at the second site (café and boating facilities) compete for attention and possibly distract and waylay potential

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contributors. Soon after the installation of the river mouth CBEM post, a local community member approached the system administrator and offered a batch of 162 images previously collected from the same vantage point between June 2003 and July 2004, thus 'historical' photos were also added to the collection, extending the project back in time. Anecdotal reports tell us that parents and students visit the posts: '[Parents] come in and say "Oh we took a photo at the CBEM post and we notice this, and did you know that there are horses down at that one?"' (Teacher interview, November 2013). The posts attract the attention of potential photographers, but they don't always direct this attention to the selected scene and to the CBEM system (See Figure 2 for examples of out-of-cradle photos contributed to the collections). The CBEM posts use their attractive paintwork and publicity to work on their own celebrity status, with students wanting to have their photos taken standing with the post (rather than taking photos from the camera cradle), and with others visiting the post without taking a photo: '"Oh we went and we saw the CBEM post" and you know, they might have been down there for a coffee, but they didn't take a photo' (Teacher reporting student anecdotes, November 2013). But not taking a photo doesn't preclude the making of other connections and a sense of ownership and responsibility: '"I saw that shark head, I was there that day that someone must have taken that photo", so they take ownership of someone else's photo' (Teacher reporting student anecdotes, November 2013).

One student explains how he appropriated a photo (see Figure 3), saving it to his iPad—"I set that photo as my background" and deployed it for his own

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purposes—"I showed my, my dad that photo when the mouth was clean and dirty … I just sended him the message, because I saved a photo" (Student focus group, December 2015). He explains how this photo shows that the river is not just a homogeneous body of water moving out to sea, but that there are different types of water, moving in different directions. "The photo … had the dirty water when it's trying to clear out and the other side was the clean water and that was really cool because you never know … You don't usually notice stuff like that … You wouldn't notice if you actually seen it there" (Student focus group, December 2015). These stories excite us because we can speculate about positive outcomes for students and families and the efficacy of the photos in an inferred learning process. These observed 'outcomes' for students are put to work in support of the project as stories circulate about the benefits for students. Students 'at risk' due to disengagement with schooling are identified for special attention in these stories: 'It engages those kids that aren't normally engaged … like my two kids that are getting the awards this year are, well one of them is a child that would never get any other kind of award but she is just absolutely amazing in science' (Teacher interview, November 2013).

Students view the online photo collections as part of their ongoing work in the CBEM Schools project. While students who were in grade 6 in 2013 had left the school by 2014, those who had been in grade 5 continued their work, joined by a new cohort of grade 5 students. The students work with the images as part of their science learning, looking for evidence of continuity and change in the growing pool of photographic data. This looking was sometimes done via iPads, but the photos were

arranged online in the order received, which is not always chronological. This posed a challenge for the students who wanted to understand the narrative of change over a linear passing of time. The teacher subsequently printed and laminated photos so they could be inspected, ordered, and grouped as part of the students' classroom work (see Figure 4). The printing and laminating of digital photos was a curiosity for the researchers involved in the project, where the needs of classroom learning demand the translation of digital material into something more easily manipulable and more in keeping with traditional classroom resources. We probably should not have been surprised by this development; as Palmer (2012) reminds us, touch has long been an important part of our interactions with photographs. These developments act on the CBEM system, stimulating a change in how the photo collections are presented, now ordered—using metadata—according to the date photos were taken.

The coupling of digital images with printing and laminating processes produced new agencies, supporting new usages. As physical objects that could be de-coupled from screens, not only could the photographs be manipulated in different ways, but they could also be used and reused in different forums. In July 2014, approximately 100 students from neighbouring schools visited InTheDunes to participate in a series of science learning activities. One of these activities was a display and presentation about the CBEM project, which included a hands-on activity using the laminated photographs. These photographs have also featured as part of displays in the school. In August 2015, a very large collection of laminated photographs was viewed and handled by visitors to the school as two students

facilitated a sorting and ordering activity as part of a 'family science night'. This CBEM display and activity was situated physically in a classroom adjacent to another activity featuring a different and otherwise unrelated project. These two projects were grouped on signage and in their proximity as parts of the 'community science zone' of the family science night event (see Figure 5). Thus the physical objects (posts, printed photos, posters) and concepts such as 'community science' serve as important focal points that extend the CBEM project beyond the classroom to parents and to other schools and to other projects, which are all co-opted by the project as potential spokespeople and potential labor. For the researchers, the CBEM Schools Project is a distinct project and a central concern. For the school, it is one of numerous projects or partnerships that is co-opted as part of the public face of the school's innovative community-focused science program.

