Redefining the Relocatable: Multidisciplinary design for a wicked problem

Abstract

This paper centres on a three-year Australian Research Project that has sought to redefine an important component of Australia’s education infrastructure, the relocatable classroom, as high performance and design-led through a multidisciplinary research process. Our focus has been to encourage conversations between educators, designers, government procurement teams, and manufacturers. This has been more difficult than expected as we speak different epistemological languages and see the world through different lenses. The paper will track some of the obstacles and strategies for carrying out a multidisciplinary research process.

There are tipping points occurring worldwide in prefabrication, sustainability technologies, 21\textsuperscript{st} century pedagogies, and information technologies. To continue building new learning environments based on what was designed yesterday, without taking advantage of new possibilities, will be wasteful of scarce funding resources.

The relocatable classroom is yet to benefit from these advances and remains a learning environment that many people consider as second rate. For decades the relocatable classroom has been maligned for its unfavourable indoor environment quality, low aesthetic appeal, temporary quality, and lack of adaptability in light of changing pedagogical trends. The manifold reasons for this are complex, although the primary issue centres on them being considered less important than permanent buildings because they are perceived as ‘temporary’. Fundamental questions arise. How temporary are they? Does this justify a less than optimum learning setting? In order for these classrooms to become agile and high performance places for teaching and learning they need to be considered from an inclusive, multidisciplinary base rather than the current silos of practice.

Keywords: Design Research, Multidisciplinary Research, Relocatable Classrooms
1. **INTRODUCTION**

The case study at the heart of this paper is a three-year Australian Research Council Linkage Project which has sought to *redefine the relocatable classroom* within Australian schools. Relocatable classrooms within Australia accommodate up to thirty percent of government school students in some states and yet they are not given the same design attention as the permanent buildings. The lack of design quality has been largely overlooked because these spaces are viewed as temporary. Our aims for the research were to capture, into a competition design brief, the multiple contexts influencing the design and procurement of the relocatable classroom and to bring the relocatable classroom back into the sight of users and providers of education facilities.

We were aware of tipping points occurring across a range of disciplines and were interested to develop confluent solutions. Our key question was whether we might leverage tipping points in 21\textsuperscript{st} century learning, sustainability, prefabrication and mass customisation to redefine the relocatable classrooms as agile, inspiring, high performance and delightful settings in which to teach and learn. More importantly, can we use a multidisciplinary research process to highlight problems with this building type in groups of stakeholders who see no problem?

To fully address all the factors that contribute to successful learning spaces – and apply this thinking to the ubiquitous relocatable classroom – the multidisciplinary research team’s expertise spanned architecture, pedagogy, sustainability, landscape design, information technology, parametric design, project management and facilities management. Research partners brought vital industry knowledge, and the collaboration with six education departments from around Australia made the research and its possible outcomes real and tangible.

In undertaking the research process we found that the issues we were addressing as researchers had parallel issues within the research problem itself. Forming a functional multidisciplinary partnership within a university context is surprisingly difficult as universities are powerful places of exclusion. The most esteemed academics are generally the most specialised.
Just as university faculties operate as largely independent silos, classrooms often operate in a similar way with students moving from one subject silo to another, regulated by bells at fifty-minute intervals. This is at odds with constructivist ideas about authentic learning using real world scenarios.

As education shifts to be more student-centred learning in a digitally rich environment there are spatial issues to be considered. Space supports people coming together formally or informally around specific problems. An important early strategy was for the research team to gather within the one open plan space making the informal sharing of knowledge more accessible. It is understood that communities of practice are aligned with depth of discipline knowledge but there is also recognition that the edge can be a powerful zone of innovation and questioning when multidisciplinary teams collaborate (Wenger 1998).

There is a growing cohort within academia, schools and organisations who might be best understood as subversive boundary riders. Yet while boundary riders are recognised for repairing of fences, our subversive boundary riders are breaking the fences between disciplines. Interdisciplinary bridge building is needed as well as disciplinary fence breaking. The role of the subversive boundary rider is high risk because recognition can be problematic. In academia, the established discourses, journals, conferences, academics and grant referees are understandably situated at the heart of discipline specific knowledge.

