

Innovative outdoor fieldwork pedagogies in the higher education sector: Optimising the use of technology

Glyn J. Thomas and Brendan Munge

University of the Sunshine Coast

Abstract

Outdoor fieldwork has been a long-standing pedagogy in the higher education sector, across a range of disciplines. Based on a review of the literature, this paper explores the use of outdoor fieldwork in the 21st century university with particular reference to the way technology contributes to student learning. Research has indicated that fieldwork enhances student engagement, links theory and practice, and assists students with the development of professional expertise. Many of the challenges for outdoor fieldwork, such as budget cuts, risk management concerns, and workload demands on staff, have been exacerbated by massification pressures in universities, such as the growth in student numbers and a more diverse student cohort. The increased use of technology on outdoor field trips both solves and creates problems, and technology use in outdoor education has been described as a double-edged sword (Cuthbertson, Socha, & Potter, 2004). It can be difficult for teachers to judge whether the benefits to student-learning outcomes created by introducing technology outweigh any negative impacts. Koehler and Mishra's (2009) concept of technological pedagogical content knowledge suggests that teachers need to develop a very specific kind of knowledge to make informed decisions about the use of technology. The substitution, augmentation, modification, redefinition (SAMR) ladder (Puentedura, 2006) can contribute to this teacher knowledge by focusing on how the use of technology can transform student learning rather than just replace, or augment, existing teaching tools and strategies. Some examples of how technology is used at the different levels of the SAMR model in outdoor education are provided.

Key words: outdoor fieldwork, outdoor pedagogies, outdoor education, TPACK, technology

In the higher education context, teachers in a range of discipline areas use outdoor fieldwork to facilitate high-quality student-learning experiences. Our perceptions of outdoor fieldwork pedagogies have emerged in response to our own reflective practice and through Brendon's doctoral research. This paper is an extension of a joint conference presentation at the 19th National Outdoor Education Conference in Australia. In this paper, we will review the literature from across several disciplines to identify some of the challenges and successes of outdoor fieldwork in higher education institutions in the 21st century. We will then specifically consider how digital technologies may be used to optimise student learning in outdoor education fieldwork. However, technology in outdoor education has rightly been described as a double-edged sword (Cuthbertson, Socha, & Potter, 2004) and we will introduce two frameworks to shed some light on the tensions. The frames of *technological pedagogical content knowledge* (Koehler & Mishra, 2009) and Puentedura's (2006) *SAMR model* will be used to consider ways to optimise the use of technology in outdoor education fieldwork. The first task in this paper is to review some of the recent literature across a range of disciplines exploring how outdoor fieldwork is used to produce high-quality student-learning outcomes.

Outdoor fieldwork pedagogies in higher education

For many university programmes in fields like geography, outdoor/environmental education, and some of the science disciplines, outdoor fieldwork

is a core teaching and learning strategy because it enhances student engagement and the development of professional expertise (Fuller, Edmondson, France, Higgitt, & Ratinen, 2006; Herrick, 2010; McGuinness & Simm, 2005). In our experience, student evaluations of courses in outdoor education consistently indicate that outdoor fieldwork is a very popular and important part of student learning. This is consistent with research conducted with 421 geography students across 16 British universities, which measured students' perceptions of outdoor fieldwork and found that most students considered fieldwork to be a "highly valuable pedagogic device" (Dunphy & Spellman, 2009, p. 27). Dunphy and Spellman also found that students valued time spent connecting theory and practice and thought fieldwork had the capacity to provide all of the subject-specific and transferable skills required within their chosen profession. The students also indicated they valued forming stronger social connections with peers and academic staff and that fieldwork inspired them to seek further engagement in the discipline/profession.

McGuinness and Simm (2005) made similar observations about the value of outdoor fieldwork when they noted "fieldwork plays an essential role in delivering real-world relevant content, . . . [and] the ability to subject conceptual and theoretical understandings to the test of empirical evidence and encounters with real people and places is the perceived strength of fieldwork" (p. 243). Herrick (2010) also explained that outdoor fieldwork provides the space and time where "student and staff autonomy can be encouraged and cultivated" and "that this

autonomy is not merely an idealised reading of the fieldwork experience, but rather an essential component of and precondition for effective . . . student learning outcomes in the field” (p. 115). Hall, Healy, and Harrison (2004) indicated that fieldwork takes on a variety of forms and purposes within the curriculum, it allows the “seeing of things in a real world context” (p. 256), and it enables the analysis of interrelationships. Wall and Speake (2012) surveyed 114 European geography academics and found there was a strong consensus that fieldwork “is a key sphere of learning in which subject-specific and generic skills are developed” (p. 433).

