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Connection to nature for sustainable development at universities—What should be done?

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Universities and institutions of higher education play an important role in today's society. They educate the next generation of decision-makers and therefore have a great influence on the decisions made in society. In today's world, where many people's livelihoods are threatened by environmental issues, it is not only necessary for universities to operate sustainably, but also to motivate students to adopt more sustainable behaviors. We believe that promoting a connection to nature is an important starting point for this, as it is a key influencing factor for sustainable behavior. Due to decreasing contact with nature and increasing urbanization worldwide, connection to nature is currently in decline. In this perspective, we propose six starting points that can help increase the connection to nature of university students: (1) Bringing students to nature, (2) bringing nature to students, (3) environmental education, (4) virtual nature contact, (5) incorporating other human-nature relationships and concepts (6) combining 1–5. For each point, we explain possible recommendations for university decision-makers.

KEYWORDS

connection to nature, university students, environmental education, virtual nature contact, human-nature relationship

1. Introduction

Universities have played an important role in society for centuries, educating intellectual, military, clerical, and other elites of society. In doing so, universities have combined research and teaching since the Middle Ages and evolved into flexible institutions that could adapt to almost any political situation and social form (Perkin, 2007). To this day, universities worldwide continue to play an important role in educating the next generation of future leaders (Alshuwaikhat and Abubakar, 2008; Bellou et al., 2017), entrepreneurs (Lozano et al., 2013), professionals (Kioupi and Voulvoulis, 2020) and intellectuals in the social, political, economic and academic fields (Lozano, 2006). Although prominent positions in society can be reached without a university education, a university education improves the chances of attaining such an important role by providing knowledge and skills (Vicente-Molina et al., 2013).

In the current context of economic, environmental, and social problems worldwide, universities have an increasing responsibility not only to become more sustainable themselves, but also to focus their education on sustainability (Cortese and Hattan, 2010; Zamora-Polo and Sánchez-Martín, 2019). Therefore, in recent years there has been a clear shift in lectures and courses on sustainability (O'Byrne et al., 2015; Rodríguez-García et al., 2019). The Sustainable Development Goals are considered to be very important among students worldwide (Kleespies and Dierkes, 2022). In this context, the UNESCO has

published a guide that explains and describes learning objectives for each of the Sustainable Development Goals (UNESCO, 2017). Among the Socio-emotional learning objectives for SDG 15 “Life on Land”, the connection of humans with nature is highlighted and suggested as a topic.

Due to the fundamental importance of human-nature connections, the topic is being studied in different scientific disciplines and the number of publications on the topic is increasing year by year (Ives et al., 2017). One consequence of this, however, is that there is now a whole range of different conceptualizations of connection to nature (Ives et al., 2018). However, the different conceptualizations and constructs generally overlap and address the same underlying construct (Brügger et al., 2011; Tam, 2013). Since this perspective emphasizes the role of universities, it is essential to expand the definition of connection to nature to include not only the personal but also the societal level. Universities, as social institutions have the capacity to shape individual identities and play a crucial role in fostering connections to nature at both the individual and social level. Therefore, this perspective advocates for the identification of opportunities to strengthen the connection to nature not only on an individual basis but also on the institutional and political dimension (Beery et al., 2023).

In our opinion, the connection to nature of humans is a particularly important factor of sustainability, which should be additionally promoted especially in higher educational institutions. People with a stronger connection to nature are more motivated to protect nature and are more likely to engage in environmentally friendly behaviors (Mayer and Frantz, 2004; Nisbet et al., 2009; Cheng and Monroe, 2012). Personal health also benefits from an improved connection to nature: for example, people with a stronger connection to nature report greater satisfaction with life and an increased sense of wellbeing (Mayer et al., 2009; Cervinka et al., 2012; Zelenski and Nisbet, 2014). Just 120 min a week in nature is enough to achieve positive health effects (White et al., 2019). Natural environments have significant positive impacts on human wellbeing and nature-related outcomes (Silva et al., 2023). Some scientists go even further and see the current loss of the connection to nature as a major driver of today’s environmental problems (Jordan, 2009).

At universities, where the focus is often on teaching skills and knowledge, the promotion of the connection to nature would be particularly worthwhile. University students are a group often studied in environmental psychology, partly because of their described social importance and partly because the group is easy to reach for many researchers. However, when investigating connection to nature, other groups are often studied, especially school children. For this reason, a synthesis of the findings is missing until now, which outlines actions that can be taken at universities to improve the connection to nature of students there. Therefore, in this perspective, we want to discuss suggestions that can help educators and policy makers in universities globally to implement measures to increase the connection to nature of their students. Especially for students in the field of nature and the environment, who are likely to deal with environmental issues later on, strengthening the connection to nature would be an extremely useful addition to the curriculum.

