

RESEARCH ARTICLE

Combining visual and linguistic methods to cultivate and communicate river meanings with young children

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Abstract

1. Environmental education is a process that helps children and people of all ages to learn about environments and develop skills to address associated challenges. For early childhood environmental education, place- and arts-based methods can raise children's awareness and appreciation of local environments by avoiding over-reliance on scientific explanations. Opportunities exist for combining place- and arts-based methods in environmental education to engage young people with local environments.
2. Place-based teaching intentionally leverages people's senses of place with emphasis on relationships to foster communication and engagement of broader concepts. Place- and arts-based methods intersect in the exploration of relationality and can create space for children to participate in the construction and modification of place meanings based on their experiences or without having visited a place.
3. In this article, we share a combined place- and arts-based method to environmental education. Our approach centred on the creation of three visual media to raise river awareness with young children in Swansea, Wales, UK, and to encourage them to communicate about river places that have meaning to them. Educational activities that raise young children's awareness and encourages them to communicate about the meanings they hold for rivers can empower them to enact change. We chart the process of making and sharing Jac's River Adventure book and then give focus to a specific case that influenced our method and resulted in the creation of two additional visual media inspired by children's responses to Jac's River Adventure book.
4. We discuss three key learnings from our creative and environmental education work, including that (1) tensions between fiction and non-fiction can diversify pathways to environmental knowledge *and* nature connection; (2) anticipation of teacher enrichment and student engagement beyond initial environmental education activities is necessary; and (3) online environmental education for classrooms challenges relationship building. Our learnings highlight that combined place- and

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arts-based methods have a role in environmental education and can foster awareness and communication about rivers through engagement and strengthening of local human/non-human and human/human relationships.

KEYWORDS

arts-based methods, environmental education, inland waters, place-based learning, sense of place

1 | INTRODUCTION

Environmental education is a diverse field focussed on influencing the way that people understand, think about, connect with and act for environments around them (dos Britto Santos & Gould, 2018). While environmental education centres life-long learning, early childhood (ages birth to eight; Copple & Bredekamp, 2009) is a particularly crucial point for developing environmental literacy (North American Association for Environmental Education, 2016; Wilson, 1996). Younger children (ages eight and below) stand to be the most affected by ongoing environmental changes (Hansen et al., 2013). While younger children might be exposed to information about complex environmental issues, there is a need for relevant materials that acknowledges that they are only beginning to understand the world beyond themselves and their families (Coyle, 2005; Wells & Zeece, 2007). If an adult presents the complexities of environmental issues to young children exclusively through scientific explanations, the children could go away from such experiences confused (Butzow & Butzow, 2006). Therefore, in early childhood environmental education, it can be particularly important to move beyond information-driven modes of understanding to place-based and arts-based methods. Place- and arts-based methods in teaching and learning can raise children's awareness and appreciation of the environments and places where they live (Wells & Zeece, 2007) and enable them to communicate and act for change (Angell et al., 2015; Leavy, 2015). However, in a recent review of 66 early childhood environmental education studies, Ardoin and Bowers (2020) showed that less than a third of practices focused on 'creative arts', 'family connection', 'personal connection' or 'action taking'. While Ardoin and Bowers (2020) focussed on the commonalities of the studies that they reviewed, their findings also underlined potential gaps in the methods used to engage young people in environmental education and that there is space for coupled place- and arts-based methods in such educational practices and studies.

Place-based refers to a broad range of teaching and learning practices whereby students make connections between broader concepts (such as climate change) and local environments primarily through direct engagement and experiences (Gold et al., 2018; Sobel, 2004). Place-based teaching intentionally leverages the senses of place (a person's attachment or bond to a place and the meanings that describe reasons for their attachment; Kudryavtsev et al., 2012) of students and instructors, and a fundamental emphasis is on relationships between humans and non-humans in local

