



Sustainability and Creativity: Growing Mindsets for a Greener Tomorrow through STEAM

Lisa Gjedde

Aalborg University, Dept. of Culture and Learning, Denmark

Abstract

The presentation explores R&D designs for fostering sustainability mindsets among youth through the integration of arts and science (STEAM) as a transformative approach in education and discusses the implications. By emphasizing the creation of learner-produced videos and animations, this study demonstrates how learners, through engagement with the arts and media, can catalyze environmental awareness and proactive attitudes toward sustainability. The research relies on the premise that creative expression and use of interactive media and games, may enhance understanding of complex STEAM concepts as well as encourage a deeper reflection on sustainability and environmental stewardship. The methodology utilized a mixed-methods approach, combining qualitative insights from student-led media projects with quantitative surveys. The study explored how the process of creating digital content—ranging from educational animations to documentary-style videos—may catalyze the integration of sustainable practices into daily life as well as a broader sustainability mindset, thus promoting a holistic understanding of STEAM subjects. Key preliminary findings suggest that learners who engage in arts and games develop a more nuanced understanding of sustainability issues, demonstrating increased empathy and a greater sense of agency in addressing environmental challenges. Moreover, the research also underscores the role of the arts in STEAM education as a vehicle for critical thinking and innovative problem-solving, enabling students to visualize and communicate complex ideas effectively.

In conclusion, this study contributes to the growing body of literature on the importance of interdisciplinary approaches to education. This also highlights the potential of STEAM as a pathway to cultivating sustainability mindsets. By integrating the arts and encouraging the production of learner-generated media as well as games, educators can unlock new avenues for engaging youth in meaningful discussions about sustainability, thereby paving the way for a more environmentally conscious and creative generation.

Keywords: Sustainability, media-production, creative learning, STEAM

Introduction

Considering the environmental crisis, there is a need to develop sustainability awareness rooted in an appreciation of and respect for nature and overcome what has been termed "nature deficit" [1], which refers to the lack of deep connection many children have with the natural world.

Creative learning designs that support students in developing a greater awareness of nature through affective and cognitive creative methods can be effectively integrated into a Science, Technology, Engineering

Arts, and Mathematics (STEAM) based curriculum. This approach may foster a mindset that is both aware of sustainability and motivated to solve the many sustainability-related problems we face today [2, 3].

This paper explores the intersection of creativity methods, sustainability, and STEAM education to suggest how learner-produced media and games can be utilized as tools for environmental awareness and action. The aim is to explore how creative expression can contribute to shaping sustainability mindsets among young individuals by drawing on findings from two recent studies. The studies utilized both qualitative data from student-led media projects and quantitative surveys.

Background



The need for creativity in STEAM education and sustainability education has been articulated clearly in recent research. Howe and Simm [4] describe how the arts and humanities might function in response to climate change, promoting creativity to foster empathy, envisioning alternative futures, and mobilizing collective action through creative expression. Such views complement UNESCO's [5] perception of education for sustainable development as a holistic endeavour that equally demands innovative and trans-disciplinary approaches.

Research has demonstrated how experiential, project-based learning fosters sustainability mindsets. Sipos et al. [6] found that engaging "head, hands, and heart" through real-world problem-solving cultivates systems thinking and pro-environmental behaviours. Likewise, studies show that media production and games promote sustainability literacy when integrated meaningfully [7, 8, 9]. By engaging multiple learning styles, these methods facilitate knowledge application and perspective-taking [7].

Regarding STEAM, Bequette and Brennan [10] highlight how art appreciation bolsters scientific literacy. Their work supports the idea that STEAM nurtures 21st-century competencies like collaboration, communication, and creativity [11]. Increasingly, scholars propose media-making and games as impactful STEAM approaches [12]. Kearney and Schuck [13] have found that digital storytelling empowered youth voices on sustainability.

Methodology

The empirical basis for this explorative project is two complementary studies that used creative methodologies in environmental education to strengthen nature awareness and sustainability mindsets. The first study is a pilot study aimed at understanding how new, arts-informed learning methods impact students' awareness of the environment and connection to nature. The second study is on creative media production, particularly animation, integrated into the different subject areas in the curriculum from classes in 28 schools across the same municipality.

Both studies employed a mixed-methods approach, combining qualitative insights from student-led media projects with quantitative surveys. Students were tasked with creating digital content, such as educational animations [14, 15] and documentary-style videos, on sustainability-related topics. Additionally, students engaged in activities like haiku writing and artwork creation based on their experiences in nature. Qualitative data was collected through observations, interviews, and reflections on the creative process, while quantitative data was obtained through surveys assessing the participating students' attitudes, knowledge, and behaviors. By triangulating these data sources within the two projects, the studies aimed to provide a comprehensive understanding of the learning designs that might engage youth's creative expressions and engagement with science and nature.