2. Strengthening the connection to nature of students, but how?—Recommendations for action for current politicians and decision-makers at universities

The literature identifies a number of positive parameters for strengthening the connection to nature (Chawla, 2020). We believe that six factors are particularly important and their practical implementation in universities can help to improve the connection to nature of students worldwide.

2.1. Bringing students to nature—Spending time in nature

The first very important factor is the amount of time a person spends in nature: There is considerable evidence for the strong positive relationship between the time a person spends in nature and their relationship with nature (Kals et al., 1999; Lengieza and Swim, 2021). Studies suggest that even simple actions can have a positive effect on the connection to nature. For example, a short walk in the woods for about 30 min a day (Chou and Hung, 2021) or a walk by some water body (Nisbet and Zelenski, 2011) can improve students’ connection to nature. Even simple actions such as visiting a park or zoo can have a positive effect and can be a starting point for further activities in nature (Schultz and Tabanico, 2007; Mayer et al., 2009; Kleespies et al., 2020). While it is debatable whether such an artificially created natural environment should be seen as nature, there is evidence that even a walk through an animal park or on a hiking trail can have a positive impact on the connection to nature (Schultz and Tabanico, 2007). In addition to these more passive impressions of nature, more active experiences of nature can also influence the relationship with nature. For example, walking around and exploring a forest can help increase connection to nature (Cervinka et al., 2020). Actively engaging with the beauty of nature, the feelings about nature, or the importance of nature can also have a positive impact on connection to nature (Lumber et al., 2017). Whether active or passive engagement with nature is better at increasing the connection to nature has not yet been proven (Sheffield et al., 2022).

Universities can take a number of steps to get students out in nature. For majors with an environmental focus, there is the option of incorporating outdoor activities in nature into the curriculum. These could include field trips to special nature sites, such as national parks, biotopes, or local ecosystems. These do not have to be expensive excursions or study tours, but the nature available in the surroundings of the university can be used. This makes this suggestion feasible for universities worldwide, even if they have limited financial resources, to improve students’ connection to nature. Within the framework of these events, the focus could be on providing students with (active and passive) experiences of nature, in addition to teaching them the subject-specific content. In this way, nature could be made accessible and tangible for university students. In majors of study in which such an integration in the curriculum is not applicable from the content point of view,

interdisciplinary or extracurricular events could be offered. These include, for example, sports courses that take place outdoors in nature. Courses offering meditations in nature at universities have also been shown to increase connection to nature (Unsworth et al., 2016; Deringer et al., 2020). Such activities can increase not only students' connection to nature but also their health (Rogerson et al., 2020). Many universities already offer such recreational programs, the focus of which could be changed to nature, thus aiming at a significant increase in connection to nature. It could also be made easier to visit natural places that have been shown to have a positive effect on connection to nature. For example, free or discounted tickets for students to visit a botanical or zoological garden could be offered as a semester ticket. In this way, students who do not usually have the opportunity to visit such places could be included.

In implementing these strategies, universities should also consider the diversity of their students and aim to create inclusive nature experiences. Providing opportunities for students with different levels of mobility, cultural backgrounds, and interests can ensure that the benefits of connection to nature are accessible to all. In addition, ongoing evaluation and feedback mechanisms should be established to assess the effectiveness of these initiatives in fostering students' connection to nature. Regular surveys and qualitative interviews with students can provide valuable insights for refining and optimizing these measures.

2.2. Bringing nature to the students—University green spaces as an opportunity

Global urbanization in particular, which has increased significantly in recent decades (Ritchie and Roser, 2018), is leading to a steady decline in opportunities to interact with nature (Soga and Gaston, 2016). As a result, a clear trend can be observed worldwide: People, especially children and young adults, are spending more time away from nature (Wen et al., 2009; Bassett et al., 2015; Khajehzadeh and Vale, 2017; Wilkie et al., 2018). One reason for the declining connection to nature, especially in urban areas, is the lack of opportunities to have contact with nature (Soga and Gaston, 2016).