Despite these strong endorsements for the educational value and popularity of fieldwork, there is little empirical evidence that it provides a deeper approach to learning. Kent, Gilbertson, and Hunt (1997) and Nairn (2005) argued that the pedagogical benefits have been undertheorised. Furthermore, the evidence supporting the efficacy of fieldwork also tends to be circumstantial and inferential rather than research based (Hope, 2009). Moreover, Maguire (1998) and Hall et al. (2004) have questioned the inclusivity of fieldwork, particularly for students with disabilities. Dunphy and Spellman (2009) suggested that fieldwork may just be a preferred way of learning for some students due to the novelty of getting off campus and learning more experientially.

Herrick (2010) reviewed the contested place of geography fieldwork in higher education programmes, and she identified a number of barriers to the use of outdoor fieldwork. These included the increasing focus on risk minimisation strategies, the push to standardise the student fieldwork experience, the need to provide value for money, and the pressure to compete for student enrolments with trips to exotic locations. Unfortunately, the pivotal pedagogical reasons for leaving the classroom can get lost in the rush. Many of the challenges for outdoor fieldwork in higher education are exacerbated by massification pressures, including the growth in student numbers, the wider range in student abilities, the increased numbers of “new-generation” students (Devlin, Kift, Nelson, Smith, & McKay, 2012), reduced budgets, and attempts to transfer fieldwork costs to students whenever possible (Kent et al., 1997). Other constraints include the exposure of the university to risk, safety of staff and participants, and keeping staff workloads sustainable (Boyle et al., 2007). Burke de Silva (2014) noted that onerous risk management processes required to lead outdoor fieldwork created more administrative work for academics, with negative impacts on their research productivity.

Despite the aforementioned challenges, outdoor fieldwork may still be considered the signature pedagogy for emerging outdoor/environmental

education professionals because of the pivotal role it plays in their induction into the profession (Thomas, 2015). Outdoor fieldwork in other higher education disciplines also has a strong focus on professional preparation and the development of contextual and cultural skills related to future professional practice (Andrews, Kneale, Sougnez, Stewart, & Stott, 2003). Within the geography area, outdoor fieldwork is recognised as being essential to the identity and epistemology of the discipline (Herrick, 2010). Fieldwork is recognised as the only viable setting for students to acquire the geographer’s skill set: observation-based knowledge acquisition, analytical research skills, decision-making, and teamwork (Cook, Phillips & Holden, 2006).

A number of authors have acknowledged tensions regarding the inclusion of technology, and particularly digital tools, in outdoor fieldwork (Fletcher, France, Moore, & Robinson, 2003, 2007; Maskall et al., 2007; Welsh, Mauchline, Park, Whalley, & France, 2013). In 2007, Maskall et al. surveyed 22 fieldwork practitioners with technology expertise who were working in the broad area of geography, earth, and environmental sciences at various U.K. universities and found many utilised digital technology before, during, and after fieldwork to develop students’ prior knowledge, aid the capturing and analysis of information during fieldwork, and improve assessment post trip. Welsh et al. (2013) surveyed 89 academics using outdoor fieldwork in the sciences and found that “there are a wide range of advanced technologies currently used to enhance fieldwork learning with more, cost-effective, portable devices in development” (p. 413). Despite this enthusiasm for technology in outdoor fieldwork in the sciences, there were still reported concerns with the field reliability, usability, and portability of devices and their capacity to store and/or access data. There was also a reluctance and/or inability from some staff and students to utilise the technology (Maskall et al., 2007; Welsh et al., 2013).

The role of technology in outdoor fieldwork continues to be an important and controversial issue for the higher education sector. Clearly, the use of digital technologies in outdoor fieldwork should be determined by their capacity to enhance student learning (Fletcher et al., 2007; Maskall et al., 2007). As Welsh et al. (2013) explained, “rather than trying to find a use for a new technology, the focus should remain on using technology to solve pedagogic issues” (p. 412). One contentious issue in the future will be the use of virtual reality field trips to support or even replace outdoor fieldwork altogether (Burke de Silva, 2014; Stokes et al., 2012), but this issue is beyond the scope of this paper. In the next section, we will explore where knowing about technology fits with all the other things teachers are expected to know, and we will introduce a model to judge the value and utility of that technology.