communities (Graham, 2007). Such relations include those with formal and informal educators who can support learning and movement towards social change (Gold et al., 2018; Leckey et al., 2021). The focus on relationships in place-based programmes is to foster communication and engagement of broader concepts through individual and group experiences (Leckey et al., 2021; Schweizer et al., 2013). It is through this focus on relationships that place- and arts-based methods in teaching and learning come together and can create space for children to participate in the construction and modification of place meanings based on their experiences or without having visited a place (Kudryavtsev et al., 2012). Place meanings (such as aesthetic, ceremonial, familial, historical, political, spiritual and scientific) can be created or cultivated through arts-based methods with focus on making and sharing of stories, paintings, collages, poems, films, music, formal and informal conversations, and memories (Giannoulatou et al., 2022; Gold et al., 2018; Stokowski, 2002). Combined, place- and arts-based methods can help children recognize the existence of different ways of knowing and diverse meanings that people can hold for an environment and support their skills development to communicate about places that matter to them and their communities (Cormack et al., 2008; Gold et al., 2015; Kudryavtsev et al., 2012).

We report here on one such effort to make three visual media creations both for and with young children as part of educational activities to raise river awareness and to encourage children to communicate about river places that have meaning to them. Inland waters, including rivers, lakes, springs, ground waters and other wetlands are home to nearly one-third of vertebrate species and 10% of all species known to science (Tickner et al., 2020). Such waters are also among the world's most modified and threatened ecosystems (Grill et al., 2019; Tickner et al., 2020). Dams, roads, land use and climate change, and pollution degrade the health and function of inland waters (Bernhardt et al., 2022; Martinuzzi et al., 2014; Tian et al., 2022). Such human induced changes to inland waters contributed to an 84% decline in the Living Planet Index for freshwater vertebrate populations between 1970 and 2016, a rate twice that of biodiversity loss in terrestrial or marine environments (Almond et al., 2020). Loss of species and ecological function threatens to further erode the diversity of ways that people know and utilize inland waters (Anderson et al., 2019; Cardinale, 2011; Cardinale et al., 2012; Lynch et al., 2023). Educational activities that raise young children's awareness about the diversity of species dependent on rivers, different ways of knowing these environments and encouraging them to

communicate about the meanings they hold for rivers is an important step in supporting the sustainability of human–nature interactions and empowering children to enact change.

Three visual media: Jac's River Adventure book, Our River Adventure banner, and Our River Adventure glossary were created as part of an educational and research project within an interdisciplinary programme that explored rivers in a fragmented world. All three visual media pieces were made through collaboration either between the authors or between the authors and children in Swansea, Wales, UK. We used a child-focused approach, whereby children were seen as social actors with their own experiences and knowledge (see Glenn et al., 2013). The processes of creating the visual media involved sharing and cultivating river meanings with young children through visual (drawings; design) and linguistic (poetry and spoken word) modes of communication. Visual media can be useful to reveal not only what can be seen but what can be *imagined*; the visual can also evoke the meanings, or connections, that exist between humans and non-humans (Gómez Cruz, 2021). We chose to create and share visual media in our educational initiative with young children to surface and make visible different river species and meanings that can often be hidden or go unnoticed in everyday life (Januchowski-Hartley et al., 2020; Monroe et al., 2009; Thomas et al., 2021). Equally, poetry (written or spoken) generalizes personal experience and taps into universality (Faulkner, 2020), creating something that readers (or listeners) experience as if it were their own (Furman et al., 2007). We felt that poetry would be particularly powerful as a communication medium for cultivating and sharing local place meanings with children. In Jac's River Adventure, poetry was chosen as a medium to meld the scientific and emotive (Faulkner, 2020) through a rhyming narrative about cultural and ecological knowledge of a local river. In the Our River Adventure glossary, poetic text was paired with drawings created by children as clues for the children to explore the different river meanings shared by others in their school and elsewhere. Below, we chart the process of making and sharing Jac's River Adventure book and then give focus to a specific case that influenced our method and resulted in the creation of Our River Adventure banner and Our River Adventure glossary that were inspired by children's responses to Jac's River Adventure book. We share and discuss three key learnings from our creative and environmental education work that could be useful for researchers, artists, facilitators and educators.