Working across discipline boundaries has been surprisingly difficult. We each bring distinct research methodologies and they do not always sit comfortably alongside each other. Some of our research team worked within a critical social context using qualitative tools such as ethnographic research methods. Others in the research team employed a science-oriented gathering of data in order to track patterns and evaluate processes. There was a constant querying of approach and we developed an iterative research dance moving in parallel before coming back together as a team and vice versa. In this sense, we tended to be a multidisciplinary team of researchers rather than interdisciplinary or transdisciplinary.

Government and corporate bodies are increasingly encouraging, indeed requiring, multidisciplinary collaboration as a pathway to new knowledge and new partnerships.
between academia and the community. The Australian Research Council (ARC) is one such government body that actively places multidisciplinary research at the heart of a number of its research funding structures. ARC Linkage Projects require not only a multidisciplinary collaboration between academic knowledge bases, but also an active participation of Industry Partners who potentially lie outside and across a gamut of disciplinary and commercial interests. Initiating and navigating such research is useful for dealing with ‘wicked problems’ (Rittel & Webber 1973).

This paper focuses on an ARC Linkage Project entitled *Future Proofing Schools* which sought to address a real world challenge, the *relocatable classroom*. We also explore related experiences from activities in our teaching and learning which highlight some of the obstacles and opportunities of working across and between disciplines. These stories are relevant for other researchers who are embarking on similar journeys and who are seeking to have an impact on design practice through multidisciplinary research.

Researchers can fall into the trap of just seeing the *blank spots* through the lenses used within their discipline area. Other disciplines can help us see our *blind spots* (Wagner, 1993). In considering the design of physical learning spaces in schools, we argue that research conversations and methodologies are richer if experts from a range of discipline areas are involved. When questioned, the core reason given for not including expertise beyond the discipline is that the important issues are within the discipline.

As we undertake our research alongside our colleagues from different disciplines we find ourselves tripping over language. The terminology within each of our disciplines appears as jargon to outsiders who miss the nuanced meaning shared within a cognate group.

2. **CASE STUDY: A REAL WORLD PROBLEM**

2.1 **The research context**

Just as different terminology across disciplines can be a stumbling block, we can find different terms being used within a single discipline to refer to the same thing, creating confusion. Our research focused on relocatable classrooms which are standard, generic classroom products that are built by manufacturers to government specifications (Figure 1).
They are known by different names depending upon the country, state, or manufacturer of origin. During our research, some of the names we have come across to describe these classrooms are: relocatables, portables, transportables, prefabs, demountables, Mod5s, brown boxes, wobbly boxes and terrapins.

![Figure 1: Typical Mod 5 Plan and Photograph. Source: The FPS Research Team](image)

Relocatables are a planned response to support changing student populations resulting from immigration and shifting demographics; they provide a rapid response in emergencies such as fires and floods; and they are useful in remote communities where labour and materials are scarce. As such, they are important components of education infrastructure in the UK, the USA and Australia, yet for a variety of reasons these classrooms are often second rate environments for learning and inhabitation. For decades relocatable classrooms have been recognised as having less desirable indoor environment quality, low aesthetic appeal, temporary quality, and lack of adaptability but there has been little interest in improving them as they are considered only temporary. In contrast there has been a growing interest in the design of permanent school spaces to accommodate changing pedagogical trends and rich information technologies (Dumont, Istance & Benavideo 2010).

The movement towards student-centred constructivist approaches to schooling has its roots in 20th century educational theorists such as Dewey (1966), Friere (1970), Vygotsky (1986) and Gardner (1993). Dewey and Friere each emphasised the need to focus on student initiative in order for education to be relevant. Friere argued that education should be based on the experiences of the learner rather than be guided by the dominant culture. Vygotsky explored learning as a language-based collaboration. The concept of ‘authentic learning’ was used by
Neumann and colleagues to advocate learning that is produced, rather than reproduced knowledge. Other writers discuss the advantages of learning being related to profound questions requiring multi-disciplinary thinking rather than being limited within subject silos such as mathematics or English. The digital revolution has been a tipping point that escalated the movement towards student-centred learning and new 21st century learning spaces.

A critical question that impacts every facet of the procurement of relocatable classrooms is: are they temporary or not? The notion of temporary versus permanent is central to the sense of worth and value that policy makers, client groups, designers and school communities attribute to these buildings. It therefore becomes the core driver in determining budget allocations; prefabrication systems; site placement, integration and landscape connections; visual appearance, design and quality; the refinement of the prefabricated classroom product over time; and a school’s sense of ownership of the buildings.

