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'Learning for resilience' as the climate changes: discussing flooding, adaptation and agency with children

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ABSTRACT

Climate change scenarios project higher flood risk, so knowing how households can increase socio-ecological resilience is essential. Children rarely feature in UK policy guidance about how households prepare for floods, and research is limited about children's roles in local resilience building. Using a participatory action research, child-centred methodology we explored (7-9year old) children's knowledge, skills and dispositions in discussions about flooding, suggesting processes for effectively engaging them in Learning for Resilience (LfR). Results suggest children have existing knowledge, skills and dispositions concerning local and international flood risk originating from various sources. They displayed cross-cultural learning, embryonic systems-thinking, and understandings of theirs and others' agency, including adults' reasons for un-preparedness, revealing awareness of risk underestimation and deferral/denial of risk. The paper offers framing of a new taxonomy for young children's significant 'LfR' and seven 'top tips' to facilitate, design and implement learning strategies with children around environmental risk, in the UK and internationally, in climate change contexts.

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Introduction

As the climate changes, predictions indicate floods and other extreme weather hazards like storms, droughts and heatwaves will become more frequent (European Academies' Science Advisory Council 2018), and will have greater impacts on communities worldwide (e.g. UNISDR 2015*Sendai Framework for Disaster Risk Reduction*). 'Learning to live with floods' is therefore important for all groups within communities, including children. Globally, children are disproportionately affected by disasters each year (Back, Cameron, and Tanner 2009; UNICEF 2017), and until recently are usually considered only as vulnerable victims. But increasing evidence suggests that children have important roles to play in Environmental Education (EE) (Lawson et al. 2018), and as agents in sustainable flood risk management (Walker et al. 2012; Mort et al. 2018; Cuidar Project 2020). Children could constitute a group with energy and influence yet to be harnessed by many agencies tasked with community disaster risk management (CDRM) and building socio-ecological resilience (Adger 2000). This integrates their inclusion in strategies to build local capital for house-hold level preparedness for flood risk, working with national environmental regulators. It also supports with the declaration of children's rights – the

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imperative for giving children 'space and modalities to contribute to Disaster Risk Reduction' (UN Convention on the Rights of the Child; UNWCDRR, 2015a,23; Save the Children). Krasny and DuBois (2016, 2) consider the importance of adaptation education and resilience in EE, concluding that

> given the immediacy and magnitude of climate change, we need education for adaptation and by carefully choosing our approaches, we can integrate adaptation education in a manner consistent with EE values of improving the environment.

Although there is a wealth of literature about children's participation in EE (Hart 1992; Chawla 2007; Wals 2010), less evidence-based guidance exists about how to involve them in actions and skills in the context of CDRM. Previous research has tended to focus on sustainable environmental behaviours in schools (e.g. waste management, Maddox et al. 2011; energy conservation, Boudet et al. 2016), and in community groups that promote responsible active citizenship (e.g. Girl Guide movement). These support the view that if children are included in discussions about these topics, they can influence their families to take preparedness actions, revealing their potential capacity, at least in some settings and thematic areas, to act as inter-generational agents of change (Winograd 2016; Rashid, Ronan, and Towers 2016; Lawson et al. 2018). Our previous research also revealed that young children (7–9 years) could learn about the importance of being prepared for a flood, and had potential to act as inter-generational agents of change by taking messages home and stimulating discussion, and in some cases preparedness action, within their families (Williams, McEwen, and Quinn 2017). 'Learning to live with floods', by increasing the actionable knowledge, planning and preparedness of households, should help minimise flood impacts on children and families, meaning that disruption is reduced and recovery quicker, both now and when children become adults (Mort et al. 2018). Ajzen's et al's Theory of Planned behaviour (2011,115) shows that

> The frequently observed lack of correlation between knowledge and behavior effective to produce desired outcomes has led many investigators to conclude that knowledge is a necessary but not a sufficient condition.

It is well established that in adults no simple relationship exists between flood risk awareness, and action to mitigate losses at an individual level (the knowledge-action-behaviour paradigm; cf. Baker 2007). Numerous cognitive biases and heuristics are reported to affect perceptions of risks (Kahneman and Tversky 1973) including flooding (Lechowska 2018). Building knowledge, skills and dispositions (in early stages), that are actionable and empowering can support socio-ecological resilience. Additionally, broadcast methods of communication and downstream interventions to change behaviour are unlikely to be successful on their own (Verplanken and Wood 2006). We require alternative thinking about how to engage children early as young citizens to build their agency in dealing with risk.

This paper explores young children's (7–9 years old) engagement with the subject of flooding addressing three questions through empirical data collection.

1. What knowledge, skills and dispositions do children display when they are involved in discussions about flooding?
2. How might these insights inform the framing of children's 'learning for resilience'?
3. How can this inform policy and practice (linking education and emergency planning) to build socio-ecological resilience?

Background literature

Three main multi-disciplinary areas of research literature inform and underpin this work. From literatures within learning for sustainable development, we embrace the associated knowledge,

skills and dispositions, identifying potential barriers and opportunities, and bring this together with 'Learning for Resilience' and CDRM. From psychology, we utilise knowledge about cognitive development (learning, memory and systems thinking) and its relevance for informing our understanding of children's cognitive and emotional abilities at different (st)ages. From sociological research, we adopt the concepts of children's agency and social capital in the context of ideas about opportunities to build collective capital and connect communities through children for disaster resilience.

Learning for resilience and 'the child citizen'

'Learning for Resilience' involves the acquisition of knowledge, skills and (pre)dispositions that support resilience building – particularly emphasising dynamic understandings through adaptation, transformation and shaping change – at individual and community levels. We acknowledge, and are informed by, the literature exploring the intersections of resilience, learning, and EE, with particular context to social-ecological systems and 'resilience as practice' (cf. Walker and Salt 2006; 2012; Krasny, Lundholm, and Plummer 2010). Here resilience thinking is applied to real-world situation/problems with an exploration of how complex socio-ecological systems can be managed to sustain and develop their resilience. Lundholm and Plummer (2010) ask questions about the critical role of EE in enhancing adaptive capacity while Krasny, Lundholm, and Plummer (2011) reflect on the outcomes of 'different approaches to EE relative to resilience attributes, such as social capital' (Krasny, Lundholm, and Plummer 2011, 665). We recognise that 'learning for resilience' means different things in different disciplines (cf. Dubois and Krasny 2016), and the potential for interdisciplinary research to contribute beyond subject silos.