Campus green spaces are recognized as an important element of urban greening and can provide benefits to students [e.g., improved wellbeing or academic outcomes (van den Bogerd et al., 2020)], but have received little attention so far (Li et al., 2019). A nature-based campus design that utilizes green spaces with trees, meadows, or ponds could invite students to spend time outdoors in nature between lectures and seminars and foster a connection to nature and place attachment through this contact with the natural environment (Raymond et al., 2010; Barragan-Jason et al., 2022). Seating areas in these nature sites could invite people to spend time in nature and do not have to be elaborately designed at all. However, the effectiveness of such seating in promoting connection to nature can vary depending on the design and location. Bringing nature into the classroom has also emerged as a way to strengthen the relationship with nature (McCullough et al., 2018). Furthermore, green outdoor classrooms can be established for flexible use in university courses. Especially in countries with a high rate of urbanization, such

an approach would be particularly beneficial and could bring positive effects for university students. Students could maintain these green spaces and contribute to their preservation as part of their courses or voluntary work. The quality of green space is also an important factor in this context, as higher quality leads to a stronger connection to nature (Wyles et al., 2019). However, the practical implementation of such concepts may face barriers and challenges, such as limited available space on university campuses or financial constraints. It is essential to address these challenges and consider alternative strategies to achieve similar benefits, such as creative repurposing of existing space or partnering with external organizations to secure additional resources. These options can help policymakers and higher education administrators who want to foster stronger connections between students and nature to implement such projects.

In this context, it would also be possible to make students aware of the nature that already exists around them. Nature is a part of our daily surroundings in the city, but is often not recognized. For example, signs at small urban meadows pointing out biodiversity in the city or more active awareness campaigns involving environmental students in university courses could be used to draw the attention of all residents to nature. In the context of these teaching opportunities, intensive contact and active engagement with nature could help strengthen the connection to nature (Richardson et al., 2022).

2.3. Environmental education—Teaching about the environment

Besides spending time in nature, environmental education programs and education for sustainable development are also a way to improve connection to nature (Barrable and Booth, 2020). Numerous studies have provided evidence of the positive effect of a wide variety of environmental education on connection to nature. For example, it has been shown that a project day consisting of indoor and outdoor learning can have a positive effect on the connection to nature (Kossack and Bogner, 2012). More extensive field trips lasting several days, for example to a water field center (Liefländer et al., 2013) or trekking in the rainforest with experts (Braun and Dierkes, 2017) have also been shown to increase connection to nature. However, less time-consuming programs, such as a 1-h zoo tour (Kleespies et al., 2020) or an environmental education module in a local garden (Sellmann and Bogner, 2013), can also improve the connection to nature. Outdoor play and enjoyment of nature have also been shown to be effective ways to strengthen connections to nature (Collado et al., 2013; Mullenbach et al., 2019). Control group studies were also able to show that environmental education in the classroom can also increase connection to nature (Kossack and Bogner, 2012; Braun and Dierkes, 2017). Although environmental education programs have shown positive effects on connection to nature, it is important to consider potential limitations and identify areas where further research is required. For example, future research could particularly examine how to increase connection to nature in a long-term.

Although environmental education and education for sustainable development already exist at universities further

emphasis could be placed on teaching in this area. Where possible, environmental education programs could be more integrated into existing curricula or special seminars on various nature-related topics could be offered. Such measures that could be embedded in the curriculum are, for example, the use of an outdoor classroom in a Biosphere Reserve (Beery and Magntorn, 2021) or field trips that include nature experiences and activities (Baird et al., 2022). Workshops in special nature areas could also be introduced as components in the curriculum (Pirchio et al., 2021).

Areas of study in which environmental education is not a focus could still establish a link to environmental education. For example, economics courses could have a further focus on environmental problems, or other programs could offer thematic excursions on the subject. Special environmental education workshops could also be created and promoted in this context. To make these modules more attractive to students, the possibility of receiving a certificate or credit points for participation could be created. University campaigns dedicated to environmental education and awareness of environmental issues would also be a good option. For example, campaigns such as “Our Campus Becomes More Sustainable” or “Car-Free Campus” would be possible, educating about sustainable development and implementing these measures with students. Such campaigns in particular allow peer groups to work together in a targeted manner. This point, finding peer support and building community with others in an environmental education context, is also highlighted as a key element by Pihkala (2020).

Past studies have shown that people with a low connection to nature particularly benefit from environmental education programs (Braun and Dierkes, 2017; Kleespies et al., 2020). Therefore, it would be desirable to motivate especially students, who normally have less contact with nature, for such environmental education programs. To achieve this, universities could consider incorporating environmental education modules into required courses, ensuring that a broader spectrum of students can benefit from these programs. Smaller seminars with a special focus on education for sustainable development probably only cover students who are already interested. In addition, it is now also known that more intense experiences in nature often lead to longer-lasting improvements in connection to nature (Braun and Dierkes, 2017). In addition, universities can partner with local schools, community centers, or organizations to extend the reach of their environmental education initiatives beyond their campuses.