Knowledge, technology, and teachers in the 21st century university

Teachers in any context are required to develop an extensive range of knowledge, skills, and experience. This section will focus specifically on the kinds of knowledge teachers require in the 21st century, and the work of Lee Shulman (1987) is significant. Shulman's writing stimulated teacher educators' thinking about how teaching is understood and how teachers should be prepared for the profession. He posited that teachers work with a range of different kinds of knowledge, including content knowledge, general pedagogical knowledge, curriculum knowledge, pedagogical content knowledge, knowledge of learners, knowledge of educational contexts, and knowledge of educational ends, purposes, and values. Not surprisingly, many of these same categories feature strongly in the Australian Professional Standards for Teachers (Australian Institute for Teaching and School Leadership, 2016). As this paper is focused more specifically on fieldwork pedagogies within outdoor education, we are most interested in Shulman's category of pedagogical content knowledge (PCK). He explains that it represents "the blending of content and pedagogy into an understanding of how particular topics, problems, or issues are organised, represented, and adapted to the diverse interests and abilities of learners, and presented for instruction" (1987, p. 8). In previous work (Thomas & Munge, 2014), we identified some of the specific PCK relevant for outdoor educators to effectively facilitate student engagement and learning in outdoor fieldwork. In this paper, we will deepen the discussion of PCK and skills by focusing on how the use of digital technologies can improve student learning.

Technologies are not new to outdoor fieldwork, and they have been an accepted part of outdoor education for a long time. We feel strongly that outdoor educators can benefit from expanding their PCK to include the effective use of digital technologies. Although the humble compass, map, and other traditional outdoor equipment are strictly speaking forms of technology, most would not normally classify the aforementioned equipment this way. Bruce and Hogan (1998, cited in Koehler & Mishra, 2009) suggested that when technologies become commonplace over a long period of time they can achieve a "transparency of perception" (p. 61) resulting in them hardly being noticed and their use rarely challenged. In contrast, new digital technologies are viewed differently because they develop and change so rapidly, the inner workings remain a mystery to most users, and they may have a broader range of uses or applications. Koehler and Mishra have expanded on Shulman's work to introduce the term technological pedagogical content knowledge

(TPACK) to describe this new knowledge that teachers must develop. Koehler and Mishra suggested that all efforts to integrate technology

should be creatively designed or structured for particular subject matter ideas in specific classroom contexts. Honoring this idea that teaching with technology is a complex, ill-structured task, we propose that understanding approaches to successful technology integration requires educators to develop new ways of comprehending and accommodating this complexity. (2009, p. 62)

According to Koehler and Mishra (2009) TPACK is an emergent form of knowledge that transcends all of the three components (content, pedagogy, and technology) in response to their interaction with each other. The challenge for teachers is to respond to challenging teaching situations with an appropriate emphasis on each of the three components to construct effective learning strategies for students.

The impacts of technology integration in outdoor fieldwork will vary depending on the higher education discipline concerned. The TPACK relevant to outdoor education fieldwork will be different to biology fieldwork because the content and pedagogies may be different. In an outdoor education programme, part of the content focus of an outdoor fieldtrip may be to explore human relationships with nature. Consequently, the way technology is best utilised, or not utilised, in the programme is determined by the decisions made regarding the content of the programme and the most appropriate pedagogies for the programme. The consequence of wilfully embracing technology without thought for the relevant TPACK has the potential to produce undesirable outcomes. In outdoor education, as early as 2001, Wattchow warned readers that

The rate of change of "modern" or "high" technology and the global reach of "techno-systems" has so shifted us from being able to acknowledge our organic links with the world, and so many of our "traditional" technologies and techniques have disappeared, that we find ourselves stranded upon our own distant island. (2001, p. 25)

Cuthbertson et al. (2004) also warned that the unexamined adoption of technology can undermine many of the positive impacts that students may experience from going outdoors. They argued that because modern technology requires less skill and time from users to develop mastery than traditional equipment, the reward and satisfaction of many learning

experiences may be lost. They concluded, “In becoming too reliant on modern technology, we miss some of the profound understandings gained from a physical dependence on, and engagement with, the land” (p. 142). If emerging outdoor educators can learn to develop their TPACK, they will be more likely to make better choices about the optimal way to utilise technology to provide transformational learning experiences for their students, without creating unintended outcomes that counter the aims of their programme.