The notion of temporary is relative. Relocatable classrooms may be located at a school for five or six years which from a student or parent perspective may be the entire time that the student spends at that school. Hence to students or parents, they are effectively permanent buildings. The reality is that these buildings don’t get moved around as much as might be
expected, and history has shown that many temporary buildings end up finding a permanent home at a school. We need to stop thinking that ‘temporary’ is a reason for lesser quality.

Another core issue is that of transferability (Figure 2). Many of the problems with today’s relocatables stem from the challenges faced by a generic, mass produced product that is pre-designed to move multiple times to a variety of different contexts over a 30 – 50 year life span. However they are not specifically customised for any of these contexts, and are generally a ‘one size fits all’ response. For the relocatable classroom to become truly agile and appropriate in the future, the design of the product will need to address how it can adapt from one climate zone to another; to a wide variety of physical and cultural contexts; and to support a wide range of teaching and learning styles.

Encouraging architects and building designers to embrace the potential offered by emergent digital fabrication technologies, and the inherent opportunities for mass customisation, will be an important key to unlocking the ability of our buildings to be more agile and adapt over time.

Within many new permanent buildings for Australian schools and buildings delivered as part of the Australian Government’s Building the Education Revolution investment (Newton & Gan 2012), we see a shift away from classrooms into more fluid environments of large and small, interconnected learning spaces. There are some permanent prefabricated learning spaces in Australia that accommodate these new ways of learning. This level of innovation is not yet seen in relocatable classrooms which are generally individual, rectangular spaces without fluid interconnections with other learning spaces.

This case study reveals gaps between disciplines. With some notable exceptions, issues to do with space are largely absent from educational discourse (Fisher 2002) while terminology used within education is foreign to many designers. Designers are likely to have limited understanding of the impact of changing technology and new thinking on pedagogy while facility planners may focus on life-cycle costing and management rather than pedagogy or space. Manufacturers and builders understand construction yet most will have little or no training in design and aesthetics. Architects are passionate about creating customised, crafted jewels of architecture for their clients. Building manufacturers are in the business of mass
production, and their business model requires a level of volume and repetition. Infrastructure managers in government departments are working within the confines of government policy and funding models, and frequently come from a project management or engineering background. The difficulty is that universities, education departments, schools and design professionals and construction sectors do not easily support conversations across discipline boundaries.

This selection of issues reveals that addressing problems within an apparently simple building type is in fact a complex conundrum. The key to unlocking such a conundrum requires a creation of links across and between disciplines in which conversations and conclusions occur at the interstices. Yet, as with many real world wicked problems, we find that the various protagonists have infrequent opportunities to meet or collaborate with each other. In order to leverage the previously identified tipping points so they become agents in step change rather than incremental change, we need to create opportunities for the cross-section of stakeholders to investigate the problems that cannot be fully addressed within the confines of our own disciplines (Cutler 2009).

Figure 3: The Complex Web of Stakeholders. Source: The FPS Research Team
2.2 The research stakeholders

The research involved a complex web of stakeholders (Figure 3), creating a number of new relationships which the team needed to negotiate and nurture rapidly. Based upon the team’s experience of previous multidisciplinary research, an early decision was taken to dedicate two Research Associates for the duration of the project. In addition to research activities, they had clear roles to identify and nurture new relationships within the wide spectrum of possible research participants.

Early in setting up the research, the team became aware of the varying degrees of ‘buy-in’ from stakeholders. Initially, certain stakeholders felt the need for change was urgent, while others did not perceive a need for change, as highlighted by the following anecdotes coming from six different people commenting on generic relocatable classrooms:

**Prefabrication expert:** Relocatables... At their best they can be described as cheap and cheerful – but they look cheap and often aren’t too cheerful. Unless we get some proper design thought applied to the problem, then prefabrication will remain synonymous with mediocrity.

**A parent:** How can the government say it values education? There are some wonderful prefab housing projects we see in magazines - why can’t the relocatables look like that? Why must they look and feel like factory sheds?

**Architect:** In developing the master plan for this school, it was especially important that we could hide all the ugly relocatables at the back of the site, out of view.

**Education infrastructure manager:** We cannot deny the stigma that is attached to them. We need to work towards systems that mean that relocatables don’t look like relocatables...