2.4. Virtual nature contact—Technology as a tool to connect students with nature

While direct contact with nature has been documented as an important positive factor influencing the connection to nature, in contrast, the use of electronic devices is often seen as a reason for the decline of connection to nature (Schultz, 2002; Larson et al., 2019; Michaelson et al., 2020). More recently, however, there has been a growing interest in using technology to promote a connection to nature. The idea that technology can be used to simulate the natural environment is not new at all. Already in Kahn et al. (2009) described a technological nature in which technology simulates, complements, or mediates the natural world.

The influence of documentaries or videos of nature on environmental behavior and connection to nature has been studied several times (e.g., Bagust, 2008; Zelenski et al., 2015; Arendt and Matthes, 2016; Klein and Hilbig, 2018). For example, Mayer et al. (2009) demonstrated that watching nature videos can have a positive effect on connection to nature, even if the effect was smaller than that of a “real” nature visit. Especially in recent years, different studies on virtual reality and 360-degree videos show that such virtual nature experiences can also improve the connection to nature (Chan et al., 2021). However, studies are mixed on whether such nature visits with virtual reality glasses are more effective than a similar experience on a computer monitor (Ahn et al., 2016; Soliman et al., 2017; Breves and Heber, 2020; Yeo et al., 2020). Despite the potential benefits of using technology to promote connection to nature, it is important to recognize the limitations of virtual experiences, as the effects are often not comparable to those found in real nature (Mayer et al., 2009; Sneed et al., 2021).

Nevertheless, the use of technology can be seen as another useful way to increase students’ connection to nature. The advantage of such technical nature experiences (e.g., through films or pictures) is that the application is very simple, spontaneous and possible without much effort. Thus, in seminars or lectures, the insertion of environmental topics could be carried out with the use of suitable materials. Courses with a more technical focus could relate these new techniques to environmental examples and thus integrate suitable learning content into the teaching. Such new technologies are also often motivating for students, which is another point for their use. Similar to environmental education, suitable focus seminars could be offered in which new technology is used in relation to nature. In addition, (mobile) applications such as iNaturalist can be used in courses and teaching formats to trigger interest in nature and thus increase the connection to nature (Altrudi, 2021). The benefits of using VR and technology in teaching are well-known (Kesim and Ozarslan, 2012; Kamarainen et al., 2013) and with the use of the right nature-related materials, increasing connection to nature could be another point in favor of their use. In this context, technology can also be seen as a tool for inclusion. People who cannot visit special natural places for various reasons are thus offered the opportunity to participate (although indirectly).

2.5. Multidimensional view—Incorporating other human-nature relationships and concepts

In the points discussed so far, the focus has been primarily on the traditional connection to nature, which is about a person’s personal relationship with nature. Meanwhile, there are other human-nature concepts that involve more than just the personal relationship with nature. One particularly promising construct in this context are relational values (RVs). In addition to a personal connection to nature (Britto dos Santos and Gould, 2018; Kleespies and Dierkes, 2020a), RVs include any kind of relationship between people that involves nature. In this context, nature can be perceived as a connector between people (Chan et al., 2016). RVs also include moral values, e.g., what a person considers to

be the morally right way to interact with nature, and eudaemonic values, e.g., values associated with a good and meaningful life (Chan et al., 2018). RVs therefore form a third category of values, along with intrinsic values (Sandler, 2012) and instrumental values (Tallis and Lubchenco, 2014), on the basis of which people make decisions related to nature. RVs are also a key factor influencing environmental behavior (van den Born et al., 2018; Topp et al., 2022) and a main driver and crucial motivator for conservation actions (Knippenberg et al., 2018; Mattijssen et al., 2020).

Similar to other human-nature relationships, RVs can also be improved through time in nature (van den Born et al., 2018). New research found a positive effect of environmental education included restoring a local ecosystem, actively experiencing local culture, and learning from people of local culture on RVs (Uehara et al., 2020). Traditional environmental education that addresses elements such as care, stewardship, or kinship is also a way to improve a person's RVs (Britto dos Santos and Gould, 2018). Collaboration with local community members can be promising for promoting RVs (Uehara et al., 2019). But projects with other cultures to understand their perceptions of nature could also be beneficial. Participation in restoration and conservation activities in the local area can also potentially be a way to strengthen "cultures of nature" (Chan et al., 2016).