Here we focus on LfR at the level of the individual (young) citizen, informed by thinking in Education for Sustainable Development (ESD) as a key international imperative (see, for example, Leicht, Heiss, and Byun 2018; UNESCO 2018). Growing interest also exists in adults' LfR and about how these knowledge, skills and dispositions sit within wider Learning for Sustainability (LfS) (e.g. McEwen et al. 2018). For example, dealing with uncertainty in LfS has strong links with risk management, along with thinking about world view and local/global citizenship and agency. More work exists on social learning for climate change mitigation than for extreme weather adaptation, although there are some examples such as Singer et al. (2017) work exploring ESD in schools in Japan in relation to resilient communities, post natural and human-induced disasters, which emphasises school-community links. UNISDR (2015) emphasises the importance of children exchanging experiences between themselves and others, understanding local hazard exposure, inputting to opportunities for preventing hazards turning into disasters and their potential to play an active role in assessing community risk. In adults, LfR includes, for example, ability to deal with complexity and uncertainty, thinking creatively about coping and adaptive strategies, the ability to build personal and collective capital, and connect with and build networks. Here intersections exist with other work on 'resilience thinking' about managing systems to enhance their resilience (Walker and Salt 2006; 2012; Sellberg et al. 2018) and in determining reflective strategies for managing complexity and uncertainty.

Importantly LfR can be considered through different resilience frames including social, emotional, psychological, economic, institutional, infrastructural, environmental, and community capital (cf. Cutter, Burton, and Emrich 2010). Some frames may be more important for children's learning than others. [We] have used Fink's (2013) *Framework for Significant Learning* to explore LfR in the context of flood action groups in challenged settings. Significant learning requires 'some kind of lasting change that is important in terms of the learner's life' (Fink 2013, 30). However, there is less research on how significant LfR might be framed and developed in children as young citizens. Additionally, although some work exists on the competencies teachers

need to support children's Learning for Sustainability (e.g. Strachan 2012), there is less about the teacher competencies and strategies to support children's LfR.

Cognitive development, memory and learning

The complex world can be perceived as particularly confusing for young people (Winograd 2016), but it maybe that children interact with the natural world more simply and easily, deducing that early understandings of complicated issues such as climate change are assimilated into child (and later adult) development. Learning to live with a changing environment will be an increasingly 'normal' state for children, and they will face challenges including increased flooding. Developing resilience and preparedness values and dispositions in childhood can form life-long skills, which may be crucial to later adaptation for resilience, and could encourage a deeper connection to, and care for, the environment (Chawla 2007; Kahn and Kellert 2002).

Memory research within this context is a growing interdisciplinary area drawing on cultural geography and cognitive psychology; most often work is on collective memory with adults rather than communicative memory (or with children) (Assmann 2008). Memory of floods interlinks with experiential lay knowledge that can be drawn on in LfR. McEwen et al. (2017) observe that

> personal and collective memories are key components of individual and social capital in themselves, and also in lay knowledges. As such they play key parts within social networking matrices, and in connecting individual and collective 'capacities for resilience.

Vertical memory is that handed down through generations while horizontal memory is shared laterally by communities as flood events play out.

Several complex stages exist in the formation of memory of events (episodes) that could subsequently influence the acquisition of knowledge (Ghetti and Lee 2011). Episodic memory is a much researched area of cognitive psychology. Its relevance here is to show the complexity and vulnerability (and inaccuracy) of the human memory system as Tulving emphasises it is a

> recently evolved, late-developing, and early-deteriorating past-oriented memory system, more vulnerable than other memory systems to neuronal dysfunction, and probably unique to humans (Tulving 2002,5).

Its' accurate recall is dependent on several factors from the content of the event, story-telling abilities (Klemfuss and Wang 2017), and methods used to ask children about their memories (Butler, Gross, and Hayne 1995). Younger children's recall accuracy can be vulnerable to suggestibility (Ceci and Bruck 1993), and false memories (Williams, Wright, and Freeman 2002). In their research, Yim, Dennis, and Sloutsky (2013, 2171) concluded 'that episodic memory undergoes substantial development between 7 years of age and adulthood'. This is of relevance to our research in appraising the approaches taken in developing educational materials to support children's learning about flooding, because the content and delivery could influence how and what is retained and recalled later.

When considering how children gain actionable knowledge for resilience, there is little empirical evidence to draw on, making it difficult to design initiatives with and for children that introduce them to complex environmental issues such as flooding as an uncertain risk. Learning resources and interventions such as computer simulations, books, games, art and drama have been developed, but these are often unevaluated for effectiveness on different criteria, and may not have been created with attention to cognitive/emotional/social development, cultural differences and different demographics (Williams, McEwen, and Quinn 2017; Johnson and Ronan 2014). The mode and medium, as well as the sophistication of content by

which these subjects are introduced to children are crucial (Johnson & Ronan. 2014). As well as emphasising the importance of including children in conversations about LfR in flooding (and other environmental issues), there is a need to provide guidance about the modes and methods that are effective in achieving this.

In adult skill development, those working in the environmental management and LfS fields increasingly advocate systems thinking approaches to understand and act upon environmental challenges (Forrester 2007). Considered a high-level skill, systems thinking requires:

> individuals to view the whole (whether problem, system, event, or entity) from multiple perspectives, while recognizing the interactions, patterns, and inter-relationships between the components, and considering the cause and effect relationships (Lee, Jones, and Chesnutt 2019,137).

There remain questions in the research literature about the ages and cognitive skills children need in order to engage in systems thinking, and although some believe that this skill should be introduced promptly and nurtured because children are more open, inquisitive and creative in their thinking early in their development (Orion 2002; Forrester 2007), others have questioned young children's ability to think in this way (Sheehy et al. 2000). Recent research assessing children's learning about hydrological earth systems shows 'that although system thinking is regarded as a high order thinking skill, it can be developed to a certain extent in elementary school' (Ben-Zvi-Assaraf and Orion 2010, 540). Wylie et al.'s research focusing on air pollution also proposed (1998, 117) '…a large proportion of the 8-year-olds demonstrated that they were capable of this kind of thinking. The results suggest that children can engage in systemic thinking earlier than predicted by traditional developmental research'. Iliopoulou's (2018, 362) research with 6-9 year old Greek children about air pollution led him to suggest that children 'seemed to exhibit a kind of systemic thinking, which was done unconsciously to a certain degree'. Both Iliopoulou (2018) and Lee, Jones, and Chesnutt (2019) recognised the need to support teachers in developing their own skills in systems thinking, and the lack of provision of educational resources to encourage its uptake in schools (and other educational settings) within the environmental, and wider scientific fields.

