School-based bushfire education: advancing teaching and learning for risk reduction and resilience

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Abstract

In response to Recommendation 6 of the 2009 Victorian Bushfires Royal Commission, the topic of bushfire has been incorporated into the Australian school curriculum. To support the implementation of this new curriculum content, fire agencies and education authorities have invested in a range of bushfire education programs and resources. Research in the field of school-based bushfire education has also intensified. Drawing on key findings from a suite of recent Australian studies, this paper outlines two key elements of effective school-based bushfire education that have the potential to advance teaching and learning for risk reduction and resilience. The first is a holistic risk framework that builds children's conceptual understanding of bushfire risk as a socio-environmental phenomenon that derives from the interaction a physical hazard, the vulnerability of exposed people and assets, and the capacities people possess for disaster risk reduction. The second is a place-based pedagogy of bushfire risk, which grounds teaching and learning in the socio-environmental contexts of children's lives. The paper concludes with some key recommendations for the continued development of good practice in this emergent field.

Introduction

In the aftermath of the 2009 Black Saturday bushfires, the Victorian Bushfires Royal Commission conducted a full and detailed inquiry into the disaster (Teague et al. 2010). Over the course of the inquiry, the Commission heard ample evidence of communities who did not think they would be affected by bushfire and of people whose lack of bushfire knowledge and preparedness had left them highly vulnerable to disaster impacts (Teague et al. 2010). In its final report, the Commission explicitly identified bushfire education for children as the most effective means by which to rectify this fundamental lack of knowledge and preparedness in the community:

> The Commission is of the view that educating children about the history of fire in Australia and about safety in the event of a bushfire will probably influence not only the children but also their parents, siblings and extended family and community. A concerted education program remains the most effective approach to instilling the necessary knowledge in Australian families
>
> Teague et al. (2010, p. 55)

Accompanying this sentiment was an official recommendation that bushfire education be incorporated into the formal school curriculum:

> Recommendation 6: Victoria [should] lead an initiative of the Ministerial Council for Education, Early Childhood Development and Youth Affairs to ensure that the national curriculum incorporates the history of bushfire in Australia and that existing curriculum areas, such as geography, science and environmental studies include elements of bushfire education
>
> Teague et al. (2010, p. 2)

As a direct result of Recommendation 6, the Australian Curriculum for Grade 5 Geography now includes a content description pertaining to the "impacts of bushfires or floods on environments and communities and how people can respond" (ACARA 2019). To support the implementation of this new curriculum content, fire agencies and education authorities have developed a range of bushfire education programs and resources (e.g. DFES 2019, VCAA 2019). Research in the field of children's bushfire education has also intensified: prior to 2009, there were no published empirical studies on this topic. However, over the last 10 years, numerous studies, from both Australia and the United States, have explored the theory and

practice of school-based bushfire education and its role in the development of fire adapted communities (e.g. Ballard et al. 2015; Gibbs et al. 2018; Monroe et al. 2016; Towers 2015; Towers et al. 2018a; Towers 2018b; Towers 2018c). In this paper, I draw together key findings from a suite of recent Australian studies to identify two key elements of effective bushfire education. The first is a holistic risk framework that builds children's conceptual understanding of bushfire risk as a socio-environmental phenomenon. The second is a place-based pedagogy of bushfire risk, which grounds teaching and learning in the socio-environmental contexts of children's lives. The paper concludes with some key recommendations for continued development of good practice in this emergent field.

A holistic risk framework

Bushfire risk is a socio-environmental phenomenon (Eriksen 2014; Whittaker et al. 2012; Simon 2017). It derives from the interaction of bushfire hazards, the vulnerability of exposed people and assets, and the capacities people possess for disaster prevention, preparedness, response, and recovery (Cardona et al. 2012; Collins 2008; Whittaker et al. 2012; Gaillard et al. 2018). If children are to develop a coherent understanding of bushfire risk that is sufficient for identifying problems and solutions in their own local context, a holistic learning framework that incorporates the environmental and social dimensions is needed. This requires teaching and learning activities that systematically build children's knowledge and awareness of the various dimensions of risk – the physical hazard, exposure, vulnerability and capacities – and how those dimensions interact to cause hazard impacts and disasters.