Given the complexity of every teaching situation, decisions about TPACK may be helpfully supported by a model developed by Puentedura (2006). His model, called the substitution, augmentation, modification, redefinition (SAMR) ladder, was developed to help teachers leverage their use of online and digital technologies to produce high-quality student-learning outcomes. The SAMR title of the model is an acronym of the four levels of technology integration that increase in complexity and impact. The two lower levels of the model are called enhancement strategies, whereas the top two levels are called transformational strategies. At the model’s lowest level of “substitution,” a teacher uses technology to replace an existing tool with no real functional change to the teaching. “Augmentation” occurs when a technology acts as a direct tool substitute but with some functional improvement to students’ learning. At the level of “modification,” teachers use technology to conduct significant task redesign producing improvements in learning outcomes. Finally, in “redefinition” the use of technology allows for the creation of new tasks that were previously inconceivable and which open up new student-learning possibilities (Puentedura, 2006).

As we move to consider the potential value of digital technologies in outdoor fieldwork in more detail, we are mindful of two key points. First, our integration of technologies into outdoor fieldwork should aim to be at the transformational end of Puentedura’s (2006) SAMR ladder. Second, care should be taken to consider and monitor any unintended consequences of introducing technology. In the next section of this paper, we will provide some examples with discussion of how technology is being, or could be, used to enhance student learning in outdoor education fieldwork for each level of the SAMR ladder.

Examples of technology use in outdoor education fieldwork

Beginning with the lowest level of the SAMR ladder, it is not difficult to think of examples of how digital or online technology is being used at the level of substitution. GPS devices are sometimes used in outdoor education programmes either as the sole navigating device or as a back-up navigation tool

for the traditional compass and map. When the GPS device is used in this limited way it is not doing much beyond what a compass and map can do, but students miss the opportunity to become proficient with these basic tools of the trade (compass and map) and the particular relationship with landscape topography that they afford. Another example is the use of tablets in the field by groups for note taking rather than a traditional notebook and pen. As a pedagogical strategy, this does not create any major advantages for student learning but does introduce problems with device charging, waterproofing, durability, and possible distractions from other device software/apps. Technology that is used at the substitution level does not always have negative consequences, but teachers should be intentional about their reasons for making the substitution.

There are numerous examples of technology use in outdoor education fieldwork at the augmentation level of the SAMR ladder. The use of tablets to access field guide apps can reduce the need for carrying a number of heavy field guidebooks. Many field guide apps also provide additional features that paper-based field guides cannot match. For example, bird identification apps for portable devices allow students to conduct searches for birds using observed features, limit those searches to the known search area, and listen to bird calls. These bird apps augment the quality of the student-learning experience by allowing students to do things that they would not be able to do with books. Another example occurs when emerging rock climbing instructors go on their first multipitch climbs without direct supervision. In such cases, there is a real risk of students moving off-route and wandering into more difficult, or poorly protected, terrain. Now that students carry a smartphone with them everywhere, the teacher’s ability to communicate with them on climbs is enhanced (provided there is phone reception). Students can also use rock climbing guide apps on their phones to zoom in on “topos” of the climb they are doing to help confirm where they are on the climb and if they are on-route. These apps provide the same quality of information to students in a more accessible manner because they often already have their mobile device in their pocket.

Another example of augmentation can be found in the use of digital technologies to enhance student journaling. Dymont, O’Connell, and Boyle (2011) have explored the use of online blogs and recording software such as VoiceThread (www.voicethread.com) in outdoor fieldwork. Some of the benefits they identified include providing multiple ways of capturing an experience, ease of sharing with others, increased opportunities for collaboration between students, and the potential to create portfolios of work across a whole programme. However, Dymont et al. also discuss some of the potential disadvantages such

as privacy concerns, distractions, ensuring equitable access to appropriate devices, storage of data, and tensions with the purposes of outdoor education. Notwithstanding these challenges, online journaling does offer some learning opportunities that paper-based journals may not.

