United in Biodiversity Research Paper

The Power of Arts Practices in Biodiversity Education in Schools

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1. Introduction

The loss of biodiversity is an aspect of climate change that has become impossible to ignore. It is an issue facing every country in the world and is, for the most part, a human made issue. It is also an issue which cannot be tackled without buy-in from all humans, as the slow rebuilding of ecosystems will require widespread shifts in policy, behaviours, and education. The UN's Sustainable Development Goals (SDGs) has mentioned biodiversity as part of goal 15 *Life on Land*, however it feeds directly into many of the other goals; such as 14 *Life Below Water,* 2 *Zero Hunger,* 11 *Sustainable Cities and Communities* and 13 *Climate Action.* Repairing biodiversity and ecosystems is key to fighting climate change, and the failure to do so will have a negative domino impact on all other areas of life on earth. Education plays a key role in tackling the causes of biodiversity loss, while also helping to better inform people about how they can help to restore ecosystems. Education is an underpinning force, as it helps show people what behaviours they can change to support the environment, and also what larger changes they must campaign for. In the way that biodiversity degradation bleeds into all other areas of sustainability and environmental health, so too does education drive change in behaviours from the level of the individual to governmental and intergovernmental reform.

While education is widely understood to play a vital role in creating a more sustainable future, there is ongoing discussion on what form this environmental and sustainable education might take. Art practices within education could have a two-pronged benefit for climate education. Foremostly it can bring a creative and fun approach to learning, helping students retain information by offering an alternative to the mainstream modes of education. Secondly, it could help students deal with the 'climate anxiety' which can sometimes arise in facing the vastness of the problem, by allowing students to take action and through the therapeutic benefits of arts interventions. In recent years, the benefits of art in educating STEM subjects has become so profound that the expanded acronym of STEAM is now widely accepted. Traditionally, STEM education has focused on "theoretical understandings of solutions to real-world problems." (Stroud and Baines, 2019, p.1) The arts, however, were always playing a part either in constructing models, drawing sketches, and creating visual representations of the 'theory.' In biology classes, diagrams have long been a staple, and for climate science it is often through imagery that complex and vast concepts can be synthesized and understood by students. Art has never been far from science, and the expansion of STEM to STEAM is reflective of a society paying its dues to the arts rather than uncovering a new mode of education. Why, then, have those in STEM fields been slow to recognise the role of art, and what does this shift mean for educators and students?

Initially it can be understood that the polarisation of science and art has had an impact on the way young people see themselves, carving out a specific identity through their affinity with one or the other. By combining arts and science, students are less likely to identify by a specific category such as 'artsy' or 'mathsy,'

(Bevan et al., 2019, p.25) as their education becomes more holistic. It is important to keep in mind, however, that arts should not be used in an extractive way, as only a means to an end, with the ends being of scientific value. Halverson and Sawyer discuss this paradox in their paper, writing, "We want to argue that arts education and STEM education can mutually inform each other, while at the same time avoiding the pressures to approach the arts primarily as a tool to improve outcomes in STEM subjects." (Halverson and Sawyer, 2022, p.4) With that in mind, this paper wishes to interrogate the benefits of arts in biodiversity education from a more holistic approach. STEAM as an area will be examined by viewing the effect of creative practices upon climate education, leaving space in the future for research into how climate education can affect creativity. Moreover, this paper will be looking at arts in biodiversity education; how it affects students' interest in their topics, how it affects their retention of knowledge, and how it affects their emotional wellbeing. By using a sample of classes from across Europe, this paper will discuss the power of STEAM education, and argue for further integration of arts into climate education, and climate science into arts education.

2. Literature Review

Much has been written about the introduction of arts into the traditionally identified STEM curricula, STEAM has made quite such a splash due, in part to the realisation that art has always played a role in science and STEM education. Art was a key method for representing the abstract and the tangible alike. In their article "Inquiry, Investigative Process, Art and Writing in STEAM," Stroud and Baines detail areas in which arts slot into the sciences in education specifically. One notable method is the 'interactive notebook,' where students not only take down class notes, but drawings, reflections, predictions, metaphors. (Stroud and Bains, p.10) The interactive notebook is in itself allegorical for the STEAM programme, giving equal space to both the sciences and the arts. By giving space for exploration, and allowing students to document failures along with successes, the journey of education can be followed. Furthermore, keeping notebooks such as this allows teachers a greater insight into their students' understanding. (Stroud and Bains, p.11) It is akin to 'showing your work' in mathematics, only it is showing one's reasoning, and following one's intuition to uncover the root of an inquiry.

