



Editorial: Innovative Approaches to Learning in Environmental Science

Hans Uwe Dahms^{1*}, Tarla Rai Peterson² and Philippe C. Baveye³

¹ Kaohsiung Medical University, Kaohsiung, Taiwan, ² The University of Texas at El Paso, El Paso, TX, United States,

³ AgroParisTech Institut des Sciences et Industries du Vivant et de l'Environnement, Paris, France

Keywords: innovative teaching, hands-on, social learning, activity teaching, scoring

Editorial on the Research Topic

Innovative Approaches to Learning in Environmental Science

Over the last two decades, the context in which educational programs in environmental science are offered to students, at all levels, has changed tremendously. The advent of internet has made readily available to educators and students a wealth of information that until then had been far more difficult to obtain. At the same time, pervasive environmental change has made it increasingly likely that graduates of environmental science programs will change jobs, or at least reorient their activities, several times during the 40 or so years that their careers will probably last. This periodic re-careering, along with the fact that the knowledge students are imparted with during their training will likely become outdated, if not entirely obsolete, far quicker than used to be the case, make it mandatory for individuals in the field to be able to constantly update their knowledge base and skills.

This rapidly changing context of environmental education challenges teachers in profound ways. Long gone are the days when it made sense to require students to try to memorize massive amounts of information covered in formal lectures. It is far more meaningful for students to learn how to discriminate, among all the information that is accessible to them within seconds on internet, the bits that are both sufficiently reliable and ultimately useful to them. Since the ability to learn new material and acquire new skills, most often via self-directed learning, will in all likelihood be the key to success in years to come, we need to actively prepare students for these activities, instead of asking them to regurgitate passively-assimilated content.

This imperative to basically rethink entirely how environmental education is conceived is a tremendous challenge to educators all over the world. Some of them have come up in recent years with very innovative ways to foster student learning. One of the best known methods, generally referred to as problem-based learning, puts students in the driver's seat, as it were, and requires them, in teams, to analyse a concrete problem and trace their way backward to the fundamental principles needed to understand and resolve it. Other innovative approaches encompass, e.g., discovery-based learning, case-based learning, tutorials to promote self-directed learning, and the development of dynamic learning portfolios where individuals document the status of their knowledge and skills in real time.

In this context, the objective behind this Research Topic (RT) shared by *Frontiers in Environmental Science*, *Frontiers in Communication*, and *Frontiers in Education*, was to give a chance to instructors who in recent years have tried to innovate in their teaching, to share experiences in successful implementations but also exploratory trials. As a result, the articles collected within this RT explore innovation in environmental education (EE) from a broad range of perspectives.

OPEN ACCESS

Edited and reviewed by:

Lu-Jun Li,
Northeast Institute of Geography and
Agroecology, Chinese Academy of
Sciences, China

*Correspondence:

Hans Uwe Dahms
hudahms11@gmail.com

Specialty section:

This article was submitted to
Soil Processes,
a section of the journal
Frontiers in Environmental Science

Received: 30 June 2020

Accepted: 06 July 2020

Published: 11 August 2020

Citation:

Dahms HU, Peterson TR and
Baveye PC (2020) Editorial: Innovative
Approaches to Learning in
Environmental Science.
Front. Environ. Sci. 8:121.
doi: 10.3389/fenvs.2020.00121