Emotional intelligence and empathy are rooted emotionally and cognitively. As early as two years of age, children have the cognitive ability to 'interpret, in simple ways, the physical and psychological states of others, the emotional capacity to experience, affectively, the state of others, and the behavioural repertoire that permits the possibility of attempts to alleviate discomfort in others' (Zahn-Waxler and Radke-Yarrow 1990, 107). Emotional levels of empathy are pre-disposed; but empathy also develops over time, and in response to several factors including cognitive development (executive function at about 6-7yrs), the experiences of early attachment, and to environmental and social factors. Children's empathetic response to potentially upsetting subjects such as flooding may help (by stimulating action) or hinder (by causing distress) attempts to engage children. Understanding more about empathetic responses in relation to discussions about flooding, and considering the role of empathy in CDRM, could allow us to create more successful guidance.

Connected children

Considering children's citizenship education, Education for Global Citizenship (Oxfam 2015) highlights the importance of individual and collective knowledge and understanding (e.g. identity and diversity), skills (e.g. communication) and values and attitudes (e.g. valuing diversity). Social capital can be defined simply as 'the links, shared values and understandings in society that enable individuals and groups to trust each other and so work together' with emphasis on bonds, bridges and linkages between people developing out from 'the individual' (Keeley

2007,102). What children as citizens can offer in terms of civic awareness, capital and agency, as a platform for community action, is rarely considered in conversations about community capital yet children can be facilitators in the community and have agency in their own right. As Wong (2017, 1) identifies 'Within much of social capital literature, children are mostly viewed as passive recipients of social capital from their parents and teachers, as opposed to being acknowledged as creators of their own social capital'. Linkages and bonds between adults (and associated knowledge networks) resulting in social capital can be a direct consequence of the connections made between children in their communities (school/clubs/playing out) (Wood et al. 2013). Harnessing these connections could lead to higher degrees of connectedness and subsequently community capital and more resilient communities engaging in more pro-environmental and risk mitigation behaviours.

From the extensive work of Walker et al. (2012), we understand much more about how devastating flooding can be for children who experience it. Research about involving children in education and preparedness for flooding is more limited, as is their potential to influence and change adults' behaviour. This could be because children are primarily viewed as a vulnerable group, meaning that their voices are lesser heard and included in emergency planning and environmental guidance. In a comprehensive review of a small number of studies, Ronan et al. (2015) found children were no more fearful after they had talked or gained knowledge about disasters, and that in many cases children reported that they worried less after learning more about particular disasters. This evidence supports the need to establish guidelines for those involved in talking to children of different ages and cultures about disasters, to ensure their inclusion in planning and designing materials and interventions which are st(age) appropriate.

Adults can be reluctant to involve or talk to children about environmental risks associated with climate change (like flooding) within the family, within organisations and within the social framework of the community, for several potential reasons. In families, adults may lack understanding or motivation to learn about risk reduction, leading to a lack of knowledge or a desire to remain disconnected and/or disengaged (Brown 2016). What should they say? Will it upset their child? Parents/carers/teachers may not know when in a child's development to engage with different issues. However, evidence from both education and psychology shows that adults' avoidance in talking about these topics with children can lead to maintained or increased levels of fear (Brown 2016), and that addressing children's questions directly can help to reduce these levels (Ronan et al. 2015; Towers 2015).

Adults also express concern about their ability to convey and discuss wider issues of climate change with children, and can be silent on this for a variety of reasons including worry, disconnection, denial, Nimbyism, lack of knowledge and/or social and political norms (Brown 2016 for USA; Ojala 2016 for Sweden). This can convey hopelessness and instability to children who are searching for guidance and answers. Sobel (2008) stresses the importance of hope and positive action when talking to children about climate change.

This poses questions about how themes within this review combine and interlink to promote and broker these roles and connections, building up from individual to community level with the potential to recognise, develop and support children's involvement in managing uncertainty and future risk.

Methodology

Our research designed to answer the three questions, involved a participatory child-led approach that both recognised and supported diversity and attended to language and power relations, accessibility, class and culture (Greig, Taylor, and MacKay 2012; Davis 2015). This was informed by, and tested with, teachers before the data collection phase. University and schools ethical clearance was obtained and the school acted as broker. The researcher also

clarified at the beginning of the research that children could choose to withdraw from the research at any stage by raising their hand and waving (to avoid embarrassment or reluctance to speak).

Seventy-three 7-9 year-old children in two UK primary schools took part in child-led group discussions (5-6 children per group) facilitated by the researcher over a period of six days in each school. The schools were in urban flood risk areas on the UK environmental regulator's flood risk maps. Setting 1 experienced a major flood in 2007, before the children were born, and setting 2 had no recent experience of fluvial flooding but had experienced some surface water flooding. Both were in areas of socio-economic disadvantage based on the Index of Multiple Deprivation (IMD). One school in particular was ethnically diverse, but we did not have access to data on this at cohort level. The researcher took a group of children out of their classroom into a separate space and spent time building rapport with each group of children asking their names, talking about the educational institution that she was from and asking about their interests, all the time assessing their ease and comfort levels. When she assessed that the children felt able to talk to her, she began to introduce the topic of flooding. She used a laptop which displayed (international) colourful and engaging pictures focused on causes, examples and effects of flooding, highlighting resilience and preparedness. There was a semi-structured script for the group discussion (see Table 1), but the researcher was skilled and experienced in working with children and allowed the children to lead the discussions sharing their (water) stories. She interjected only when the conversation was irrelevant, to answer questions, or to fill in key information.

The group discussions (five hours in total) were audio-recorded and all data were anonymised and confidentially stored. The sessions lasted between 15 and 25 min, and the children then took part in a creative task (Williams, McEwen, and Quinn 2017) after the group discussion, later returning to their classrooms. Children were not untouched by the research process, and the research design itself could serve to create social capital between the children through their discussions, provide the opportunity to rehearse and discuss content, and connect through the topic. It is important to note the timing of the research in one school. The previous day there had been a widely reported earthquake and flood in the Philippines; some of the children were aware of this.

The qualitative data set was analysed with careful attention to process and in a thorough and transparent manner (Gibbs 2002; Welsh 2002), the audio-transcripts from the groupwork were transcribed and coded by two independent coders using QSR N-Vivo. The coding process involved initial 'careful reading and re-reading of the data' (Rice and Ezzy 1999) to identify commonalities and patterns. There were two phases involved in coding the data. Initial codes were mapped against the semi-structured script (Table 1) to organise the data. These were cognitively mapped and using an interpretative approach to the data (Mason 1996), initial codes were discussed and agreed by the coders. The data were then coded by one coder. Both coders read through the final dataset and at this stage some codes were combined and subsumed to produce emergent final themes from which quotes were selected to inform and support the research findings.