As the climate crisis worsens, it is widely accepted that further education in this field is necessary. With such a threat entering every area of life, the luxury of ignoring it is no longer a realistic option. For this reason, education into biodiversity, among other aspects of the climate crisis, is necessary at all levels of schooling. In their article "Biodiversity Education: A Teacher's Perspective," Chris Gayford expounds upon the way that biodiversity was taught in schools; "often integrated into broader science or social science programmes that have a more cross-curricular nature," (Gayford. 2000, p.350) than as a direct science subject. This is partly due to the fact that, even at the turn of the century it was understood that for issues regarding biodiversity to be addressed, absolutely everybody must be on board. This paper also includes a study of science teachers' perspectives on biodiversity loss and biodiversity education. In this matter they found that most science teachers were knowledgeable on the topic, and believed that it is not sufficient to confine it to one area, but that biodiversity education should be integrated into the entire curriculum. (Gayford, p.356) Furthermore, they also found that although science teachers were expected to take the lead on biodiversity education, they "felt inadequately equipped particularly in terms of methodological expertise," (Gayford, p.358) when it came to the

non-scientific aspects of it. Biodiversity education is required, therefore, to simultaneously be holistic and encompass multiple avenues of inquiry and learning, while also falling primarily in the remit of science educators. This supports this paper's intention to create a methodology and lesson plan for educators to include arts in their teaching practices, and to offer them a mode of engaging with these nnon-scientific aspects of biodiversity education.

The need for biodiversity education is founded in the reality of climate change, and the relentless biodiversity loss of recent years. The dominant anthropocentric view of biodiversity looks at the threats to biodiversity in terms of its effect on humans. Our reliance on pollinators for over 75% of food crops, on healthy ecosystems to provide 75% of global freshwater resources, on over 50% of modern medicines still being derived from natural resources. (WHO, 2025) Despite this human centred position dominating headlines, several studies have indicated that when people experience climate anxiety it is not out of concern for the self, but for others and the environment. (Van Valkengoed et al., 2023, p.259) The relevance of this issue for this paper is that young people may be more likely than adults to experience climate anxiety. (Wu et al., 2024, p.435) Young people are worried about their futures, and many of the most direct effects of climate change on youth are already apparent. Rising sea levels, biodiversity loss, rising temperatures have all led to the fact that a young person today will have to cause 8 times less carbon emissions over their lifetime than their grandparents did, to restrict global warming to the 1.5°C cap set out by the Intergovernmental Panel on Climate Change in 2018. (Wu et al., p.435)

What then is to be done? If biodiversity and climate change need to be taught, but doing so can cause anxiety and stress among young people? Arts interventions are shown to be effective in combatting anxiety symptoms in young people and children as much as in adults. In a meta analysis of research on the effects of art therapy interventions on anxiety in children and adolescents, Zhang et al. found that art therapy has a significant role in reducing anxiety levels in youths. They identify two types of anxiety; state anxiety - which is context specific, arising due to a certain situation - and trait anxiety which is more related to an individual's predisposition towards anxiety. (Zhang et al., 2024, p.4) Art therapy "offers children and adolescents a safe and creative environment to articulate, comprehend, and regulate their emotions, bolstering their confidence and adaptability." (Zhang et al., p.7) It can have a calming effect, likened to methods such as meditation or breathwork, which can intercede with the feelings of Climate Anxiety as a form of 'state anxiety' before they fully take root. For this reason arts interventions in climate education offer a valuable benefit for the wellbeing of the students as well as in supporting learning outcomes.

3. Methodology

The initial step in writing this paper was deciding which type of arts practice would be both effective and scalable for different age groups. Poster-making workshops were chosen so as to best support the learning outcomes of the biodiversity classes, while offering the students a chance to take action and battle the feeling of hopelessness which can be associated with Climate Anxiety. (Ogunbode et al., 2022, p.258) Poster-making was also chosen due to the ease with which it can be scaled for different age groups, from kindergarten to young adults, without changing the topic of the posters. Finally, beyond the educational and climate

focused uses of poster-making workshops, there is also the creativity and art element. As mentioned above, art therapies can be used to effectively deal with the symptoms of state anxiety, and works equally for climate anxiety.