**Generic relocatable manufacturer:** The single biggest challenge for us is that of preconceptions. Our product has improved greatly but the perceptions have not... Our new products lead the way in green technology...

**University academic:** I went to school in relocatables, my children went to school in relocatables – it didn’t do us any harm...

These anecdotes come from a range of people who each bring their own framework of knowledge. Each comment is true for the speaker and yet as a group of comments they reveal contradictions. The frustrated expert is seeking to increase the uptake of prefabrication yet believes that the many benefits it brings are masked by negative associations. A parent laments the utilitarian building where her 6 year old is experiencing school for the first time, and knows that other sectors are developing more interesting prefabricated buildings. The architect boasts that she managed to hide all the relocatable classrooms at the back of the site,
even though this means those young students are further away from the school’s main toilet block. An infrastructure manager knows the relocatables need improvement, but is constrained by established procurement protocols and funding models. The manufacturer is proud of the build quality of his product yet doesn’t appreciate that it could look and function so much better. Finally, a successful academic from a supportive, nurturing and financially secure background is unaware of how relocatable classrooms might be perceived by communities of social, economic and educational disadvantage.

How do we accommodate or unravel these separate truths into a more coherent and richer analysis regarding relocatable learning spaces? Multi and cross-disciplinary conversations are needed so that we can find common ground.

“We are not students of some subject matter, but students of problems. And problems may cut right across the borders of any subject matter or discipline.”

This observation by Karl Popper (1968) reflects the multidisciplinary research experiences of both authors. Perhaps it is timely for communities and organisations to invest in some subversive boundary riders commissioned to build bridges and break fences.

2.3 The research milestones

It was essential to create an inclusive research framework that would bring together the manifold voices and perspectives of the various stakeholders while avoiding situations of conflict and tensions. The process needed to provide safe and trusting contexts for our wide range of stakeholders to express their viewpoints with honesty. A three phase research process (Figure 4) allowed for moments of disciplinary focus, multidisciplinary collaboration, and forums for key stakeholders to meet, share and review findings to map a way towards the future. It also included speculative responses by over one hundred designers in the form of a Design Competition embedded within the research process.

Phase 1 allowed opinions to be shared and data collected within the familiarity of discipline strands. Team members visited schools across Australia to understand best practice in learning environment design and educational challenges. Focus groups, workshops and
involved many age groups, contexts and cultures ranging from primary to tertiary level education, suburban communities with large representations of new migrants to remote, indigenous homeland communities. Other team members travelled nationally and internationally to understand emerging best practice in prefabrication, during which conversations with manufacturers, architects and client groups highlighted opportunities, constraints and inspirational new ideas. An ecologist and landscape architect investigated the opportunities presented by continual reframing of the relocatable classroom’s relationship with the landscape. Sustainability experts monitored the indoor environmental quality of relocatable classrooms across Australia.
Yet these activities were largely discipline based in their nature. In order to create moments for true multidisciplinary collaboration, the research required orchestrated moments when the discordant voices of the various stakeholders came together. Three primary events – the symposium, the competition and the round table session – presented key opportunities for the research investigators to leverage an increasing body of multi-disciplinary knowledge and take on the role of subversive boundary riders.

A carefully crafted multidisciplinary symposium provided an important moment for ideological shifts. During previous research projects, the team had gained a reputation for creating unique events conceived as conversations that brought together educators and building designers to discuss learning spaces. Building upon these successes, we designed an event that invited delegates to share honest viewpoints on various aspects of the relocatable classroom. Educators, architects, government education departments and researchers attended the event.

Authenticity was crucial. One speaker was the principal from a remote community school in Australia’s outback who shared stories of her day to day challenges in creating a nurturing learning community in a context where distance and culture could be divisive. These stories were told with humour and respect, and the audience were transfixed. The audience also noted the red dirt of the outback that was still ingrained in the soles of the principal’s shoes, having arrived in the city only the night before. Another speaker, an academic in the architecture discipline, shared research and student work with the audience as he explained the potential of impact of parametric design on the future built environment. These presentations were followed by vibrant discussions in a series of smaller working group sessions when delegates collaborated and discussed the key themes.