Results

We found that children had existing knowledge, thoughts, opinions and questions about flooding. Four strong themes emerged from the data analysis: knowledge and experiential learning (on local and global scales); affect and empathy; agency, adaptation and behaviour change; and insight into reasons for lack of action by adults. We also reflect on the various knowledge sources that children mentioned.

Table 1. Visual aids, discussion topics and semi-structured interview questions.

PowerPoint content	Discussion focus	Semi-structured question(s)	Rationale for question
3 photos depicting natural causes of flooding	What causes flooding	What happens when it floods? Does anywhere you know flood?	To allow children to talk openly about their own experiences/knowledge of flooding
2 pictures showing fun aspects of rain – jumping in puddles	Rain can be fun	Have you ever had a rainy walk/ fun in puddles?	To set children at ease. To orientate to thinking about past experiences. To provide a sense of perspective.
3 pictures showing damage of floods – cars and houses flooded	Flooding can cause damage and can be dangerous	What sort of damage could a flood cause? Why is it dangerous?	To allow children to imagine what it might be like for those involved in a flood.
1 picture of map of the world with small pictures showing where floods happen	Global examples of floods. They happen all over the world with similar consequences	Where are these places?	To gauge sense of global occurrence. Allows consideration and discussion of other cultures.
2 pictures with people in the image – showing cars damaged and people sitting on the roof of a flooded house	Flooding can cause problems for people	What would life be like for these people?	To allow children to consider the effects and impacts of flooding.
Text saying it's important to be prepared	Ideas for being prepared	How can we get prepared? Sometimes people don't prepare even though they know there is a risk – why not?	To identify if children have a sense of the need to be prepared and what their ideas might be. To assess children's understanding of adults' non-action and the reasons for this.

Theme 1: knowledge and experiential learning

In every group discussion, children revealed that they had pre-existing flood knowledge and at least one child (and in most groups all of the children) was spontaneously inclined to tell the researcher what they knew. This was in response to the very first picture the researcher showed - of a river before and after a flood, and before the start of the more structured questions (see Table 1). Children disclosed knowledge about a variety of natural and human-induced causes of flooding.

> I know, I know. It's when we have lots of rain. (Group 5, child aged 7)

> Mostly rivers overflow, the rivers get really full and then it spills out. (Group 4, child aged 8)

> Sometimes the drains get blocked up and when the rain comes up. (Group 4, child aged 8)

> Ooo ooo I know, I know, a dam might break. (Group 3, child aged 8)

Children also revealed some awareness of cultural difference in their understanding about flooding, referring to events that had recently taken place in the Philippines, and to their (limited) understanding of flooding happening more often in Asian and African countries. This could indicate that children have a sense of these extreme weather events only taking place elsewhere and happening to other people (othering) which could lead to a false sense of security.

> We heard on the news. It was windy …. Almost all the roofs of all the buildings had fallen off. It was in the Philippines. My country was ruined. (Group 1, child age 7)

> Also some countries in Asia and Africa. They're very poor and they get quite a lot of floods. (Group 1, child age 7)

However, children's lived experiences (experiential learning) contribute to their memories, knowledge, and definitions about flooding, and can be inclusively defined as they relate their local memories (and related knowledge) at different spatial scales. The children shared local memories which stimulated dialogue and discussion. Three separate groups in one school mentioned a time when there was a large 'flood' [surface water 'puddle'] outside their school.

> When it started raining quite a lot in near our school the drains got blocked up so there was like this mini-flood. It was just outside the school. So we had trouble crossing the road. (Group 2, child age 8)

This memorable event indicates children search their memories of their own (episodes) experiences (here also in collective memory) to provide meaning to their understanding of flooding. It should be noted that a photo of children playing in puddles was included in the group discussion which could have acted as a prime. In the exchange below, the child also admits to being 'worried' indicating a level of emotional awareness which [when scaled up] could lead to higher levels of empathy:

> You could walk right along but you couldn't go past. (Group 2, child age 8).
>
> So was it tricky? (Researcher)
>
> I was worried and I got my shoes wet. (Child).

Children's accounts of their knowledge and memories of flooding included content on both local (quote above) and global scales (quote below), these often being mixed together in their recounts. Children were aware of human agency in adaptation:

> I think I was in America and I saw Hurricane Sandy and people put sandbags around their house. (Group 8, child age 8)
>
> My Dad said he went to Venice in the winter when it was flooded. He said they put wooden planks out and people walked across them. (Group 1, child age 8)

Children also showed understandings of negative effects of flooding (e.g. loss of life):

> I've been in a flood before. When I was about two. I was about that tall and the water was about that tall and six people in our family died. I think it was this country. It was scary…… I literally cried. Two of our dogs died in the flood… (Group 7, child age 9)

These memories may, however, be piecemeal, showing how as children develop they have a mixture of (real and fantasy) information, knowledge and memory formation going on simultaneously. Concrete operational memories form about age 7/8 years; children become more logical, but they still hold previous information and so what they may think of as an accurate memory may not be (and maybe from stories or other recounts). Skills in communication and the methods used to engage children in discussions can affect the quality and quantity of information they disclose.

Equally, children's lived experiences could include visits to other countries, and/or listening to stories from family members and/or peers from other countries linking the children to their cultural identity. We found evidence of children having knowledge about experiences, consequences and responses through their inter-generational interactions with family members (parents/grandparents) and through peer-to peer learning. In the school with much greater ethnic diversity, children frequently referred to global experiences of flooding, adding to their collective breadth of knowledge, impacts and reactions to flooding. The children freely talked to classmates about these experiences, as the exchange below shows, signifying multi-cultural peer learning is taking place:

> There was a flood in Mexico where my other family live. My grandpa fell out of a tree because he climbed up the tree so he couldn't get knocked over by the tide. He fell out of the tree and three adult teeth fell out. (Group 5, child A, age 9)

> Did he survive? (Child B, age 8)

> Yes he did, but his eye could have come out 'cause he fell out and landed on his eye (Child A)

> But it could have been dangerous cause he could've gone out to sea and he could've drowned. (Child B)

Children were able to discuss the dangers of flood water illustrated by this exchange between two children (in group 3). Here, there is also further evidence of peer-to-peer learning, as well as a hint at the role technology could play:

> At least you didn't have to pay for drinks 'cause there's water everywhere. (Group 3, child C, age 8)

> You can't drink it, It's dirty. It's sewage. (Child D, age 9)

> What if you had one of those things on your boat that makes water clean? (Child E, age 8)

In this exchange, children reveal their knowledge of the dangers of flooding and flood water, indicate their engagement with global news sources, and show evidence of peer-to-peer (social) learning:

> Yeah um… on the news last week there was a country which had a flood in it and also some people died in it. (Group 6, child F, age 8)

> In Philippines there was an earthquake. (Child G, age 8)

> No, it was a typhoon. (Child H, age 8)

If as our evidence suggests, children have pre-existing knowledge of issues such as flooding, it follows that those responsible for their care (pastoral and educational) should have the information and skills to be able to communicate with them effectively about such environmental issues. Guidance on this for facilitators of learning in the UK is currently limited.