A lesson plan was designed for the poster-making class that could be scaled by the teachers depending on the age group of the students, the number of students, and the materials they wished to use. Sustainability in choice of materials was essential, in line with the ethics of the paper. Collage with recycled materials was suggested, but it was made clear to the teachers that they could use whatever art materials they already had in their schools. After the lesson plan was prepared it was shared with the teachers.

A feedback form was then created so that the teachers could report back their experiences and both quantitative and qualitative data could be gathered for this paper. The full detail of the questions on the feedback form is attached in **Appendix A** at the end of this paper. The questions were designed to understand how the classes on biodiversity were going before the poster workshop, and what effect the workshops had on the retention of information, the interest in the topics and how the students felt learning about biodiversity and climate change. The latter point is enquiring after that sense of climate anxiety mentioned earlier, and speaks to the use of arts practices for stress relief.

Meetings were set up with the teachers, to go through the lesson plan and feedback form, and to assuage any concerns they may have had, and answer any questions. These meetings took place online over three days, with between one and five teachers in each meeting. It was during these meetings that the true flexibility of this workshop became apparent, as teachers asked about whether they needed the posters to be in English or their own language, whether they could do them digitally, and if they could do the workshops with smaller groups such as with science clubs. In the interest of reaching as many students as possible, it was decided that the native tongue of each school could be used. Digital posters could be made so long as the students used their own research and design skills to make them.

The intention of this research paper was to reach schools around Europe in order to glean an understanding of environmental education on a large scale. Seeing as biodiversity is not contained within man-made borders, neither was this research. Teachers in 10 schools were reached out to in 5 different countries. Schools were of both primary and post-primary level, with some schools electing to partake in this project with full classes or with smaller groups such as science clubs or green schools committees. Each teacher reached between 10 and 30 students, with over 150 children and young people taking part in total.

4. Results and Discussion

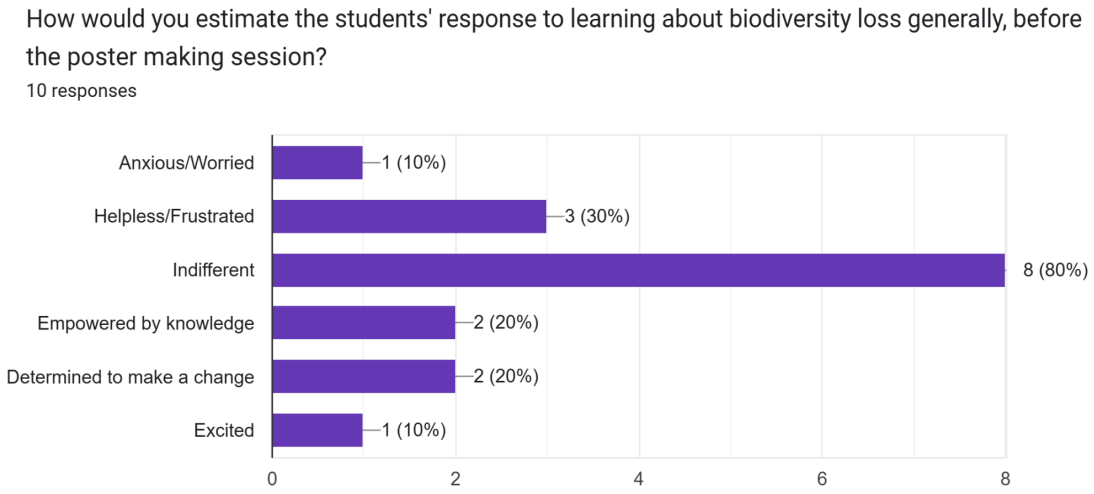

Fig.1 Students' response to learning about biodiversity.