Delegates later visited the factory of a prefabricated building manufacturer. The diverse group included architects, architecture students, educators, facilities managers, as well as the bus driver who preferred to join the tour rather than linger outside the bus. If any delegate had harboured negative preconceptions of the potentially high quality of prefabricated building prior to the visit then they all left as converts, including the bus driver who clutched the sales brochure tightly in his hand. On the trip back, he excitedly told us that he might have found the solution for his rural block of land.
The purpose of this symposium was not to solve the problem. Its purpose was to introduce the various stakeholders, many meeting for the first time, and provide them with new lenses with which to view common issues. This format of *authentic conversations* and experiences can foster a new awareness of differing viewpoints and opportunities outside of our day-to-day disciplinary context.

Embedding a design ideas competition within a research process is unusual, yet we considered it as a pivotal element of our research methodology. Design is an invaluable strategy for working through wicked problems that are so complex that they defy definition. Through design, complex ideas can be tested within scenario settings in order to explore different futures. In funding a design ideas competition within a design research project, the ARC was allowing us to invite a broad base of design practitioners to become active research participants.

In developing the brief for the *Future Proofing Schools Design Ideas Competition*, the research team was aware that the problem of the relocatable classroom was too complex to be resolved in a one-stage competition format. For example, detailed responses to issues of temporality and transferability could only be touched upon within the time frame. Instead, we were inviting entrants to think ‘otherwise’, and therefore encourage and inspire government education department, manufacturers and educators to do the same. Although we had encouraged entrants to form multidisciplinary teams, we found that these were formed largely from within the disciplines of the design professions.

At the conclusion of the competition, an on-line gallery, exhibition and exhibition brochure were tangible means of sharing 119 new ideas for the future. We shared and celebrated the competition entries with the wide range of stakeholders, in the hope that seeing an inspired and delightful version of a building type they knew well would shift both their aspirations and expectations. The research team analysed the key themes, quick wins and gaps of the competition responses and these findings were documented in our publication *The Phase 3 Research Reflections*. It was at this point, when ideas were on the table and key opportunities for the future had been identified, that educators and manufacturers started to engage in the conversation about relocatable classrooms of the future.

Six months later, a round table session was a final collaborative research event that brought together the various stakeholders of the three-year research project, allowing us to assess and
understand new knowledge bases, where viewpoints may have shifted, where they remained the same, and plan future steps. This final event was conceived as a reflective session, and the body of knowledge developed during the research provided a springing point for a series of speculations. It involved forecasting an aspirational future then backcasting to understand the possible route to achieving that future.

The event was attended by educators, architects, government education departments, researchers and prefabricated building manufacturers. With the research team’s new appreciation of connections and potential collaborations, we acted as ‘matchmakers’. We planned strategic seating combinations to generate fruitful connections, making sure that there was a balanced mix of perspectives at each table.

Prefabricated building manufacturers had been under-represented in the previous activities so the research team made a conscious effort to create an agenda that made their attendance worthwhile. A focus on networking with key players in major client groups was enough to achieve a ten-fold increase in their attendance when compared to the first event. Following the event, numerous manufacturers who had heard of how useful it had been for their peers expressed regretting their non-attendance.

A number of important outcomes are emerging from the round table session, building on these new conversations. Architects and manufacturers who met at the event are now discussing potential collaborations to develop new, design-led products for the future. Another emerging outcome is a multidisciplinary group working towards the formation of a peak body for Australia’s prefabrication industry, something that we observed in other countries during our research. This peak body will act as an innovation and collaboration hub between manufacturers, designers and client groups, further building upon these new relationships. Such step-change would not be possible without crossing and breaking boundaries between disciplines.

3. REFLECTIONS ON MULTIDISCIPLINARY THINKING

Reflections by academics on interdisciplinary research were published in a recent document titled ‘Interdisciplinarity in Research’ (Bolitho, McDonnell 2010). Academics emphasised the importance of their own founding disciplines and tended to seek interdisciplinarity when ‘this would get them the best results’. One researcher highlighted that his best papers are all
within his discipline. Another said that he would not present at a conference outside his
cognate field even though these other fields influenced his research. The same document
quotes cautionary notes which state that it is not clear the degree to which academic and
research organisations and journals are prepared to change to support interdisciplinary work.

All researchers referred repeatedly to issues with the University’s faculty structure and
excellence-based rationale, and all highlighted that the problem of publishing is acute.
The pressure of the ERA is unremitting and interdisciplinary work tends not to be
associated with the highest impact journals” (p5).