2 | JAC'S AND OUR RIVER ADVENTURE VISUAL MEDIA

2.1 | Jac's river adventure book

Inspiration for Jac's River Adventure book came to article co-author Stephanie R. Januchowski-Hartley (SRJ) during seasonal walks along the Tawe River, Wales, in 2019. The book was created through a collaboration between three of this article's co-authors, SRJ, Ioanna Daphne Giannoulatou (IDG) and Joelle Evans (JE). The three of us

brought together our knowledge and experiences with education, river environments, visual art, creative writing and graphic design to create the Jac's River Adventure poem, illustrations and activities to engage children ages five to eight with their local rivers. Our interest in making a book about the Tawe River related to a goal of the broader interdisciplinary programme we collaborated on, which was to design locally relevant materials to support river engagement and research in Swansea and the Tawe River catchment. Our intention with Jac's River Adventure book was to provide children with different pathways, through verse, visuals and creative activities, to reflect on and share about their river memories and to create river meanings.

To encourage children's recall of rivers when reading or listening to Jac's River Adventure, our design accounted for different ways that they could visualize rivers, including not only those things that can be seen above but also below the surface of waters, and not only what is seen with eyes but also with minds when reading or listening to spoken words, or imagining a river. The book was written by SRJ and illustrated by JE. The illustrations depicted scenes of the Tawe River that might resonate with people, including cultural and hydro-geological features and wildlife that children would likely encounter or know. The poem and illustrations featured Jac, a fictional canine character with a cultural link that we anticipated would be identifiable by many children in South Wales because of the canine legend Swansea Jack who allegedly rescued people from drowning in the Tawe River in the early 1900s. Cultural features, such as the Sleeping Giant (Welsh: Cribarth) (Figure 1), were included in the poem and illustrations to help children situate and visualize the Tawe River in relation to landmarks that might have meaning to them. Both conspicuous species, such as dippers (*Cinclus cinclus*) that bob around on rocks above the water, and more cryptic species, such as minnows (*Phoxinus phoxinus*) that are small and live underwater, were part of the poem and illustrations. Conspicuous species were included in the book because children are likely to encounter or know them from their own experiences on the Tawe River, whereas more cryptic species could require and inspire children's curiosity to take a closer look and share about what lives in and around the river (Figure 2).

Three learning activities were designed for Jac's River Adventure book by IDG and illustrated by JE. The activities were designed to develop different areas of learning through the lens of rivers seen or imagined. For example, the My Local River activity was designed to encourage children to make their own place meanings while developing their observation and communication skills. In the My Local River activity, children are prompted to lead their own river adventure, to use their senses to observe the river and its surroundings, and to use those observations to create a map of the adventure (Figure 3). The My Local River activity was part of classroom engagement (Section 2.2) led by SRJ and IDG in Swansea.

The poem, activities and all cover materials in Jac's River Adventure book were written in English by SRJ and IDG and then translated from English to Welsh by poet and translator Aneirin Karadog. The book was printed and made available to children in English and Welsh, because Wales is a bilingual country, and we



FIGURE 1 JAC's River Adventure spread showing Jac, the Sleeping Giant (Welsh: Cribarth), and the Tawe River.



FIGURE 2 Jac's River Adventure spread showing Jac, a dipper, and a school of minnows.

wanted to cultivate learning and communication of river words in both languages. Digital versions of Jac's River Adventure book in English and Welsh can be downloaded from Figshare (Januchowski-Hartley, Giannoulatou, Evans, et al., 2022).

2.2 | Jac's river adventure workshops

Jac's River Adventure book was used to facilitate non-formal education and research workshops with 155 children in six classrooms at three primary schools in Swansea. For the purposes of this

article, we use one case: Sian Howells' (SH) year-1 class (22 children) at Ysgol Gynradd Gymraeg Y Login Fach (YGG Y Login Fach) to chart the Jac's River Adventure workshop and post-workshop processes. In 2020, when the Jac's River Adventure workshops were initiated, SH was a year-1 teacher at YGG Y Login Fach, a Welsh medium school (where most children speak English as their first language, but their education is primarily delivered in Welsh) in a peri-urban environment of Swansea. The same workshop format was delivered in the five other classrooms in Swansea, but it was SH's further integration of the Jac's River Adventure book and concepts in her classroom that inspired the creation of the Our River



Be like Jac!

Lead your own river adventure!

Lead an adventure along a river and draw "My Local River".