At the modification level, the use of digital technology is transforming how outdoor education teachers can teach when in the outdoors. A coaching app for digital devices called Coach's Eye (www.coachseye.com) allows an outdoor education teacher to live stream digital video of students' skill performances from cameras (for example, point-of-view cameras such as GoPro) and then display and annotate that video footage with students to provide feedback on skill performance in the field. Technology has allowed many of these tasks to occur in the past, but not with the ease, simplicity, and connectivity that is possible with apps like Coach's Eye. Research published recently exploring the use of point-of-view cameras by adventure sport athletes (French, 2016) also indicates how compact, portable cameras will allow coaches to work with athletes, potentially in real time, to improve skill performance and/or decision-making.

Another challenge for many emerging outdoor leaders is developing navigational skills and experience to safely lead others in the outdoors (see Bellette, 2005). An example of a digital technology that may support learning in this area is the interactive, virtual reality sandbox (for more information see <https://arsandbox.ucdavis.edu>) which can be used to teach students map-reading skills. Some students find it difficult to transition from the three-dimensional (real-world environment) to a two-dimensional representation of that world (topographic map). Unlike a conventional sandbox, which can be a useful teaching tool in itself, the virtual reality sandbox will allow teachers to perform additional tasks such as overlaying contours on sculpted features within the sandbox and to simulate the effect of rain falling on, and moving through, the established features. Students will also be able to create landscape interpretations of maps of locations they may visit in the future, helping them with landform analysis, route planning, and the development of navigational strategies prior to entering the actual landscape.

At the redefinition level, an example of technology-enhanced learning has been developed by teachers at La Trobe University in Australia with their use of near-peer teaching to enable close-to-graduation students experience genuine leadership situations (Bester, Muller, Munge, Morse, & Meyers, 2017). Mobile devices, tablets, and GPS devices now allow staff to safely supervise these preservice teachers from a distance and less obtrusively, as they lead their near peers during outdoor fieldwork trips. The quality of

the information these technologies provide for the staff allows the staff to supervise remotely. The abundance of weather apps, communication tools, and tracking devices allows staff to let the students lead with more independence. The team of student leaders take video of their teaching, send it to teaching staff, and receive feedback without those staff members being physically present during the learning experience. For the most part, the technology remains largely unseen and the near-peer participants may not even know it is there. This approach has many benefits and overcomes many barriers to outdoor fieldwork identified earlier. There is a reduction in cost to the institution as it allows multiple groups to be in the field with reduced staffing allocations. Timely feedback can be provided to students in the field, such that they can respond immediately. Issues of safety management are tightly controlled through the use of GPS tracking, mobile devices for weather warnings, and even to the point of calling upon the staff for evaluation of trees or campsite locations via video or image transfer if required. This type of fieldwork creates a more authentic experience of outdoor leadership and group management with a very high level of ownership of the learning achieved. In every respect, this use of technology has transformed the learning opportunities for the emerging outdoor leaders and their near-peer participants.

Conclusions, implications, and recommendations

In this paper, we have provided a snapshot of some of the research and changing practice occurring in outdoor fieldwork in the higher education context. We have specifically considered the role that technology is playing now and might have in the future. We are not saying that all fieldwork needs to involve more technology-enhanced learning. We are mindful of the complexities — the equipment breakdowns, the loss of signal, the flat battery, the faulty connection — with their capacity to undo the best high-tech teaching strategy. On the contrary, we are arguing that the decision to investigate and perhaps use digital technologies be taken seriously and weighed up in relation to the potential benefits. The functionality of any particular digital technology must involve consideration of pedagogical imperatives. TPACK should be what guides the decision to engage with technology to enhance student learning. We have introduced Puente's (2009) SAMR model as a particular TPACK tool that can be used to facilitate such decisions.

To date, there have been numerous warnings about using digital technology in outdoor education fieldwork — but there have been very few frameworks provided in the outdoor education literature to help teachers make informed decisions about whether to use such technology or not. We recognise that

the content or pedagogical focus of some outdoor education programmes will make the use of various digital technologies inappropriate. However, we also wonder if critics of digital technologies conveniently overlook the way that other technologies, such as new forms of equipment and clothing, are also changing what it means to be in the outdoors. For example, during fieldwork focused on paddling conducted in the cold, snowmelt rivers of southeastern Australia in the late 1990s, most university students wore polypropylene thermals, woollen jumpers, and wetsuits to keep warm. Today, almost every student specialising in paddling owns an expensive, high-tech dry suit, which markedly changes the way they experience the whole situation.