Building children's knowledge of the physical hazard in the early stages of the education process is fundamentally important. Children often approach bushfire education with a wide range of misconceptions about the physical characteristics of bushfire hazards and these misconceptions exert a strong influence on their understandings of risk and risk reduction (Towers 2012; 2015). For example, children often understand bushfire spread solely in terms of direct flame contact, which leads them to assume that a non-flammable physical barrier (e.g. a river, a road or a brick wall) will prevent a bushfire from reaching their neighborhood or property, thereby eliminating any potential risk (Towers 2012). Children can also tend to underestimate the intensity, magnitude and speed of major bushfire conflagrations and thereby assume they will be able to safely escape on foot or by car, even after a bushfire has begun to impact on their property (Towers 2015; Towers & Ronan 2018c). It is also common for children to report that their family has an emergency bushfire plan, but when encouraged to share the details of that plan, they often describe the features of a house fire escape plan (e.g. get down low and go, go, go; climb out the window; meet the family at the letterbox), which suggests they don't readily differentiate between the physical characteristics of house fires and bushfires (Towers 2012; Towers 2015; Towers & Ronan 2018c). As these examples illustrate, children actively construct their perceptions of bushfire risk and formulate risk reduction strategies by drawing on their existing knowledge of the physical hazard. When that knowledge is characterised by gaps and misconceptions, their ability to accurately interpret and apply new information can be impeded (Towers 2012; Towers 2015).

When children have developed an adequate understanding of the hazard, they are able to explore how it interacts with the social dimensions of exposure and vulnerability to create the conditions for damage and loss. In the context of bushfire risk, exposure refers to the location of people and property relative to a potentially harmful bushfire event (Whittaker et al. 2012). As noted above, children often assume that some form of physical barrier will prevent fire spread, which has obvious implications for their understanding of exposure. However, there is often a broader misconception at play. While children might readily recognise exposure in the context of densely vegetated bushland environments, they often perceive more developed, built-up areas as being relatively immune to bushfire activity (Towers 2012, Towers & Ronan 2018). This stems from an underlying assumption that bushfires happen 'in the bush', not towns or suburbs, and this can prevent children who live in more built-up areas from viewing bushfires as something they need to be concerned about (Towers 2012, Towers and Ronan 2018). Importantly, post-fire research with adults in fire affected communities (Whittaker et al. 2013), as well as numerous formal commissions and inquiries conducted in the aftermath of bushfire disasters (Ellis et al. 2004, Miller et al. 1984, Teague et al. 2010), have found that residents living in more urbanised environments can tend to underestimate their potential exposure. As such, learning how processes like ember attack and house-to-house ignition can carry a bushfire into a built-up area is important, particularly for the increasing number of Australian children living on the wildland-urban interface.

At this point, children also need to understand that exposure to a bushfire event will only lead to damage and loss when it is coupled with vulnerability. Children are usually quick to grasp the concept of vulnerability and they can often identify the general conditions that increase the susceptibility of individuals, households and communities to bushfire impacts (e.g. a lack of public knowledge and awareness; low levels of planning and preparedness; limited financial resources for structural mitigation) (Towers 2012; Towers 2018a; Towers 2018b; Towers 2018c). However, more detailed knowledge of the specific conditions that lead to harm, damage and loss is often lacking. For example, children often advocate for a 'wait and see' approach to evacuation (Towers 2015; Towers 2018c), not realising that this is a major cause of bushfire fatalities and injuries (Haynes et al. 2010; Teague et al. 2010). It is also common for children to identify the bathroom as a safe place in which to shelter during a bushfire (Towers 2015), but this is where a large proportion of bushfire fatalities occur (Haynes et al. 2010; Teague et al. 2010). From the perspective of the learner, it is very difficult to identify and implement effective risk reduction strategies when the conditions that increase susceptibility to bushfire impacts are not clear. Over the past 15 years, scientific research on major bushfire disasters has provided essential insights into those conditions and the social, cultural, political, and economic factors and processes that drive them (Whittaker 2013; Whittaker 2019; Handmer & O'Neill 2016; Haynes et al. 2010). Unfortunately, little if any of that research has been translated into quality age-appropriate educational resources or activities for

children. Hence, incorporating the concept of vulnerability as part of a holistic learning framework remains a challenge for educators, who may be reluctant to address this concept in the absence of trusted guidance and advice (Towers et al. 2018a; Towers et al. 2018b). There is a certainly a need for quality resources that can address this gap.