1. Visit a local river and lead others on an adventure alongside it.
2. Use your senses. Take note of what you see, hear, feel or smell.
3. Think about what you saw, heard, smelt or felt on your visit.
4. Draw a map of your adventure and note where different things happened.
5. Add the name of the river and a title to your map!
6. Take a photo of your map and email it to team@firelabkids.uk.

Stop by firelabkids.uk to see the Local River Map Collection!

Draw your map below:

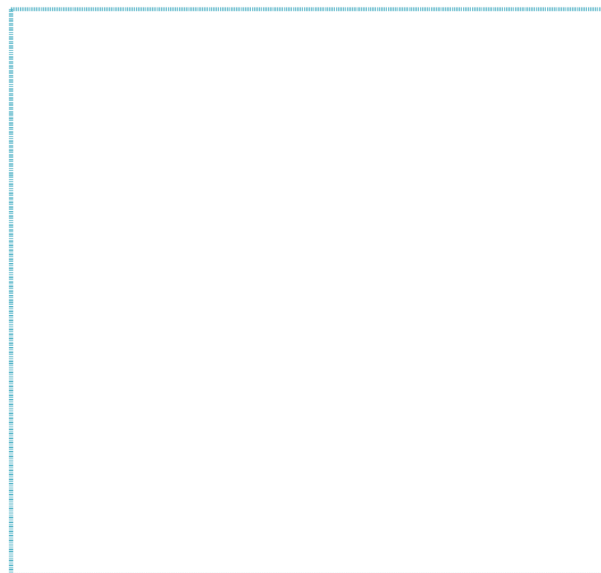


FIGURE 3 The My Local River activity as presented in Jac's River Adventure book.

Adventure banner and Our River Adventure glossary that are the focus of this article.

In response to COVID-19 restrictions, co-authors SRJ and IDG designed Jac's River Adventure workshops to be delivered via Microsoft Teams. Recruitment to Jac's River Adventure workshops was both purposive and opportunistic. Invitation emails from SRJ and IDG were directed to head teachers and teachers of year-1 to year-4 classrooms (purposive). Each child's participation in the Jac's River Adventure workshops relied on their head teacher, teacher and parent or carer having interest in the project and responding to the invitation (opportunistic). In October 2020, as part of broader recruitment sent to all primary schools in Swansea, SRJ and IDG contacted the head teacher of YGG Y Login Fach by email. SRJ and IDG invited teachers of year-1 to year-4 (ages 5–8) classrooms at YGG Y Login Fach to participate in a workshop with Jac's River Adventure books ([Appendix S1](#)). SH responded positively to the invitation, all parents or carers consented to their child's participation (see [Appendix S2](#) for the provided consent forms), and in February 2021, SH and 22 children from her classroom joined a Jac's River Adventure workshop with SRJ and IDG.

Jac's River Adventure books, in English and Welsh, were delivered to YGG Y Login Fach ahead of the workshop. The workshop was approximately an hour in duration and was delivered in English by co-authors SRJ and IDG who appeared side-by-side on a screen in the classroom. The children were gathered in the classroom so that they could see SRJ and IDG on the screen and hear the audio. The workshop began with introductions and a short overview of what we were going to do together. The children were then asked to observe the covers of the Jac's River Adventure books they had in front of them and to share what they believed the story would be about. After the children shared their ideas, SRJ read Jac's River Adventure aloud, and the children followed along in the Welsh language version

of the books they had in front of them. After the reading, the children were asked to share their thoughts and ideas about the book and what the Tawe River means to them. Several children mentioned that they wanted to know more about Jac and to hear a longer story, which opened a short discussion about where the story could go and the stories that the children could make about Jac to continue her journey in different ways.

The children were then guided through an adaptation of the My Local River activity ([Figure 3](#)). While the activity was originally designed to encourage and guide children to physically visit a local river, we adapted it for the classroom setting, whereby children were invited to visit a river that they knew in their minds—either experienced or imagined. At the start of the activity, we asked the children whether they liked to draw or not and assured them that if they did not like to draw, they could write or share their creation verbally instead. We offered the children choices because we acknowledged the importance of the children being heard and respected, and that by providing them options, we empowered them to choose how they expressed themselves (Glenn et al., 2013). IDG explained to the children that they would each depict their own river adventure from their memories or their imaginations if they could not remember a lived experience. IDG verbally prompted the children through a visualization technique (World Health Organisation, 2002) to encourage them to think about and visualize where their adventure started (e.g. home, school, or somewhere else), what they could hear, see, smell, touch, or even taste, and if something notable or unusual happened on the day. The children had 20 min to depict their river adventures. If their drawings or other creations were not finished within that time, the children were able to finish them later. The classroom was quiet during the activity apart from a few reminders about how much time was left. The workshop concluded with the option for