The manipulation and analysis of photographs was attached to other types of activities where the teacher and students sought other types of data. For example, on some field trips to the CBEM posts, students looked for 'evidence of life', using magnifying glasses, collection containers, and iPads to collect data to complement the photo collections. This coupling of other types of data collection with the students' CBEM work both demarks the limits of and extends the project, where photographic data generated from fixed photo points are seen as limited, yet where the CBEM work stimulates and is coupled with other data collection activities. Thus the CBEM Project escapes the boundaries we imagined for it, yet through this escape endures as a potentially richer project serving a broader range of learning activities and perceived

outcomes and, therefore, interests. Digital media also exert complimentary forces of both escape and enrichment. On one of the 'evidence of life' fieldtrips, students found an unusual looking fish-head on the beach. While still on the beach, the teacher sent a photo of the fish-head via email to Julianne, who then forwarded it on to two aquatic scientists who work in her corridor. In less than ten minutes, the fish was identified and this information emailed back to the teacher and her students. Other digital work was done by the teacher and students at this school, including publishing images and text on their own school-based blog and to the school's Facebook™ timeline, but at no time did any of the students post online comments to the CBEM online system. Instead, the CBEM work and resulting photos and other digital artefacts were co-opted by other, existing social networking sites already employed by the school. These moves occur outside of our imagined project but they serve to fuel the project while also transforming it.

These 'escapes' work to perpetuate and enrich the project but they also present to the authors—as initiators and researchers of the project—a loss of control, where images, text and other materials proliferate in ways that are difficult for us to track. Our initial imagining of the project anticipated students using the online photo collections as sites for observations and questions. At the time of writing, we are hatching a plan for containment (perhaps naively), developing a 'student-friendly' password-protected portal for use by participating schools, through which they will be able to make observations, upload other digitalized data, and have online textual exchanges with 'experts'. The teacher has also mobilized containment strategies that

seek to bed down the project by coupling it with normalized structures and processes. In the first year of the teacher's involvement with the CBEM project, she had treated the CBEM work as complimentary but additional to the main science work undertaken by the 5/6 grade level. In November 2013, although the teacher identified areas in the formal curriculum with which the CBEM work aligned ('science as a human endeavour' and 'scientific literacies'), she explained that mapping the project activities onto the formal curriculum was not an essential part of this work: 'In the other science lessons I have to have an outcome that links with [the curriculum framework]. I know everything else is covered so that the CBEM project is … an extra. So I don't have to worry too much about [the curriculum framework]'. And in relation to pedagogy, she explained, 'To me it feels very unstructured compared to a normal lesson where you have all plans in your head and where you're going to go. Whereas…we look at the photos and say "Okay what can you notice here?" And they'll say "Well we notice the bushes." "What do you notice?" "Oh one's yellow and one's green." "Okay well let's have a look. What does it mean when one's yellow and one's green?" And take it from there. … so there's not a lot of planning for me.' However, by 2015, the institutionalized structures of schooling—the organization of space, time, curriculum and students—act more forcefully on the student and teachers' CBEM work. As they progress through 2015, each grade 5/6 classes at the school cycle through a unit of work developed by the teacher to focus on the project. Although the teacher continues to let student observation and questioning drive the foci of inquiry, this work is now contained within stricter time limitations, with

pressure to reach a state of completion over a small number of lessons. Thus structure and accountability emerge from the translations undertaken as the project changes status from an innovative extra for a small group of students to a program delivered to all.

Across the 'life' of InTheDunes' involvement with the CBEM project, many translations have taken place. Yes, photographs are taken but not always from the camera cradle provided. Yes, attachments are formed, but not necessarily through the taking of photos. Yes online observations and exchanges occur, but not via the channels provided by the CBEM system. Pedagogy and curriculum are continually negotiated as an interplay between what is imagined, planned and required and the force and desires of unanticipated and often uninvited actors. Some connections between school community members (e.g., parents) have become more tangible as they couple with physical objects. The connections between parent, child, school and the sites are not new, but the exchanges about them are, and the direction of flow of information is not always conventional with parents now submitting information and initiating exchanges with the school. Other connections are more fleeting, and the flow of information is more conventional, with external 'experts' responding to requests when called upon. Despite the work done by the school timetable and term structure, and requirements to 'complete' project work over a short period of time, other actors continue to present opportunities for escape, and the work of the students navigates a path between structured activities and unplanned events and entities: the sea continues to present curious objects, unknown members of the public continue to

submit photographs with unpredictable content, the weather shapes narratives of continuity and change that are largely predictable but sometimes disruptive, 'issues' arise in local media or the work of local authorities, and many of the 'outcomes' escape the view of curriculum and assessment tools, and indeed our research tools.