Other concepts of nature, such as the indigenous peoples' concepts of nature (Hill et al., 2020) could be better integrated into university teaching. Central concepts, which include for example nature's contributions to people (Díaz et al., 2018; Brauman et al., 2020) or socio-eco-evolutionary dynamics in cities (Keeler et al., 2019; Des Roches et al., 2021), can be considered in own student projects in urban spaces. This could likely increase knowledge not only about these environmental issues, but also about different kinds of human-nature relationships. Existing university courses could therefore incorporate elements to enhance these different kinds of human-nature relationships and include participation in such programs as a curricular course. To this end, universities worldwide could establish contact with local communities and environmental conservation organizations and together offer programs for students with the goal of restoring local nature and improving the connection to nature. In particular, this transdisciplinary approach and the relationship of local groups to their natural environment could be the focus of these programs. Cooperation between universities with different cultural backgrounds or different world regions would also be a good way for students to actively exchange ideas with each other. Through such an active exchange, an increase in the perception of nature and connection to nature is also possible.

2.6. Bringing (1)–(5) together

The points described above can all make an important contribution to strengthening the connection to nature of students at universities. However, it is particularly important that none of the measures mentioned should and can stand alone. Instead, the individual aspects (1)–(5) should be closely interconnected in their application, thus strengthening the effects of the individual measures and creating synergies (Figure 1). For

example: Environmental education can take place outside and nature experiences can include environmental education. Projects with local communities can have an environmental education focus. New technology can be combined with environmental education or primary nature experiences. Interdisciplinary or transdisciplinary courses are good opportunities to bring together the expertise and emphases of different disciplines on nature and thus strengthen the connection to nature of the participants. A good way would be to integrate time spent in nature as part of university classes on environmental topics. Seminars and courses could be combined with active experiences in nature to strengthen the relationship with nature. Instead of the abstract description of environmental problems in seminars, the environmental problems caused by humans could be demonstrated in modern learning formats directly on-site in nature using local examples. For instance, a simple starting point for this could be field trips with a focus on environmental education (Kleespies and Dierkes, 2020b).

3. Global perspective in the implementation of the suggestions

In all suggestions, it must be kept in mind that universities around the world have very different prerequisites for implementation. They differ in terms of local conditions, their size and number of students, their focus of content, their subjects of study, their financial possibilities, their cultural and religious background, their anchoring in society, and their proximity to natural areas. For example, universities in a highly urbanized city have different conditions than a university in a rural area. Also, the baseline connection to nature of their students differs (Kleespies and Dierkes, 2023). Therefore, each educational institution must consider for itself which measures seem appropriate at the moment and can be implemented. As a possible support for this, a greater exchange between the universities of different cultural regions would be desirable. For example, material, concepts and experiences could be exchanged to enable students to have new (nature) experiences and thus increase the connection to nature.

In addition, universities around the world are challenged to break down institutional barriers that contribute to a decline in connection to nature. These include discrimination or institutional structures that reproduce inequalities and thus block access to nature experiences. Physical, psychosocial, structural or legal barriers that limit opportunities to experience nature should also be removed worldwide (Beery et al., 2023). In this way, universities can use their institutional influence to improve students' connection to nature.

4. Conclusion

People's connection to nature is an important factor that has a direct influence on health and environmental behavior. In the present time, where people spend more and more time separated from nature on the one hand and environmental problems increase massively on the other hand, the promotion



FIGURE 1

Example of an integrative environmental education concept at universities. The establishment of a science garden on the university campus offers the possibility to use this area for outdoor education programs and to bring students closer to nature. Here students have the opportunity to experience learning content in direct contact with nature. Courses can include the determination of biodiversity with mobile applications, the cultivation of organic products and practical implementation of these activities with the peer group, show links with the sustainable development goals, integrate non-university experts in a transdisciplinary context (e.g., beekeepers regarding honey production).

of connection to nature can make an important contribution to the sustainable development of society. Especially at universities and higher educational institutions, where the focus is normally on teaching skills and specialist knowledge, the systematic promotion of a connection to nature is an important starting point.

We propose to implement measures at universities that can help to promote the connection to nature of students and therefore the next generation of decision-makers. The six points mentioned above, (1) Bringing students to nature, (2) bringing nature to students, (3) environmental education, (4) virtual nature contact, (5) a multidimensional view and (6) combining 1–5 should be seen as a basis for action to help universities and higher education institutions to find and implement appropriate measures and policies.

It is important to note that this is not a complete catalog of measures that can be implemented in every university without further ado. For each of the six points mentioned, there are numerous other possibilities and opportunities that can increase the connection to nature that are not mentioned here. Further research and especially practical implementation of new programs are needed to find out how effective different new interventions are and if there are new effective approaches to increase connection to nature in the future. In this way, universities can make a significant contribution to the sustainable development worldwide.

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Conflict of interest

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