Amador demonstrates that active learning can constitute the basis for the comprehension of soil science at the university level. His analysis is motivated by the increasingly prevalent awareness that traditional, passive approaches to teaching, such as lectures, are relatively ineffective at motivating student learning. This weakness has been particularly noted when it comes to developing qualities that employers seek in graduates from soil science programs, such as problem-solving and practical sustainable solutions. Stevenson et al. focus on the K-12 level, and respond directly to the lack of direct links between EE and traditional academic outcomes such as standardized testing, a claim often used to justify minimal or no allocation of time and other educational resources to EE. Their proposal that environmental educators should “celebrate” this absence offers a potentially radical solution to the challenge of integrating EE into already overcrowded curricula. Their data provide powerful evidence supporting the argument that a null effects framework has the potential to achieve contemporary EE goals while supporting integration of EE into schools. Andrews et al. use experiential learning about soil and water iron microbes to show that environmental sciences provide a relatively unexploited forum for innovative teaching methods in secondary education. This holds particularly for macroscopically observable components, creating many opportunities to link classroom lessons and the environment. Since environmental management decisions increasingly rely on progressively complex quantitative ecological models, Herman et al. use interactive workshops and hands-on-learning to demystify ecological models through interactive workshops and individual problem-solving to increase public awareness of potential outcomes of management actions. Collaborative modeling and social learning in the context of joint forest management in India lead Banerjee et al. to address challenges arising when traditional forms of public participation are either unavailable or inappropriate for a particular audience. They describe how using a systemic approach to both EE and environmental management enables them to shift a potentially hostile situation to an opportunity for joint learning that is implemented beyond the traditional learning background at schools. They argue that providing non-threatening opportunities for residents and professional environmental managers to learn from each other has strong potential for joint problem solving that contributes to sustainable solutions. Finally, in an opinion piece, Baveye analyses two examples of experiential learning that were particularly important in his own education, and argues that an effective way to allow students to benefit from the same type of experience is to first modify the training of student teachers, who then later, when

they start working, can bring about change in their classroom, at any level.

This RT comprises a total of 6 contributions (5 research articles and 1 opinion). One, relatively defeatist, way to look at this total is that it is very modest, given the magnitude of the reforms that are needed if we want the educational system to successfully address the enormous environmental challenges the world is facing. One possible explanation for the low turnout is related to the fact that, in most countries, funding opportunities for projects focused on improving educational offerings are hard to come by when they exist at all. In the absence of the type of serious funding needed to conduct surveys or interviews of test subjects, and to analyze the resulting data using robust statistical techniques, as is demanded typically for research articles, researchers have to make do with shoestring budgets, and with voicing qualitative impressions. Publications that result from these efforts in general do not meet the standards of international research journals, and often end up in fourth-tier, regional journals. A case in point is the recent string of articles published in French by French and Canadian soil scientists in the French journal *Étude et Gestion des Sols* (Aran et al., 2019; Richer-de-Forges et al., 2019; Crespin et al., 2020; Dulaurent et al., 2020). These articles are very interesting, and their publication in French makes their content more readily available to teachers, which is undoubtedly a good thing. But it also means that researchers in non-French-speaking countries are likely to miss out on the experience of their French colleagues, which is regrettable.

From a more upbeat viewpoint, the 6 contributions of this RT evince a significant array of innovative attempts related to learning in environmental sciences. Their educational contexts range from institutionalized educational programs to non-traditional learning environments, as well as covering both commonly researched settings in Western Europe and North America and the less frequently studied Global South. Some offer suggestions for, and even demonstrate, ways of, assessing the long-term impact of innovative environmental science program offerings. Taken together, the articles provide critical reviews of a significant portion of the relevant literature and perspectives ranging from ones already implemented in multiple contexts, to those still on the anvil of maturation.

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

REFERENCES

- Aran, D., and Maunoury-Danger, F. (2019). Un voyage à travers le sol: Récit d'une animation destinée à faire découvrir la pédologie aux scolaires et au grand public. *Étude Gestion Sols* 26, 163–173.
- Crespin, P., Pérès, J., Sinagra, J.-P., Lacassin, J.-C., Blanchart, E., Chevallier, T., et al. (2020). Une exposition sur le Sol à Alès (2018-2019) pour les jeunes et le grand public: faire du jeune avec du vieux, de l'imagination et de la passion. *Étude Gestion Sols* 27, 23–34.
- Dulaurent, A.-M., and Houben, D. (2020). Sensibiliser les jeunes au sol à l'aide de la démarche scientifique: retour d'expérience d'un atelier conduit dans le cadre de la Fête de la Science. *Étude Gestion Sols* 27, 9–22.
- Richer-de-Forges, A. C., Courtemanche, P., Bertel, O., Ortega, C., Arrouays, D., Bispo, A., et al. (2019). Une boîte de sensation tactile des sols à huit

compartiments pour une découverte par le grand public et les enfants. *Étude Gestion Sols* 26, 133–142.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Copyright © 2020 Dahms, Peterson and Baveye. This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.