Teachers were asked to consider the students' initial response to learning about biodiversity, before the poster workshop took place. The question was multiple choice with the option to select multiple if they believed that multiple were applicable to their class. This was aimed at inquiring after any element of climate anxiety present in the class. As displayed in Figure 1, indifference was by far the most prevalent feeling at this stage. When asked if this response changed after the workshop, 7 out of 10 teachers said *Yes*, with the ways in which they differed changing depending on the school. One teacher said that there was a "significant rise in people feeling frustrated" while another said;

> *While some students initially felt indifferent or passively informed, the creative process of designing posters allowed them to engage emotionally and intellectually with the issue of biodiversity loss. As they visualized the consequences and shared messages with their peers, many shifted towards feeling more responsible and motivated to take action.*

Two other teachers mentioned the effect that engaging actively had on the students, with one saying,

> *The students became more engaged because they were actively participating in the learning process. Creating the posters helped them understand the topic better and express their ideas in a creative way. It also encouraged teamwork and critical thinking, which made them more motivated and involved in class.*

Overall, the workshop seems to have encouraged a greater connection among students to their topics, deepening an empathy for environmental issues and engaging them more in the learning outcomes of their class on biodiversity. This is supported further by 90% of teachers agreeing that their students were excited about the poster making workshop, with the remaining teacher admitting that the interest varied depending on the student group but that "most of them were quite motivated. Similarly, when asked to rate their student's level of interest in their topics, there was a 50/50 split between those that voted for 'Very Interested' and those that voted for 'Interested' with none claiming any level of disinterest among their students.

The consensus among 100% of the teachers that the poster workshop helped the students retain the information on biodiversity is a great success for this research. It is unsurprising then that 90% of teachers will be using this

workshop format to creatively reinforce their lessons in the future. Although these findings are not unexpected, they do add to the chorus of research which is calling for creative practices to be included into education curricula.

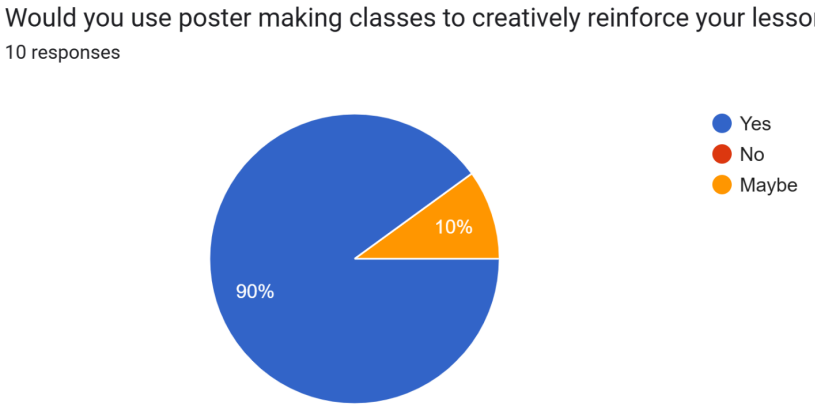

Fig. 2 Likelihood of teachers revisiting the poster-making method for future classes.

When asked how the students responded to having their posters shared around the school, an interesting pattern emerged. All eight teachers which responded to this question mentioned the students responding positively in this regard, with 5 out of 8 respondents mentioning the feeling of pride specifically. Students clearly felt like their work had an impact, and were happy with the outcomes of their projects. One teacher wrote of this

> *They felt proud and recognized for their work, which boosted their confidence and motivation. Seeing their posters displayed publicly gave them a sense of ownership and importance, making them more enthusiastic about participating in future activities. It also showed them that their voices and ideas matter.*

Another wrote "the students felt proud and excited to see their posters displayed. They felt their voices mattered and became more motivated to raise awareness. Some even showed interest in continuing similar projects." Both of these responses highlight another interesting theme; that making posters helped the students to feel like what they did *mattered*. Children can often feel a sense of helplessness, or - as this research has shown - indifference in the face of climate change and biodiversity loss. These are topics which are overwhelmingly large and require more work than any individual can solve. It is a great success of this research to see that the poster-making workshop has offered a partial solution to this problem.

5. Conclusion

For biodiversity loss to be combatted, everyone needs to be involved. The importance of biodiversity and healthy ecosystems seeps into every aspect of life, and for that reason we must include it in our school curricula. What this paper has shown is that learning about biodiversity in a traditional classroom setting can be met with apathy by students, while other studies have also shown that children and young people are more likely to experience symptoms of anxiety when faced with the realities of climate change and the enormous scale of damage already done. This paper has taken a more focused view on the issue, and the poster-making workshop has proven to offer an opportunity to face both of these issues.

Over the course of this research it has become clear that students engaged more with their topics when a creative element was included in the class. Teachers reported feelings of pride among their students, and noticed that they felt a greater sense of connection to their topics after completing the workshops. Students engage better with the topic when they can be actively involved with it, by using their hands and their creativity, making posters allows them to truly dive into the topics related to biodiversity. The impact of the workshops were clear to the teachers, whom all reported positive responses from the students, and have mostly agreed that they will be using this method to creatively reinforce their future lessons. Finally, another result of this workshop can be seen in **Appendix B,** where some of the students' posters have been shared, showing the care and effort gone into this research on the part of the participants.