children to share their creations with SRJ and IDG. Children were invited in front of the camera and prompted to share with SRJ and IDG about the river, their adventure, and describe what they had created. It was each child's choice to share their creation in front of the camera, and some children chose not to share.

2.3 | Post-workshop happenings and our river adventure banner

After the workshop, SH exchanged emails, ideas and reflections about the project with SRJ. She emailed photographs of the children's creations from the workshop, apart from any that went home with children and did not return to class, and she shared how she guided the children to write and draw their own stories (in Welsh) about Jac. The images she shared of the children's extended stories about Jac and their experiences creating the stories, inspired IDG and SRJ to reciprocate the process of continued creation, storytelling and engagement. JE agreed with the ideas, and the three designed a banner that included elements from children's creations returned to SRJ and IDG after the Jac's River Adventure workshops, including those from YGG Y Login Fach and the other two primary schools.

The Our River Adventure banner was designed to showcase the diversity of meanings that children attached to rivers and how those were visualized in their workshop creations. IDG and JE used Adobe Illustrator to extract at least one element from 113 children's creations for the banner. Two additional children's creations were written and represented by drawings included in the banner. The banner was designed in Adobe Illustrator by JE to look like the cover of Jac's River Adventure book but with the words Our River Adventure instead of Jac's River Adventure and included elements from the children's river creations and additional characters from the book (Figure 4).

The Our River Adventure design was printed on vinyl banners that could be hung indoors or outdoors. IDG and SRJ delivered the banners to the three participating schools in November 2021. Each banner was greeted with a small assembly, which provided the first opportunity for everyone to meet in person, to engage with the river meanings expressed by different children, and to ask questions and share about different river experiences. SH and the children at YGG Y Login Fach hung their Our River Adventure banner at the main entrance of the school, where it still greets every student, staff, and visitor 3 years post project.

2.4 | Our river adventure glossary

After the banners were delivered to the three schools, SH again exchanged emails with SRJ and shared about the children's engagement and responses to other's river drawings. The children's responses to the banner during SRJ and IDG's visit to YGG Y Login Fach, along with the additional feedback shared by SH, sparked conversation between IDG and SRJ about a visual media design that could share the visual *and* linguistic responses of the children in an engaging way. IDG and SRJ agreed to design Our River Adventure, a visual and linguistic glossary, to share the meanings that children expressed for rivers in their creations.

To identify the different elements that children included in their creations, IDG listened to audio recordings of the six workshops, transcribed the children's explanations and matched 44 children's explanations with their visual creations. Most elements from the children's creations that were included in the Our River Adventure glossary were those that IDG paired with their explanations. However, some children added elements and colours to their creations after the workshops, and those were not captured in the audio recordings. As an additional step, IDG identified visual elements that were not necessarily expressed by the children but



FIGURE 4 Our River Adventure banner sharing the diversity of meanings that children attached to rivers along with characters from the Jac's River Adventure book.

were clear in the drawings or writing (e.g. trees, birds). IDG and SRJ wanted the glossary to focus on meaning commonalities shared among the children, so only elements expressed by two or more children were included. IDG and SRJ selected visual representations from different children's creations for each element in the glossary (Figure 5) and extracted those images with Adobe Photoshop. SRJ wrote short poetic clues to accompany each element in the glossary. Each clue conveyed different emotions (e.g. happiness, excitement, sadness, fear) and phenomena (e.g. humour, imagination) expressed by the children when they shared their creations in the workshops (Figure 5). The glossary was designed so that readers could look at the images, read the poetic clues, and then guess the corresponding word. The glossary words were presented as answers to the visual and linguistic clues and revealed at the back of the book. The glossary was translated from English to Welsh by Swansea University's translator, Angela Black.