Theme 2: empathy

Children showed awareness and understanding of groups that they considered vulnerable (including homeless, poorer, older people), and were able to differentiate the impacts that flooding may have on people according to their (perceived) vulnerability and socio-economic status. They displayed levels of both emotional and cognitive empathy in their thoughts about different types of impact and consequences for those who experience flooding:

> People that live on the streets won't have any home. (Group 13, child age 8)

> They're too poor, they don't have any money to buy wellies and they can't do fixing. (Group 5, child age 8)

> If you had a flood and people die, you wouldn't have anyone to play with and you could be lonely. (Group 5, child age 8)

The quotes above and those that follow support the notion that their own worldview and experiences, as well as their considered priorities, are driving the children's thinking. They consider their own experiences and transfer these to other people in different contexts. For example,

children who thought about 'getting away on an aeroplane'; 'going on holiday' or 'having food [shopping] delivered' may be from more affluent families:

> My grandma has a wheelchair and it can't go in the water. (Group 13, child age 9)

> The flood might get really bad and you might have to leave your home. (Group 3, child age 8)

> If you needed your food, they might not be able to deliver it. (Group 10, child age 9)

> It could also be hard for the poor people because they might not have enough money to get on an aeroplane and get away from the flood. (Group 12, child age 8)

Children imagined and reflected on the direct and indirect impacts on processes of everyday life that may emerge as flood impacts at a range of scales:

> If you wanted to drive somewhere or go on holiday you would have to drive and there would be too much water and your car could break down. (Group 10, child age 7)

There was also evidence of more literal thinking about the impacts of wetness (e.g. on money) suggesting an understanding of the physical damage a flood could cause:

> Or they might have no money because there might be water in the money. (Group 11, child age 8)

Children showed some skills in embryonic systems thinking about the 'knock on' effects of impacts:

> If there's loads and loads of really big winds and you live near a beach, the waves can get really high and it can make a wave flood. Then the water is on the road and in the house and if you go up(stairs), you can be trapped and then you can wave to someone to help, but if you can't go up(stairs) you get wet. (Group 8, child age 8).

> Why couldn't you go up? (Researcher)

> Because my Gran can't go on stairs. (Child).

Children also showed ability in systems thinking when they considered the differential ability of more vulnerable groups to have agency and adapt:

> People might run out of food and they need to buy food in the shops, but they don't have any boats or they don't know how to swim so they can't go to the shop. (Group 6, child age 9).

Theme 3: agency, adaptations and behaviour change

Children displayed knowledge and understanding about the importance of agency and preparedness in relation to making temporary (e.g. sandbags) and permanent adaptations (e.g. stilts, 'mud walls') to buildings, along with lifestyle and behavioural changes. Often this was in relation to other people or agencies, suggesting that children perhaps do not feel that they have personal agency in relation to preparedness for flooding:

> I know what's really important when there's a flood. You have to put sandbags so water doesn't go in your house. (Group 4, child age 8)

> In some countries they build house, put house on stilts (Group 2, child age 7)

Children also mentioned positive behaviours in terms of dealing with risk during events such as floods, showing levels of resilience and adaptation as well as early problem solving skills:

> I saw this clip. This man had built a huge mud wall round his house. All the other houses around him flooded. (Group 14, child age 9)

> If you're at the beach those trees that are in it are really strong and you can climb up them. (Group 6, child age 8)

> If you do escape but your house is demolished, you might need to put in some money so you can get some food and a new place to stay. (Group 9, child age 8)

In this exchange between three children (in group 11), children showed ability to think about potential damage, risk and problem solving in coping:

> If there's a flood, always stay in your house and make sure all the windows and doors are closed. (Child A, age 9)

> yeah but [child's name], what if the water crashes through the windows and doors. Because the windows are made of glass and if it gets higher the water would break the glass. (Child B, age 8)

> maybe they should put wood over the windows? (Child C, age 8)

> or metal. (Child B, age 8)

Although limited understanding of physical processes of flooding is revealed, children displayed an aptitude to apply logic to their independent thinking about these issues. This could indicate a desire and capability to acquire and understand information, revealing potential for children's personal agency and a degree of systems thinking.

Towards the end of the group discussion to introduce further thinking about agency, the researcher asked 'What's a grab bag?' No reference is made to the 'grab bag' being anything to do with flood preparedness (see Table 1) although this is the terminology that is referred to in the environmental regulator's guidelines (with adults) (c.f Pickering et al. 2018). Children revealed an instinctive understanding of the term, and all groups were able to offer a suggestion that was (to some degree) accurate:

> It's a bag. You have all these special things in it. When the flood comes you can grab it. (Group 4, child age 8)

The context and flow of the group discussion most likely provided a prompt for the children to consider what they thought a 'grab bag' was. Their logic and intuition allowed them to consider the word and make a (semi-)informed answer. This provides evidence to suggest the terminology 'grab bag', as a portable collection of emergency supplies, can be used effectively in guidance about preparing for floods with young children in this context.

This exchange also shows how easily children can switch their thinking to incorporate the creative (largely impractical), but in most cases positive (as they see it) and unexpected opportunity:

> Floods can be kinda good. (Group 11, child age 7)

> Kinda good, why? (Researcher)

> Cause if you're scared of something in your bathroom you could just go outside [for a wash]. (Child)

> I wish it would flood in my house 'cause I can get my skateboard and take the wheels off and go on the water. (Group 9, child age 8)

Table 2. Children's understanding of adults' non-preparedness.