The final component in a holistic risk framework relates to capacities, which can be defined as "the set of diverse knowledge, skills and resources people can claim, access and resort to in dealing with hazards and disasters" (Gaillard et al. 2018, p 865). As Gaillard et al. (2018) point out, everyone possesses a unique set of knowledge, skills and resources that are often shared and combined with those of relatives, neighbours, friends etc who face the same hazards. While often overlooked, children also possess capacities that can be harnessed for reducing bushfire risk and building resilience (Towers 2015). Firstly, children have expert knowledge of their day-to-day activities, routines, movements, networks and interactions (James & Prout 2005). In this context, it is worth emphasising that disaster risk is constructed in the fabric of everyday life (Hewitt 1983, 1998), and the most knowledgeable informants on children's everyday lives are children themselves (Kellett 2011). Secondly, children are not a homogenous group: they have varied concerns, perspectives, interests, talents and strengths that, when applied to the problem of bushfire risk, can drive the development of innovative and creative solutions. While the last several years have seen a gradual shift toward more participatory community-based approaches to bushfire risk reduction that draw upon the endogenous capacities of local people (Muir et al. 2017), opportunities for children to participate have been limited. Incorporating capacities as part of a holistic risk framework for bushfire education provides a pathway for children's participation because it explicitly recognizes them as active citizens with knowledge, skills and resources that can be deployed to enhance and strengthen local risk reduction efforts (Pfefferbaum et al. 2018; Tanner et al. 2009; Mitchell et al. 2008).

A place-based pedagogy of risk

Historically, bushfire education programs for children have tended to consist of standardised activities that decontextualize children's learning from the environmental, social, cultural and historical contexts of the places in which they live. While standardised activities may offer a useful introduction to general principles, processes and practices, it is becoming increasingly evident that for children to develop a accurate perceptions of local bushfire risks and make genuine contributions to risk reduction efforts, teaching and learning needs to be grounded in place (Towers et al. 2018a). In a place-based pedagogy of bushfire risk, the surrounding socio-environmental context serves as the learning ecosystem: abstracted environments are substituted with local landscapes; textbooks and worksheets are replaced by local experts and experiential activities in the field; and generic information about bushfire risk is augmented by local knowledge, data and predictions. While a holistic risk framework provides a robust structure for learning about bushfire risk as a socio-environmental phenomenon, place-based pedagogy makes that learning relevant and meaningful in the context of children's own households, schools and communities.

Place-based education is nothing new. Over a century ago, in 'The School and Society', John Dewey advocated for an experiential approach to student learning in the local environment, stating that "Experience [outside the school] has its geographical aspect, its artistic and its literary, its scientific and its historical sides. All studies arise from aspects of the one earth and the one life lived upon it" (2007, p. 91). Over the last two decades, however, a proliferation of research and practice, predominantly in the fields of outdoor education and environmental education, has demonstrated the benefits of place-based education for children's learning and development (Gruenewald & Smith 2013; Smith & Sobel 2010). These benefits include stronger connections between students, schools and their communities; the active participation of students in democratic processes, including problem-solving and decision-making; increased student understanding and appreciation of their natural and social environments; and enhanced ecological literacy (Gruenewald & Smith 2013). There is also growing evidence that place-based learning can have a positive impact on academic engagement and achievement across a range of domains, including reading, writing, mathematics, science and social studies (Smith 2013).