Copies of the Our River Adventure glossary in English and Welsh were printed in May 2022, and SRJ emailed teachers from all six participating classrooms to reconnect and share the glossaries. Despite several email efforts, SRJ only reconnected with SH and the children at YGG Y Login Fach. Printed copies of the Our River Adventure glossary in English and Welsh were shared with the children at YGG Y Login Fach who participated in the Jac's River Adventure workshop as well as with children in SH's current year-1 classroom. Additional printed copies of the glossary and Jac's River Adventure books in English and Welsh were shared with YGG Y Login Fach because SH and other teachers at the school wanted Jac's River Adventure to continue to be a part of classroom activities beyond the duration of the project with SRJ and IDG. Digital versions of the Our River Adventure glossary in English and Welsh can be downloaded from Figshare (Januchowski-Hartley & Giannoulitou, 2022).

3 | DISCUSSION

We have charted the process of creating and sharing Jac's River Adventure book and Our River Adventure banner and glossary. The three visual media encouraged children to engage with rivers creatively, to express what rivers mean to them, and created space for them to feedback and influence the broader educational and creative methods of the project. Below, we share three learnings that could be useful to researchers, artists, facilitators and educators exploring intersections of place- and arts-based methods for environmental education in school settings.

First, SRJ and IDG observed that the tension between fiction and non-fiction in Jac's River Adventure book diversified pathways for children to activate environmental knowledge, which is a fundamental component of environmental education (Otto & Pensini, 2017) and nature connection (Richardson & Butler, 2022). While SRJ, IDG, and JE designed Jac's River Adventure book with the intention of connecting local folklore with river environments and the species that depend on them, we had not anticipated the extent to which the children would connect with Jac compared to other features in

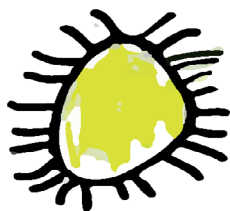
the book. In the workshop with SH's classroom, SRJ and IDG made a general observation that many of the children knew about Jack, the dog who was said to have rescued people from the Tawe River, and that the children made connections between that story and Jac's River Adventure. At the same time, few children had heard of or seen local species such as the dipper or geological features such as the Sleeping Giant. SRJ and IDG observed that Jac could offer a pathway for children to (re)connect with the river and that was reinforced by the follow-up activity that SH led with her classroom, which offered the children an opportunity to expand Jac's cultural story. Further, after the workshop, SH reflected to SRJ and IDG that the book had strengthened her own connection with local rivers:

we thought that [Jac's River Adventure] would not be very enjoyable, it wasn't a topic that I would have chosen. But we learnt a lot ourselves. When the both of us were going on walks during lockdown in our own areas we were noticing more life on the river.

(SH)

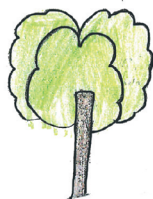
The reflection shared by SH suggested to SRJ and IDG that the book's cultural relevance extends beyond young children to people of different ages in South Wales, and possibly Wales more broadly. While not necessary, some adjustments could be made to Jac's River Adventure book to make it more engaging for older audiences. For example, additional detail could be added to the illustrations in Jac's River Adventure book and the activities could be revised to include greater complexity (e.g. more species, ecological interactions), including interactions with humans that were not necessarily appropriate to the younger ages. Maintaining the friction between fiction and non-fiction in the book works well for all ages because the fictional elements can instil a sense of hope and foster reimagining of rivers (D'Avanzo, 2018; Giannoulitou et al., 2022), and the somewhat technical vocabulary, such as 'riffles', can spark dialogue and questions from audiences of any age.