The application of Puente's (2006) SAMR model to outdoor education fieldwork encourages us to ask questions about the unintended consequences of adopting digital technologies. We highlight once again that it is not digital technologies per se that are important, but the pedagogical impacts. It is important to continue to question and identify the potentially negative impacts of using digital technologies, even if they afford some otherwise unavailable learning opportunities at the transformational levels of the model. This is especially relevant when the use of technology is not particularly critical, as with substitution or augmentation. Hence, it is fitting to recall Watters' (2001) 15-year-old warning to "keep alive as broad a range of technological experiences as possible" by investing "meaning in our techniques and skills that make us question the world through our actions" (p. 26). The temptation to adopt new technologies in outdoor education will always be there, as will be the need to question how these technologies will alter student experience.

References

- Australian Institute for Teaching and School Leadership. (2016). *Australian professional standards for teachers*. Melbourne: AITSL. Retrieved from <http://www.aitsl.edu.au/australian-professional-standards-for-teachers/standards/list>
- Andrews, J. R., Kneale, P., Sougnez, Y. G., Stewart, M. T., & Stott, T. M. (2003). Carrying out pedagogic research into the constructive alignment of fieldwork. *Planet Special Edition*, 5, 51–52.
- Bellette, M. P. (2005). How are student approaches to learning navigation correlated with their assessment outcomes? *Australian Journal of Outdoor Education*, 9(2), 31–43.
- Bestor, L., Muller, G., Munge, B., Morse, M., & Meyers, N. (2017). Those who teach learn: Near-peer teaching as outdoor environmental curriculum and pedagogy. *Journal of Outdoor and Environmental Education*, 29(1), 7–13.
- Boyle, A., Maguire, S., Martin, A., Milsom, C., Nash, R., Rawlinson, S., . . . Conchie, S. (2007). Fieldwork is good: The student perception and the affective domain. *Journal of Geography in Higher Education*, 31(2), 299–317.
- Burke de Silva, K. (2014). Biological fieldwork in Australian higher education: Is the cost worth the effort? *International Journal of Innovation in Science and Mathematics Education*, 22(2), 64–74.
- Cook, V., Phillips, D., & Holden, J. (2006). Geography fieldwork in a 'risk society'. *AREA*, 38(4), 413–420.
- Cuthbertson, B., Socha, T. L., & Potter, T. G. (2004). The double-edged sword: Critical reflections on traditional and modern technology in outdoor education. *Journal of Adventure Education & Outdoor Learning*, 4(2), 133–144.
- Devlin, M., Kift, S., Nelson, K., Smith, L., & McKay, J. (2012). *Effective teaching and support of students from low socioeconomic status backgrounds: Resources for Australian higher education*. Retrieved from <http://www.lowses.edu.au>
- Dunphy, A., & Spellman, G. (2009). Geography fieldwork, fieldwork value and learning styles. *International Research in geographical and Environmental Education*, 18(1), 19–28.
- Dyment, J. E., O'Connell, T. S., & Boyle, I. (2011). The intersection of Web 2.0 technologies and reflective journals: An investigation of possibilities, potentials and pitfalls. *Journal of Outdoor Recreation, Education, and Leadership*, 3(3), 137–150.
- Fletcher, S., France, D., Moore, K., & Robinson, G. (2003). Technology before pedagogy? A GEES C&IT perspective. *Planet Special Edition* 5, 52–55.
- Fletcher, S., France, D., Moore, K., & Robinson, G. (2007). Practitioner perspectives on the use of technology in fieldwork teaching. *Journal of Geography in Higher Education*, 31(2), 319–330.
- French, G. (2016). Going pro: Point of view cameras in adventure sports research. *Journal of Outdoor and Environmental Education*, 19(1), 2–9.