While documented examples of place-based bushfire education are relatively rare, two case studies from southeastern Australia serve to demonstrate the value of grounding children's learning in local phenomena. In the CFA's Survive and Thrive program at Anglesea Primary School (Taunt & Rankin 2017), children in grade 5/6 participate in a series of "Bushfire Behaviour and Resilience Sessions" with local CFA staff and volunteers, and other local fire and emergency management experts. They learn to calculate fire danger ratings using local weather data and the Macarthur Forest Fire Danger Index. They conduct local assessments of fuel type, moisture content and slope to map the rate of fire spread under different fire danger conditions. They explore the traditional use of fire with local Indigenous land managers and conduct interviews with veteran volunteer firefighters about past bushfire emergencies and disasters in the area. They also examine local emergency response plans and consider the shared roles of emergency management agencies and local residents in bushfire risk management. Once they have they gained an appreciation of their local bushfire risk and local emergency management arrangements, children identify what Anglesea residents would need to know in order to 'Survive & Thrive' before, during and after a bushfire (Taunt & Rankin 2017). They then develop 25-minute interactive child-led workshops to communicate that information to their families, children at other schools and the wider public (Taunt & Rankin 2017). Through these place-based learning activities, children not only gain a coherent understanding of the local bushfire risk, they also develop a sense of their individual and collective capacities to influence risk reduction and resilience at home, at school and in the local community (Gibbs et al. 2018; Taunt & Rankin 2017; Towers et al. 2018a).

At Strathewen Primary School, the Strathewen-Arthurs Creek Fire Education Partnership program for students in grade 5/6 commences with a fieldtrip to nearby Kinglake National Park, where the children are immersed in a full day of experiential

learning activities (Hayward 2018). With guidance from fire management experts and local CFA volunteers, they explore the influence of fuel, weather and topography on local fire behavior, calculate fire danger ratings using the Macarthur Forest Fire Danger Index, and map fire spread using 6-digit grid refencing. They also explore the effect of fire on biodiversity with the local park ranger. Following this fieldtrip, the children work together with their local CFA brigade to explore how human-action and decision-making influence bushfire risk, and identify problems of concern in their local context. Ultimately, through production of educational books and films, they share solutions to those problems with their local community. In 2016, the children produced a claymation film that explains the fire danger rating system and how it can be used to inform household decision-making on high fire danger days. In 2017, they created a children's book about a family who have just moved to Strathewen from the city and need advice and support to prepare for bushfire season. In 2018, they produced a film that explores the fire history of the local area - from the Indigenous use of fire by traditional landowners, through to impacts of the 2009 Black Saturday bushfires and the lessons learned from that event. In a community that was so severely impacted by the Black Saturday fires, the impact of this placed-based approach on the children's learning and development has been profound (Hayward 2018). Not only have the they developed an accurate understanding of the physical hazard, they have also come to understand how exposure and vulnerability interact to cause bushfire disasters (Towers et al., 2018a). In doing so, they have learned that bushfire disasters are not inevitable and have recognised the important role they can play, as children, in preventing them (Hayward 2018; Towers et al. 2018a).

These examples from Anglesea and Strathewen serve to demonstrate how bushfire education that cultivates and values the use of local knowledge and local places can benefit children's conceptual understandings of bushfire risk and resilience. Importantly, the local knowledge children acquire through these programs often extends beyond what most community members would ordinarily gain access to. This positions the children as valuable sources of knowledge and information within their families, which in turn, facilitates their genuine involvement in household bushfire planning and preparedness (Towers et al. 2018a). The process through which children take ownership of that local knowledge - via the production of child-led workshops, books and films - is also an essential part of the equation. It is through that process, in which they exercise a high level of power in decision-making, that children gain a sense of agency and empowerment (Gibbs et al. 2018; Towers et al. 2018a). As demonstrated by findings from in-depth program evaluations undertaken in both Anglesea and Strathewen, the combination of local knowledge and a sense of empowerment leads to a range of highly valuable risk reduction outcomes, including increased levels of planning and preparedness within children's households (Towers et al. 2018a).

Conclusion

The emerging evidence pertaining to holistic, place-based bushfire education provides policy makers and practitioners with a valuable foundation for the advancement of teaching and learning for bushfire risk reduction and resilience. However, it also presents some major challenges with regards to scaled, sustainable implementation. Existing programs and resources tend to adopt more standardised approaches that can be delivered over short time frames within the confines of the classroom. In this sense, programming that incorporates a holistic risk framework and a placed-based pedagogy represents a radical departure from current practice. Not only does it require a creative approach to program development that is driven by teachers, fire managers and other community partners at the local level, it also requires an extended period of program delivery. Building capacity and capability for this task would require sustained commitment and investment from the fire management and education sectors, at both the state and local level. However, in a context where climate change and rapid urbanisation are exacerbating Australia's bushfire risk and existing approaches to community bushfire education continue to fall short, that commitment and investment is both needed and justified.

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