Even though there is increasing recognition that innovative research often occurs at the
boundaries between disciplines (Leonard-Barton, 1995, Carlile, 2004)), conflicting and
powerful forces work against these interdisciplinary endeavours.

Discipline approaches are relatively new in our history. Weingart (2010) suggests that
disciplines as we understand them first arose in around 1800. As disciplines became
established they developed specialised languages in which the audience was other members
of their own discipline. “The essence of discipline formation and evolution is self-referential
communication.” (Weingart 2010, p8) Communities of scholars generated a division between
specialists and laypersons. Access of specialised knowledge was available through
‘popularisation’ which gradually as a separate activity not intended to contribute to new
knowledge but to mediate scientific knowledge to the educated public. The difficulty of this
structure is that knowledge held within academia runs the risk of being self-referential and
remote from industry in terms of problem setting and outcome communication.

Ann Balsamo in 2006 introduced the term ‘epistemological humility’ as a necessary position
for interdisciplinarity to succeed (Jasanoff 2010). Successful collaboration begins with the
position that one’s own definition of important knowledge may not be the only definition.
But humility alone is not enough. Collaboration requires both patience and respect for other
disciplines including those that seem frustratingly antithetical to our own ways of thinking.
In a previous paper one of the authors made the analogy of the interdisciplinary researcher as a subversive boundary rider (Newton 2010). In Australian folklore culture they have played two distinctive but relevant roles. Historically we know them as solitary horse riders living lightly in remote and lonely locations. Their task is ensuring the long wire fences around stations are in kept in good repair to ensure livestock stay in and vermin stay out. Today the term ‘boundary rider’ is used in Australian football for the commentators who work from the sidelines during the game. These boundary riders are focused on communication. They have access to players and coaching or medical staff on the interchange bench in order to be able to give a more detailed commentary of the game and any injury concerns.

Researchers working across discipline boundaries can be conceptually understood as subversive boundary riders. As subversive boundaries riders, their role is to open up the fences rather than repair. They play a role in bringing together knowledge and people from across disciplines, supporting the development of unexpected collaborations and helping repair misunderstandings. They may take a pragmatic bricolage (or tinkering) approach to research. The traditional boundary rider carries little baggage.

The subversive boundary rider who stays close to the fence lines of research disciplines chooses the high risk life of not quite belonging. Within academia, a dilemma exists for such a person. They risk losing a home base where discipline knowledge depth has clearer peer recognition processes than the boundary rider’s knowledge breadth.

Perhaps our new subversive boundary rider has to travel lightly with an adaptable suite of tools and lenses, and a willingness to learn different epistemological languages. At times the role of the subversive boundary rider is simply the carrying of messages from one group to another in order to develop a more holistic view of the question to do with whether space can support or hinder learning communities. Like the football boundary rider, there may also be a third role which is to act as a commentator from the sidelines.

4. CONCLUSION

Bringing the design of relocatable classroom back into the sight-line of consumers and education facility providers was undertaken as a multidisciplinary research project over three
years involving academics and industry stakeholders. We set out to bring about a step change in the design of relocatable classrooms and used a design competition as the focus. The solution cannot be achieved by any one discipline but we used the design discipline as a means of visualising alternative futures, synthesising knowledge from tipping points in disciplines such as education, sustainability, design, manufacturing and infrastructure procurement. With the results of the competition as a backdrop, we then brought together the key stakeholders into a venue to jointly forecast a possible future followed by a process of backcasting. Backcasting is a useful strategy to translate ambitious step changes into manageable incremental changes.

In order to navigate the unknown, we found that it is essential to approach each issue with the wide-eyed openness of a child who is eager to grow and to learn, to simply ask ‘why’. This allowed us to constantly question assumptions made within individual epistemological frameworks. The breadth and depth of knowledge we now hold at the conclusion of the research project has brought clarity for both researchers and industry stakeholders.

Communication, collaborations and conversations have been at the heart of the process and the research has initiated and informed new networks and authentic collaborations. Organisational change and committed leadership is needed within universities if effective collaborative environments are to be supported. The power of the physical environment to establish venues for new teams to co-exist and collaborate should not be underestimated. Equally, interpersonal and intrapersonal skills play a critical role in supporting collaboration. It is suggested that there is scope for communities and organisations to consider the potential of subversive boundary riders with the necessary passion to infiltrate and negotiate boundary territories. This is where new knowledge is born.
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