Preliminary Findings

The data demonstrated that students who engaged in arts-based activities had a nuanced understanding and empathetic approach towards sustainability issues and showed agency to address environmental problems. Digital content created by students on the topic of sustainability provided the opportunity to deal with complex concepts in an involving, creative way, which enabled them to gain understanding and foster deep reflection. The collaborative nature of the projects, called for peer learning and to collaborate, share ideas, viewpoints, and even innovate solutions to sustainability challenges.

The project on media-production integration in all subjects, focused on the integration of student creative media productions, especially animations. The findings indicate that creative media production can be integrated into STEAM subjects with increased student engagement, motivation, creativity, and deeper learning, depending on the teacher's background and the structural support from the schools. In-service qualifications of the teachers to acquire not only technical skills but also a mindset focused on supporting student creative processes were important for the successful implementation of the approach.

Methods to Enhance Nature Awareness

The nature awareness project involved several creative methods, such as haiku poetry, role-play, and video production, to promote environmental awareness to the students. For example, the students authored and illustrated haiku poems written while in the forest in contact with nature. In such an exercise, students could focus on being in nature and their personal experiences and connections



with nature. For example, one student commented, "It was easier to find inspiration in the forest because you could use the trees and everything around you."

Role-playing was another effective method used in the project. In one scenario titled "What Should Happen to the Marsh?", students assumed various roles such as municipal officials, landowners, and environmental activists to debate the future of a local natural area. This activity not only engaged students in the learning process but also helped them empathize with different perspectives. One student reflected on the affective engagement, "I started using my own feelings about nature in my role... It wasn't just what was written on the paper, but my own feelings."

Video production was used as a tool for research and creative expression. The students were tasked with simulating a television crew investigating an environmental problem at their local pond, conducting interviews, and presenting the case as a national news night program.

The combination of these methods not only enhanced students' understanding of sustainability but also promoted a sense of agency and responsibility toward environmental stewardship. These findings underscore the potential of arts-based approaches in STEAM education to cultivate sustainability mindsets among youth and empower them to become agents of change in their communities.

A Sustainability Mindset

The sustainability mindset is fostered by a sense of nature awareness which is a prerequisite to ensure that environmental challenges are adequately addressed. More than ecological knowledge, nature awareness is a deep, affective relationship with the natural world that can inspire and maintain sustainable practices and environmental stewardship [18, 19]. Nature awareness may help build the foundation of the sustainability mindset because it will make one be aware of the processes that goes on in nature. A further step that could be taken is of responsible behaviour and readiness to act toward the protection and preservation of natural resources. Thus, students in the nature awareness project connected on a personal note with nature through creative activities would be empathetic to environmental concerns and capable of taking the perspectives of others.

Being connected to nature and inspired by it can fuel the creative process which can be essential to developing innovative sustainable solutions.

It enables students, through creative reflection in nature, to come up with unique insights and approaches to solving environment-related problems. Arts integration in STEAM education promotes the process because there are various ways of expression and exploration. Creative activities that include writing haikus, role-playing, and video production regarding sustainability issues as material content make learning personified and, therefore, meaningful and powerful for students [16, 17]. When such creative products are made and shared within this context, students deepen their learning about environmental issues and may inspire others to take similar sustainability actions.

The integration of arts into STEAM education enhances this process by providing diverse means of expression and exploration. Artistic activities such as haiku writing, role-playing, and video production allow students to engage with sustainability issues on a personal and emotional level, making the learning experience more meaningful and impactful [16, 17]. As students create and share their work, they not only deepen their understanding of environmental issues but also inspire others to engage in sustainability efforts.

Conclusion

This study highlights the process of integrating arts into STEAM as a way of facilitating the development of a sustainability mindset for youth. By engaging students in creative expression through learner-produced media and games environmental awareness and proactive attitudes toward sustainability can be facilitated. The results indicate that arts-based methods can improve students' grasp of STEAM concepts and foster critical thinking, innovative problem-solving skills, and communication of complex ideas.

There is however a need for further research into how this arts-based STEAM education can profoundly impact students by introducing a mindset oriented toward sustainability



Using creative methods like digital storytelling, role-playing games, haiku, and animation in STEAM education has the potential to contribute to enhanced nature awareness and promote a mindset focused on sustainability. Through digital storytelling, students can engage with themes and problems that are relevant, explore their connections and implications, and envision solutions. The students' writing of stringent haiku poems showed that an aesthetic and poetic approach that is affective can help students connect deeply with the environment, fostering appreciation and care for nature. Incorporating sustainability principles into the creative process encourages students to consider environmental implications, cultivating a sustainability mindset [4].