Disconnection	*Vulnerability/lack of information*	*Denial/Deferral of Risk*	*Socio-Economic barriers*
'When they watch too much TV their brains get all weird and they just don't know'.	'Some people don't know what is the internet'	'Because they don't think it's true'	'Some might not have equipment'
'Too busy, too lazy. I just want to watch T.V'.	'They're silly'	'It might happen in lots of days' time'	'They don't have equipment, don't have any money'
'I want to stay in bed'	'Is it because they are dumb, not dumb. Is it because there's something wrong with them?'	'Some people just don't bother. They think its only water, what would happen? I've got bricks and wood'	'They couldn't buy the wellies cause they had not enough [money]'
'They're lazy. Watching TV too much'	'If people haven't had a flood they wouldn't know what to do'.	'They say it could be a flood, but its only could…'.	

Theme 4: insight into reasons for non-action (non-preparedness)

During the discussion, the researcher prompted the children to consider why adults might not prepare for floods if they know that there is flood risk. The children displayed sophisticated knowledge of human behaviour, an unconscious understanding of deferral/denial of risk and awareness of vulnerability and socio-economic barriers (Table 2).

To our knowledge, there is no existing research that asks children to offer reasons for adults' thoughts and behaviours about preparedness. Yet following well-established social learning theory (Bandura 1979), it is clear that these actions or lack of actions could profoundly influence children's learning, knowledge, and later actions. Observing adults' lack of preparedness could provide a (negative) exemplar for children who may replicate the attitudes and behaviours that they see. This could lead to they themselves becoming disconnected, remaining unprepared, relying on others, distancing themselves from risk (and environmental issues more widely) and limiting their own personal agency.

Sources of children's learning for resilience

Community resilience partly depends on trusted information sources that can be drawn on by people in deciding how to act in unknown situations (Norris et al. 2008). How does this apply to children's sources for learning? The National Curriculum (covering England) includes flooding as an optional topic, but is covered in classes with children older than in this research, suggesting that children aged 7–9yrs flood knowledge is not derived from school. Children increasingly gain geographical knowledge through popular culture/media (Morgan 2001); which is arguably accelerated through online learning resources based on high-profile documentaries such as Planet Earth, Blue Planet (https://www.bbc.co.uk/bitesize/articles/z2qwr2p), and publications such as eco-kids magazine (https://www.ecokidsplanet.co.uk/). Throughout our results, children refer to intergenerational learning, peer-peer learning and gaining knowledge from their own experiences and memories. Even though not directly asked, children mentioned their information sources 53 times in their recounts. Analysis of these information sources revealed that experiential learning (47%) was cited most. Some referred to the news or television (23%), which had recently reported on flood events in the Philippines and the UK. Family members' experiences were also mentioned (17%). Considering the prevalence of online initiatives (games and apps) that are developed to support children's understanding of flooding (Williams, McEwen, and Quinn 2017), it was surprising that children mentioned internet and social media much

Table 3. A taxonomy of significant learning* for resilience with children's exploration of flood risk and contributions to community capital.

Significant learning	*Capabilities or capacities evidenced in the results*
Foundational knowledge: understanding and remembering information for resilience	Local experiential knowledge Cultural knowledge (of other people and places) Identifying adaptive options Inter-generational knowledge
Application: Skills for resilience	Embryonic systems thinking Problem-solving
Integration: Connecting with people and places	Cross-cultural learning
Caring: Attitudes/dispositions/feelings for resilience	Enthusiasm/ empowerment Willingness to participate
Caring: Developing values for resilience	Concern for others Value diversity Taking personal responsibility
Human dimension: Learning about oneself	Surfacing existing knowledge, skills and attitudes Perceiving own agency and autonomy Recognising potential and social capital
Human dimension: Learning about others	Intergenerational conversations/interactions Understanding others' agency Listening Storytelling

cf. Fink's (2013) *Taxonomy of significant learning*.

less often (9%). This could be because of the children's age (lack of interest or strict access control), or socio-economic reasons (i.e. not having devices with internet access) noting that flooding tends to preferentially affect those living in poorer areas. Either way this raises questions about whether designing initiatives online to engage young children in discussion about environmental issues, such as flooding, is an appropriate or effective route. 4% of mentions were attributed to children applying knowledge from other topics (e.g. the Titanic).

Discussion

Our results clearly indicate that 7-9 year old children are able to contribute to child-led, adult facilitated discussions about flooding, adaptation and agency. Here we return to our three research questions to explore how this evidence can inform our understanding of children's Learning for Resilience (LfR) and the development of a taxonomy of significant learning in this context (Table 3), along with their implications for policy and practice in promoting socio-ecological resilience.

Knowledge, skills and dispositions: implications for 'learning for resilience'

The knowledge, skills and dispositions displayed by this age group provide opportunities to develop thinking about children's EE within the context of LfR, and with implications for Community Disaster Risk Management (CDRM). The children had pre-existing flood knowledge in terms of its processes, adaptations and effects on their families and communities, although it is worth emphasising that the content and accuracy of this knowledge could be explored further. They also displayed knowledge of the importance of adaptive behaviours to infrastructure (stilts/sandbags) and personal actions (making preparations). An understanding of the developmental processes involved in the acquisition of their knowledge could stimulate more sophisticated and effectively designed interventions, resulting in more meaningful engagement and inclusion of children in (CDRM) policy and practice.

We suggest that children gained their knowledge, and drew holistically and imaginatively, from their experiences, with creative content included in their narratives fuelled by personal memories and storytelling (see Lambert's (2013) 'Story and the human experience'). However,

memory development is a complex process and Yim, Dennis, and Sloutsky (2013, 2171) showed that 'episodic memory undergoes substantial development between 7 years of age and adulthood'. Children's recall accuracy can be vulnerable to suggestibility (Ceci and Bruck 1993), and false memories (Williams et al. 2002), and so careful attention to cognitive st(age) in developing both content and delivery could influence how and what is retained and recalled later. This could result in inaccurate or incomplete knowledge meaning that preventative or preparedness actions later may be ill-informed and/or ineffective. Previous research supports the view that children's thinking starts to shift from 'magical' to 'logical thinking' from about the age of 7 years (Piaget's 'concrete operation' stage). Before this age, distinguishing what is real and what is imagined may be very difficult and so using symbols in designing learning is appropriate and likely to be more effective.

Attention to scale of different events (a 'puddle near to the school' versus a substantial flood event) may not be well considered when children are thinking about, and recalling, their memories/knowledge. This could also represent blurring of details between different levels of cognition, identifying a stage where creative and real information regularly interject, resulting in inaccurate (or incomplete) knowledge/memories. These factors should be integrally considered in appraising approaches taken to develop educational materials that support children's learning about flooding, and wider extreme weather events.