- Fuller, I., Edmondson, S., France, D., Higgitt, D., & Ratinen, I. (2006). International perspectives on the effectiveness of geography fieldwork for learning. *Journal of Geography in Higher Education*, 30(1), 89–101.
- Hall, T., Healey, M., & Harrison, M. (2005). Fieldwork and disabled students: Discourses of exclusion and inclusion. *Journal of Geography in Higher Education*, 28(2), 255–280.
- Herrick, C. (2010). Lost in the field: Ensuring student learning in the ‘threatened’ geography fieldtrip. *AREA*, 42(1), 108–116.
- Hope, M. (2009). The importance of direct experience: A philosophical defence of fieldwork in human geography. *Journal of Geography in Higher Education*, 33(2), 169–182.
- Kent, M., Gilbertson, D. D., & Hunt, C. O. (1997). Fieldwork in geography teaching: A critical review of the literature and approaches. *Journal of Geography in Higher Education*, 21(3), 313–332.
- Koehler, M. J., & Mishra, P. (2009). What is technological pedagogical content knowledge? *Contemporary Issues in Technology and Teacher Education*, 9(1), 60–70.
- Koehler, M. J., Mishra, P., & Cain, W. (2013). What is technological pedagogical content knowledge (TPACK)? *Journal of Education*, 193(3), 13–19.
- Maguire, S. (1998). Group projects: An effective fieldwork teaching strategy. *Earth Sciences Teachers’ Association Occasional Series*, 2, 39–42.
- Maskall, J., Stokes, A., Truscott, J. B., Bridge, A., Magnier, K., & Calderbank, V. (2007). Supporting fieldwork using information technology. *Planet*, 18(1), 18–21.
- McGuinness, M., & Simm, D. (2005). Going global? Long-haul fieldwork in undergraduate geography. *Journal of Geography in Higher Education*, 29(2), 241–253.
- Nairn, K. (2005). The problems of utilizing ‘direct experience’ in geography education. *Journal of Geography in Higher Education*, 29(2), 293–309.
- Puente-dura, R. R. (2006). *Transformation, technology, and education*. Retrieved from <http://hipposus.com/resources/tte/>
- Shulman, L. S. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review*, 57(1), 1–21.
- Stokes, A., Collins, T., Maskall, J., Lea, J., Lunt, P., & Davies, S. (2012). Enabling remote access to fieldwork: Gaining insight into the pedagogic effectiveness of ‘direct’ and ‘remote’ field activities. *Journal of Geography in Higher Education*, 36(2), 197–222.
- Thomas, G. J. (2015). Signature pedagogies in outdoor education. *Asia-Pacific Journal of Health, Sport and Physical Education*, 6(2), 113–126.
- Thomas, G. J., & Munge, B. (2014). Best practice in outdoor environmental education fieldwork: Pedagogies to improve student learning. In M. Robertson, R. Lawrence & G. Heath (Eds.), *Experiencing the outdoors: Enhancing strategies for wellbeing* (pp. 165–176). Rotterdam, Netherlands: Sense Publishers.
- Wall, G. P., & Speake, J. (2012). European geography higher education fieldwork and the skills agenda. *Journal of Geography in Higher Education*, 3(3), 421–435.
- Wattchow, B. (2001). A pedagogy of production: Craft, technology, and outdoor education. *Australian Journal of Outdoor Education*, 5(2), 19–27.
- Welsh, K. E., Mauchline, A. L., Park, J. R., Whalley, B. W., & France, D. (2013). Enhancing fieldwork learning with technology: Practitioner’s perspectives. *Journal of Geography in Higher Education*, 37(3), 399–415.

About the authors

Glyn Thomas is a Senior Lecturer at the University of the Sunshine Coast in Queensland, Australia. He is the coordinator of a new Bachelor of Recreation and Outdoor Environmental Studies that started in 2016. He has worked in outdoor experiential education programmes in school and higher education contexts for more than 30 years and enjoys conducting research in the areas of facilitation, facilitator education, and fieldwork pedagogies.
Contact: gthomas2@usc.edu.au

Brendon Munge is an Associate Lecturer at the University of the Sunshine Coast in Queensland, Australia. Prior to this appointment he worked in the Outdoor & Environmental Education Department at La Trobe University for eight years. He is currently undertaking his PhD with a focus on fieldwork pedagogy and best practice in higher education. His primary teaching areas are introductory theory and practice in outdoor and environmental education, bushwalking, and expedition knowledge and practice.
Contact: bmunge@usc.edu.au