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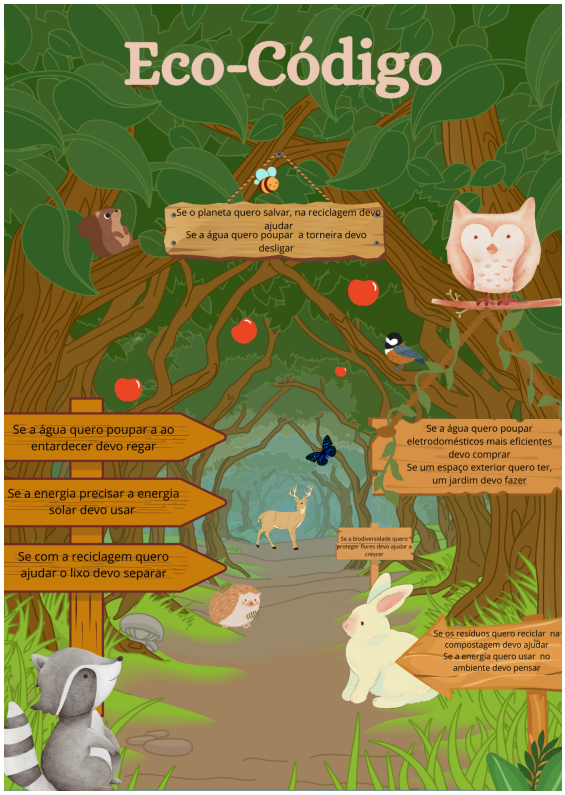
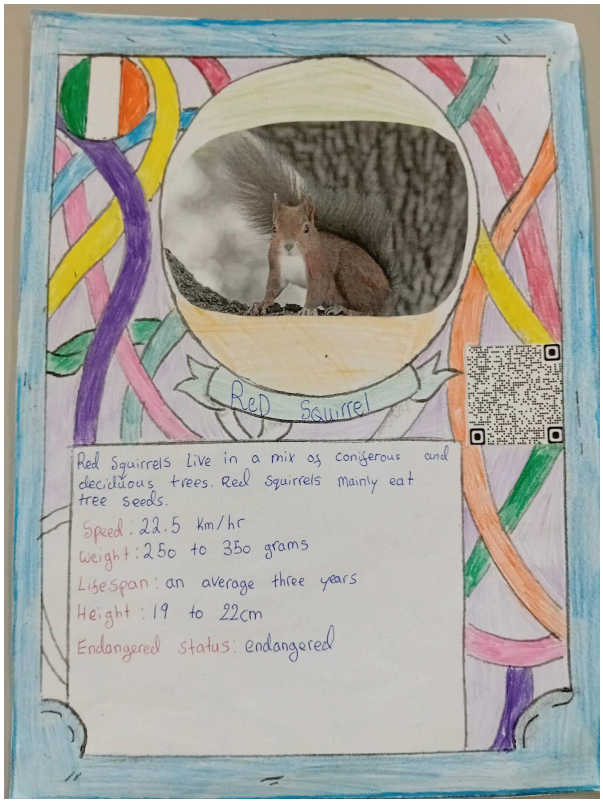
Appendix A - Poster Feedback Form

The following questions were asked as part of the poster workshop feedback form.

1. How would you estimate the students' response to learning about biodiversity loss generally, before the poster making session?
    a. Anxious/Worried
    b. Helpless/Frustrated
    c. Indifferent
    d. Empowered by knowledge
    e. Determined to make a change
    f. Other (please specify)
2. Do you think that this response changed after the poster making class?
3. Were the students excited by the poster making class?
4. How would you rate the student's level of interest in their poster topics? (from very uninterested to very interested)
5. Do you think that making posters affected their retention of information on the topic of biodiversity loss?
6. How did the students respond to having their posters shared around the school?
7. Would you use poster making classes to creatively reinforce your lessons in future?
8. Do you have any suggestions as to how to improve the poster making class to better engage the students and better achieve the learning outcomes?
9. Space to upload photographs of the posts.

Appendix B - A Selection of Posters





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