But does it matter that children report stories as memories and that these contain inaccuracies? If the aim is to educate and equip children with knowledge to realise their potential as effective agents in the preparation and response of families to flood risk and actual flooding, then the answer is probably 'yes'. However, we could view children's storytelling and sharing of memories as a means of introducing the topic (in this case, flooding), and providing a child-led 'space' where a skilled facilitator (teacher/parent etc.) can add to discussion building accuracy and providing further information to strengthen LfR. If we recognise that perception and intention (adult and child) rather than knowledge are more strongly related to behaviour (Ajzen et al. 2011), then having inaccuracies in content of memories or stories that result in accurate knowledge for preparedness may not matter.

Recognising that Krasny and Roth (2010) highlighted the potential for the EE field to be elevated by cross-disciplinary thinking, we suggest that skills in embryonic systems-thinking maybe evident in how these younger children think and talk about a topic such as flooding as a hazard?, and that this can be further targeted for development to support LfR. Contrary to some literature (Sheehy et al. 2000), our results support the view that children can be(come) skilled in systems-thinking. In this context, at a young age, we observed children's ability to think about consequences of not becoming isolated (not being able to travel/get sustenance), and of potential flood impacts (flooding leading to property damage and increased financial costs). Ben-Zvi-Assaraf and Orion (2010) suggest that key to facilitating young children's systems-thinking is providing opportunities in terms of skilled facilitation and appropriate context, and methods utilised in our research encouraged this.

Interestingly here, (and despite their young ages) children showed dispositions of cognitive and emotional empathy, perceptions and refined understanding of adults' behaviour (parental; carer) in terms of non-action and non-preparedness. From this, we can infer children had an understanding of adult denial/deferral, dissociation, avoidance of risk and disconnection. Talking to children about a potentially upsetting topic such as flooding did not prompt upset, or purely emotional displays of empathy. Children showed concern through cognitive empathetic responses. Including content that triggers an empathetic response when discussing topics like flooding with children seems appropriate at this age, and in line with developments of the executive function. This could be developed as a pre-cursor for empathetic concern, which could lead to higher levels of actionable empathetic responses that could involve taking positive action later in life.

Children were able to recognise adults' reluctance to engage with risk, with the vulnerabilities and barriers (e.g. financial) involved. Intuitive understanding of deferral and denial of risk was

revealed as children talked about actions avoided and delayed. Children also appreciated that lack of action could be because of willingness to take known risks – 'It could be a flood, but its only could', when dealing with uncertainties of flood occurrence (Table 2).

Children's exposure to, and the influence of, adults' non-action and non-preparedness could provide children with a (negative) model of behaviour that, if they emulate into adulthood, could mean that they also become non-engaged, distant and unwilling/unable to make preparations to mitigate risk. But this reflection too can act as a focus for learning, and could encourage children to develop into adults who counter these attitudes and behaviours (rather than replicating responses) in response to risk and environmental challenges, and on a wider scale, climate change.

Bringing together these findings about children's knowledge, skills and dispositions, we offer the framing of 'a new taxonomy for young children's significant 'Learning for Resilience', drawing on Fink's (2013) taxonomy of learning that has distinct value for the individual learner in the context of change (see Table 3). We suggest that there should be integrated concern for, and inclusion of, LfR in educational and CDRM policies with attention to both formal and social learning. For this, there needs to be political will to integrate the development of such critical capital within curricula. Those involved in designing and delivering such LfR initiatives need evidence-based resources, guidance and support to increase their confidence and knowledge, allowing successful initiatives (local/national) to be developed that enable children to learn and develop socio-ecological resilience.

Implications and recommendations for practice

Krasny, Lundholm, and Plummer (2011, 190) proposed that EE should 'not be viewed as an isolated means to address environmental issues but rather as a complex and multifaceted part of a larger system of interacting structures and processes'. Our results enable us to advocate some recommendations for practice for socio-ecological resilience in two main inter-connected ways: firstly in formal and informal primary education, and secondly in emergency planning and policy guidance. These applications interact and need to be synergetic in strategy, policy and practice within wider environmental education.

Our participatory research methods worked well to scaffold and facilitate discussions with young children about flooding and LfR more widely, with potential for both curricular and co-curricular use. Central to this was a clear, interactive, child-led methodology, guided by Greig, Taylor, and MacKay (2012) and Davis (2015). Recognising children's natural desire to search and relate information to their own encounters, experiential learning needs to be supported as a major influence, and the importance of ESD and system- thinking for young children (cf. Strachan 2012) advocated more widely. We suggest that content in interventions should be cognitively appropriate, visual, intuitive and relatable to children's experiences. Small group discussion allows free flow for children to express their thoughts and feelings, listen and learn from each other with the additional scaffold of a skilled, informed adult facilitator. Being able to facilitate peer-peer learning with the inclusion of storytelling, sharing memories and capitalising on cultural diversity within their group and their families, can result in deeper discussion with wider knowledge sharing (with some similarities to Holmes and McEwen (2020) work with adult storytellers who had experienced flooding).

When considering how to include children in conversations about extreme environmental events such as flooding, attention should be given to both cognitive and affective domains. Even a basic knowledge of children's cognitive development can significantly influence the likelihood that educational interventions will be effective, but often risk practitioners who design educational resources about CDRM, including flooding, do not have this knowledge and/or do not take these factors into account. This can limit the success of learning interventions, with potentially negative consequences (e.g. raising fear and uncertainty; Johnson and Ronan 2014). Together with a largely

Table 4. Seven 'top tips' with and for designing and implementing LfR initiatives for young children.