Second, SRJ and IDG learned that it is important to anticipate teacher enrichment and student engagement beyond the initial environmental education materials and activities. Proactive acknowledgement that at least one teacher would engage with Jac's River Adventure book beyond the workshops means that ethics approval could have been sought to collect any additional stories and creations made by the children so to account for broader engagement and learning facilitated by the project. SRJ and IDG also reflected that there was a missed opportunity to integrate specific dialogical prompts when delivering the banner and glossary. Doing so would have added value to the educational and research potential of the project. Ideally, SRJ and IDG would have anticipated the additional creative responses from the children and better facilitated additional learning and dialogue with the children. SRJ, IDG and SH also reflected that a teacher's guide would have offered greater support to teachers who brought Jac's River Adventure into their classrooms. Based on those reflections, the three, along with two other teachers, created a teacher's guide to accompany Jac's River Adventure



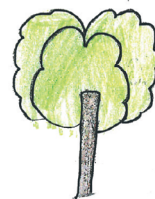
bright spot burning in the sky¹

connect and sustain our lives²



rise to the sun,

tickle soils below³



a place to rest after adventures⁴



distant relatives, who are part of us all⁵



who we each are⁶



where river waters begin⁷



FIGURE 5 A page from Our River Adventure glossary showing children's drawings (from top to bottom) of sun, rivers, trees, house, fishes, 'me', and sky paired with poetic clues by article co-author Stephanie R. Januchowski-Hartley.

book. The teacher's guide is for anyone who would like to integrate Jac's River Adventure in their learning space and includes eight enrichment activities designed by SH and two other teachers who hosted Jac's River Adventure workshops. The guide can be downloaded from Figshare (Januchowski-Hartley, Giannoulatou, Howells, et al., 2022).

Third, SRJ and IDG reflected that moving environmental education addressed to classrooms online was less than ideal and, while doable, made relationship building difficult and placed strong dependency on the teacher's ability and time to facilitate the workshop. SH and other teachers fed back to SRJ that they felt that the children would have engaged more with the storytelling and activity facilitated in the workshop if delivered in person. As the facilitators of the workshops, SRJ and IDG reflected that when environmental education is addressed to classrooms, online engagement should be seen as a supplementary method once relationships have been built in-person with teachers and children, and any activities designed for outdoor engagement had been delivered in that respective setting. While online engagement was essential for Jac's River Adventure workshops because of the time of the pandemic and to enable delivery of project outcomes, SRJ and IDG observed that relationships were strengthened between all collaborators when the banners and glossaries were shared in person with the schools. The additional in-person engagement at schools provided space for questions and sharing about the project and to identify shared interests between the schools and the project team. It was through these additional engagements that SH and other teachers at YGG Y Login Fach expressed interest in having Jac's River Adventure continue to be part of classroom activities, and so the books and glossaries stayed on in the school, furthering river awareness and opportunities for young children to communicate river meanings.

4 | CONCLUSION

In the context of environmental education in Wales, the creation of visual media via collaboration between researchers, designers, educators and young children demonstrated that combined place- and arts-based methods can foster awareness and communication about rivers through engagement and strengthening of local human/non-human and human/human relationships. The combined place- and arts-based method we presented here encouraged children to engage with rivers creatively, to express what rivers mean to them, and created space for them to feedback to and influence the broader educational and creative methods of the environmental education project. We observed that children's online engagement with visual media and project facilitators could be enhanced by additional face-to-face interactions. This highlights an important research direction: exploring how to better address and acknowledge the critical role of relationships between researchers, facilitators, educators and children in online environmental education, particularly when the programme is place-based. The future design and implementation of combined place- and arts-based methods for environmental

education in schools would benefit from longer term strategies and financial investment to support relationship building between researchers, educators, and children.

AUTHOR CONTRIBUTIONS

Stephanie R. Januchowski-Hartley, Ioanna Daphne Giannoulatou and Joelle Evans conceived the ideas and designed Jac's River Adventure book and Our River Adventure banner and glossary. Stephanie R. Januchowski-Hartley and Ioanna Daphne Giannoulatou designed the Jac's River Adventure workshops and implemented the workshop at Ysgol Gynradd Gymraeg Y Login Fach with Sian Howells. All authors shared reflections about what was learned through the creative processes and workshops. Stephanie R. Januchowski-Hartley led the writing of the manuscript, and all authors added ideas and contributed critically to the drafts.

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CONFLICT OF INTEREST STATEMENT

The authors have no conflicts of interest to state.

DATA AVAILABILITY STATEMENT

Anonymized visual and linguistic data used to create the Our River Adventure glossary are archived in Figshare: <https://doi.org/10.6084/m9.figshare.28735178.v2>.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

Appendix S1. Recruitment email invitation sent to head-teachers.

Appendix S2. Information sheet and consent forms.

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