Conclusion

So what can we say the CBEM Schools Project is when we draw on concepts from ANT and how might this approach speak to existing understandings of place-based education and community-school partnerships in times of mobile media? Traditional constructivist or perspectival approaches (as critiqued by Mol (2002)) might say that the project means different things to different people, therefore assuming an ontological depth where somewhere behind our different perspectives lays a singular phenomenon. However, ANT suggests that this view is inadequate. Translation is not a mere metaphor for supporting the unearthing of different viewpoints of the same, but instead points to an ontology where properties emerge through relations that produce multiplicity (Mol 2002). That is, it is not only that different bodies experience the project differently, but that these bodies—in relation with each other—enact different realities of the project and are themselves are changed. The co-existence of these different realities is necessary for the project to endure. At times these realities overlap; at other times they are in conflict. The continual policing of the project *as a project*, and the on-going recruitment of people, material and ideas that are folded into it, both respond to and perpetuate this requisite multiplicity. This insight into requisite multiplicity is illustrated by Hinchliffe (2010) in his case study

of an urban community garden. Hinchliffe stresses that 'the reality of the garden is dependent on it being more than one thing' (Hinchliffe 2010, 310):

> The notion of there being alternative views of the same garden, with one somehow being privileged over the others in terms of its ability to really represent the garden, doesn't capture the ways in which these gardens relate to one another and so make the garden. (Hinchliffe 2010, 305).

So rather than a perspectival approach that would have different views of an a priori phenomenon in tension with one another, Hinchliffe suggests that there are multiple realities that are sometimes in tension with one another and need to negotiate with each other. Sobel (2004) identified the dynamic tension between potentially mutually supportive agendas as the generative force of place-based education. An ANT approach allows us to describe the tension between realities and how they are negotiated. The teacher enacts the CBEM Schools Project in relation to curricula, timetables, groupings and typings of children. For her, the project is sometimes structured and sometimes unstructured in a playoff of particular risks and opportunities that are conditioned by the structures, constraints and stakeholders of formal schooling. For the community 'experts', the project is enacted differently depending on their interests and their ability within their organisations to mobilize resources. The CBEM posts assert themselves as a focal point of the project, performing their celebrity status. The researchers try to shift this attention to the photo collections, wanting to see them grow and be used in particular ways. For the researchers, these collections are central to their imaginings of the project and they continue to look for ways to harness particular types of participation. However,

mobile media couple with other bodies to produce unanticipated escapes from the CBEM system. In this way, the relation of human bodies and digital material support the translation of the concept-project and the proliferation of realities. Visitors to our sites of interest enacted new paradigms of surveillance, where sites are surveilled for the purpose of community empowerment along the lines of the participatory sensing theorised by Shilton (2010). More traditional logics of surveillance also persisted as we—the researchers—seek to metricise the behaviours of visitors through our collection and analysis of metadata, and as we seek to shape the ways in which visitors participate in the project. Escapes from surveillance are performed by the students and teacher as a multiplying of channels is enacted through exchanges of digital material occurring outside of the CBEM system. Thus, the project manifests in multiple forms that co-exist as key actors pursue their interests and—in relation with other actors—have their interests translated. We argue that these translations and tensions are a prerequisite for the success of the project. This could be said of any body—a school, a teacher, a child—if there is not ongoing translation, then interests and vitality begin to disperse.

Actor-Network Theory provides a non-conventional view of innovation as a process of translation, where properties emerge through relations: as actors are recruited to the innovation, the innovation is multiplied. What is important for the durability of the innovation is that these different versions can coexist and interrelate in generative ways. Visitors to CBEM posts may well upload photographs taken of other scenes and other objects, but when teachers use this as an opportunity for

learning about the environment, or when through interactions with these photos, students' sense of connection with a particular location is enhanced, these visitors and their photos contribute to the performance of a new reality. Thus the interests of teachers, students, researchers and others involved in the project are translated into something different that both represents a potential risk or loss of control, while also being commensurate with the ambitions of key human actors.

The CBEM Schools Project is a function of multiple translations and escapes, which teach us about the need for flexible and fluid boundaries within such projects. Various stakeholders might attempt to define boundaries and agendas, but the success of the project is reliant on a tolerance—even an embrace—of transgression as multiple realities interrelate. If entropy, dispersal and disconnection are underlying material forces, then the work involved in maintaining an educational innovation is work that maintains the interest of relevant actors while also responding productively to emergent versions of the innovation.

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Figure 1. Illustrative photos taken from the camera cradle at the river mouth and beach posts respectively

Figure 2. Illustrative out of cradle photographs from each post.

Figure 3. “the dirty water when it's trying to clear out and the other side was the clean water” (Student focus group, December 2015)

Figure 4. Students organise laminated photographs on floor

Figure 5. Signage for one of the spaces featured in the Family Science Night