Tip	*Design*	*Implementation Process*	*Research evidence-based approach*	*Link to research literature and theory*
1	Ensure learning initiative is child-led	Provide scaffolding and loose structure with a skilled adult facilitator	Children had existing knowledge and questions that can provide a starting point for discussion. Skilled adult can guide discussion through questions and the introduction of content. Training may be needed.	Child-led learning (Greig, Taylor, and MacKay 2012; Davis 2015)
2	Use cognitively appropriate, intuitive, visual stimuli	Ensure content and conversation is tailored to cognitive (st)age with skilled facilitator	Pictures on a laptop stimulate discussion. Children can consider other's perspectives and think about flooding globally. Some knowledge of cognitive stages of development should be pre-requisite in devising content and initiatives for children. Training may be needed.	Cognitive development in children (Piaget 1972)
3	Give children the space to lead discussion: small groups; encourage questions	Emphasise the experiential, making place -based and making locally relevant	Children mentioned experiential memories more than any other source of information about flooding.	Experience-based learning (cf. Kolb, 1984)
4	Capitalise on scalability of impacts, building out from the local	Encourage peer-peer storytelling and capitalise on diversity	Children shared knowledge and memories from families, experiences in different cultural settings, and had an appreciation of different (and similar) risks and climates.	Children's strategies in peer talk and learning (e.g. Cekaite et al. 2014)
5	Build in opportunity to consider connections and perspectives.	Prompt reflections on connections (systems thinking). Build in opportunities for empathy	Children displayed some ability to engage in systems thinking talking about knock-on effects of flooding, and consider different cultural perspectives and adaptations. Children displayed emotional and cognitive empathy in their responses	Systems thinking in children (Ben-Zvi-Assaraf and Orion 2010) Empathy (Zahn-Waxler and Radke-Yarrow 1990)
6	Encourage participation through active learning experiences	Build in creative opportunities to deepen learning and connection	Children talk in groups while taking part in a creative process following the group discussion. This allows rehearsal of information which could lead to deeper connection to content and memory formation.	Active learning theory; learning as a process of meaning making (Monk and Silman 2011); children's voice and participation (Bucknall 2012)
7	Focus on realistic, achievable positive actions	Use intuitive (action-based) language when talking about adaptation	Children intuitively understood what a 'grab bag' was designed to do. They were able to reflect and act to add appropriate resources.	'Grab bags' as DRR Strategy (Pickering et al. 2018)

dispersed and vague current primary national curriculum (in England at least) where flooding is not included, we emphasize the opportunity and need for interventions, resources and training to ensure that children are included appropriately. In answer to critics who advocate that it is sufficient to include risk/resilience topics such as flooding later in secondary school, we highlight

that a proportion of children will not choose to study geography meaning that they will miss this knowledge and ways of thinking completely (through formal curriculum). More important is recognising that learning about such a pervasive hazard goes beyond academic disciplines and knowledge; it needs to include attention to dispositions and skills. We advocate that it should begin at primary level, tailored to specific contextual and cultural adaptation in different countries. We identify seven top tips informed by our knowledge of existing literature and theory, research observations and critical reflections on our processes with the aim of providing guidance for the development of future CDRM initiatives with children (Table 4).

Research futures

Several areas emergent through this research warrant further investigation in the development of skills and dispositions for LfR, and its importance in policy and practice for wider socio-ecological resilience and longer-term embedding of learning practices. We need to address research gaps in critical skills, for example, to further our understanding of how young children's systems-thinking develops. In doing so we will be able to make important contributions to LfR, and continue to develop and promote *integrated* guidance and resources, for education, and emergency policy and planning.

Recognising the importance of LfR, and that adults (parents/carers/teachers) can be reluctant to talk to children about environmental issues (Ojala 2016), research identifying these barriers, and associated gaps in knowledge and understanding is crucial, alongside that focused on exploring how to address them. There is also a need to understand more fully how significant adults' environmental behaviours (or lack of) may influence children's understanding and behaviour – for example, the role of a parent is different to the role of a teacher and a researcher. This could stimulate provision of research-led methodologies, evidence-based guidelines and resources to encourage, and give confidence to adults to talk to young children about risk and resilience.

We are witnessing an increased awareness of environmental issues in children through the work of high profile individuals (e.g. David Attenborough, Greta Thunberg). These influences could be major catalysts for providing frameworks to promote engagement and preparedness. But there is a need to ensure that those who act as key role models in children's lives have the information and skills to promote children's engagement and preparedness. This further highlights the need for evidence-based guidance about working with children, which is specifically targeted for parents/carers/teachers. Such guidance needs integration within both curricula and environmental policy for socio-ecological resilience.

Timing of LfR in relation to st(age) is important. Children involved here were open to learning and discussing flooding, and appreciated the need for preparedness. Cognitive processes occurring and emerging at ages 7-9 years may indicate that this is an ideal age at which to introduce LfR to children, encouraging the development of life-long habits and strong environmental values. Further research comparing young children's responses to LfR initiatives at different st(ages) would provide useful evidence for this. Finally, more research is needed to explore potential for young children's knowledge for resilience to become actionable and shared through family and community networks (cf. Williams, McEwen, and Quinn 2017) for increased civic awareness and community action. There is a need for a more holistic multi-stakeholder engagement on children's roles in the socio-ecological resilience of households and communities, and how wider EE supports this.

Conclusions

Child citizens represent a currently under-utilised, but increasingly advocated group with agency and capacity that is yet to be realised and included in research-informed guidance and resources

for local socio-ecological resilience building. Rather than being considered only as a vulnerable group, harnessing and extending children's knowledge about flooding and 'living with risk', could prove invaluable in building individual, family and community flood resilience. Through children, people connect and so building on, and extending, their knowledge, skills and dispositions could reveal a more substantial role for children, for example as knowledge brokers, or in helping the wider community in efforts to increase preparedness and resilience - through their own agency and empathy in helping others. This supports their inclusion in, and critically an integration of, local and national LfR educational initiatives, and CDRM guidance and strategies to ensure children's effective engagement. In the UK, this could include inclusion in the primary curriculum, or meaningful engagement with younger children by emergency planners, visiting schools and engaging with children in small interactive group discussion (following our top tips and framework), so avoiding a broad-brush 'broadcast' approach to engagement (typically a whole school assembly). Internationally, these approaches in research-informed practice have potential wider applicability. For example, this could be through civil protection professionals, using tailored approaches that are culturally appropriate.

However, to be effective contributors to resilience (at individual, family and community levels) children need to be informed, prepared, and able to deal with (climate) uncertainty and change, as they face increasing exposure to environmental challenges, including flooding and extreme weather. This requires active multi-stakeholder attention to the intersections between EE, LfS, LfR and CDRM in resilience practice (cf. Walker and Salt 2012) that works with children as citizens. Such focus on learning for resilience is critical in equipping and empowering children to reach their full potential in being involved in discussions and decisions about climate resilience issues that affect them now, and as future citizens.

Our research found that young children have valuable capital (knowledge, skills, attitudes/dispositions), and potential to act as significantly more than a vulnerable group of citizens for which our policies and practices plan for and about for socio-ecological resilience. Young children have potential to be important members in individual, family and community emergency planning and wider preparedness, with agency and capacity to learn. They can undertake flexible and adaptive thinking with peers and show empathy and understanding of complex status quo (adult) attitudes and behaviours that often resist changes (e.g. preparedness). Involving children (particularly at ages where their cognitive and socio-emotional skills are rapidly developing) could provide the opportunity for longer-term, flexible and significant change, challenging static views and emphasizing growth, adaptation, responsiveness and resilience which may be necessary as they face a future of climate uncertainty and increased impactful extreme weather events.

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