Further research is needed to explore the long-term effects of arts-based STEAM education on students' mindsets and attitudes toward sustainability. The scalability and replicability of such approaches must be explored in diverse educational contexts and settings. However, this study offers indications of how interdisciplinary, arts-based teaching methods can provide an avenue to develop the sustainability mindsets that are required to tackle the urgent environmental issues we now face. Methods that can empower the next generation with creative confidence, critical thinking abilities, and a deep connection to nature are needed as well as educators that through creative learning designs can pave the way for a more environmentally conscious, innovative, and capable generation of problem-solvers and change-makers.

Acknowledgements

This research was made possible through the financial support provided by 15 Juni Fonden, we are deeply grateful for their commitment to fostering innovative approaches to learning and environmental stewardship. We also express sincere gratitude to the consultants, teachers and students who participated in this project, generously contributing their time, insights, and experiences.

REFERENCES

- [1] Louv, R., "Last child in the woods: Saving our children from nature-deficit disorder", Algonquin Books of Chapel Hill, 2008.
- [2] Chawla, L., "Learning to love the natural world enough to protect it", *Barn*, vol. 25, no. 1, pp. 57-78, 2009.
- [3] Sobel, D., "Place-based education: Connecting classrooms and communities", 2nd ed., The Orion Society, 2013.
- [4] Howe, S., Simm, J., "The arts and climate change: A call for mobilizing innovation", *Environment: Science and Policy for Sustainable Development*, vol. 62, no. 4, pp. 14-23, 2020.
- [5] UNESCO, "UNESCO roadmap for implementing the Global Action Programme on Education for Sustainable Development", UNESCO, 2014.
- [6] Sipos, Y., Battisti, B., Grimm, K., "Achieving transformative sustainability learning: Engaging head, hands and heart", *International Journal of Sustainability in Higher Education*, vol. 9, no. 1, pp. 68-86, 2008.
- [7] Dezuanni, M., "The building blocks of digital media literacy: Socio-material participation and the production of media knowledge", *Journal of Curriculum Studies*, vol. 47, no. 3, pp. 416-439, 2015.
- [8] McKeown-Ice, R., "Environmental education in the United States: A survey of preservice teacher education programs", *The Journal of Environmental Education*, vol. 32, no. 1, pp. 4-11, 2000.
- [9] Meadows, D. H., "Leverage points: Places to intervene in a system", Sustainability Institute, 1999.
- [10] Bequette, J. W., Brennan, C., "Advancing media arts education in visual arts classrooms: Addressing policy ambiguities and gaps in art teacher preparation", *Studies in Art Education*, vol. 49, no. 4, pp. 328-342, 2008.
- [11] Bellance & Brandt, Bellance, J, Brandt. R. (eds) 21st Century Skills: Rethinking How Students Learn .Leading Edge 2010;
- [12] Hogan, K., "A sociocultural analysis of school and community settings as sites for developing environmental practitioners", *Environmental Education Research*, vol. 8, no. 4, pp. 413-437, 2002.
- [13] Kearney, M., Schuck, S., "Spotlight on authentic learning: Student developed digital video projects", *Australasian Journal of Educational Technology*, vol. 22, no. 2, pp. 189-208, 2006.
- [14] Gjedde, L., Hecht, J., "Animated Learning: Kreative produktionsorienterede læringsfællesskaber som katalysator for udvikling af kompetencer til det 21. århundrede", 2018.



- [15] Gjedde, L., Hecht, J., Pedersen, H., "Kreativ læring med levende billeder: Potentialer, udfordringer og anbefalinger for produktionsorienteret læring", Recreate, Aalborg Universitet, 2018.
- [16] Inwood, H. J., "At the crossroads: Situating place-based art education", Canadian Journal of Environmental Education, vol. 13, no. 1, pp. 29-41, 2008.
- [17] Jakobson, B., Wickman, P.-O., "What difference does art make in science? A comparative study of meaning-making at elementary school", Interchange, vol. 46, no. 4, pp. 323-343, 2015.
- [18] Lumber, R., Richardson, M., Sheffield, D., "Beyond knowing nature: Contact, emotion, compassion, meaning, and beauty are pathways to nature connection", PloS One, vol. 12, no. 5, e0177186, 2017.
- [19] Zylstra, M. J., Knight, A. T., Esler, K. J., Le Grange, L. L., "Connectedness as a core conservation concern: An interdisciplinary review of theory and a call for practice", Springer Science Reviews, vol. 2, no. 1, pp. 119, 2014.
- .