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Pre-Service Early Childhood Educator Experience in a UNESCO Biosphere Reserve

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Abstract: There has been significant interest in the values and benefits of early childhood nature experiences on children's well-being and development. One aspect of studying the exposure of children to nature that requires more focus is the role played by early childhood educators. In particular, there is a need for early childhood environmental education training for pre-service educators. This study will explore the use of a UNESCO Biosphere Reserve as an outdoor classroom for early childhood environmental education pre-service professionals. Exploratory quantitative and qualitative descriptive data from a series of three short surveys (pre/post/delayed post) provide a basic overview of pre-service teacher perspectives, experiences, and outcomes of an environmental education intervention. The results indicate that the participating pre-service educators had little to no familiarity with the environmental concepts or the biosphere reserve site before participation in the intervention. The post-intervention and delayed post-intervention results show that pre-service educators perceived that their understanding of the concept had improved. The results also show a perception of the positive role that biosphere reserve sites can play in early childhood education. Three critical implications emerged from the overall quantitative and qualitative results: (1) specific support should be given for early childhood environmental education training; (2) biosphere reserve functions provide support for efforts to improve connections to nature; (3) early childhood education has the potential to support the broadening of the biosphere reserve audience.

Keywords: biosphere reserve; early childhood environmental education; Kristianstad Vattenrike Biosphere Reserve; pre-service educator training

Citation: Beery, T.; Magntorn, O. Pre-Service Early Childhood Educator Experience in a UNESCO Biosphere Reserve. *Sustainability* **2021**, *13*, 4231. https://doi.org/10.3390/su13084231

Academic Editor: Julie Ernst

Received: 15 March 2021
Accepted: 7 April 2021
Published: 10 April 2021

1. Introduction

Over the past decade, there has been a substantial increase in research-based efforts to understand the relationship between early childhood and nature experiences, with a subsequent increase in systematic research reviews in recent years [1–5]. This growing body of research has demonstrated the benefits to children related to spending time in nature and having access to green and other natural spaces; these benefits have been documented across physical, cognitive, and affective domains that comprise overall well-being as well as other aspects of being, learning, and development, such as executive skill functioning [6–13]. In addition to the scientific literature, the past twenty years have seen a surge in educational and general public interest in the idea and practice of children in nature. An example of this interest and convergence between popular culture and scientific study can be seen in the Child and Nature Network (https://www.childrenandnature.org accessed on 9 April 2021); an organization that supports children in nature efforts. An essential aspect of this convergence between public interest and scientific study is practitioner engagement, i.e., translating the widespread cultural interest and scientific study into support and resources for practitioners [14]. However, research into early childhood environmental education training for pre-service professionals represents a gap in this growth of interest and focus on supporting children in nature efforts. This article hopes to contribute to this knowledge area and draw attention to this critical and potentially overlooked aspect of interest in

children and nature experience. At the foundation of this study, is the consideration of the key role of early childhood educators in supporting child and nature educational efforts. Moreover, the study is based, in part, on the concern that pre-service teachers are not prepared to face sustainability challenges [15].

This study will explore the use of a UNESCO Biosphere Reserve (hereafter BR) as an outdoor classroom for early childhood environmental education (hereafter ECEE) pre-service professionals. Specifically, we explore the use of the Kristianstad Vattenrike Biosphere Reserve and the impact of this as an environmental education classroom for 180 pre-service early childhood teachers from Kristianstad University in southern Sweden. Exploratory quantitative and qualitative descriptive data from a series of three short surveys (pre/post/delayed post) provide an overview of pre-service teacher perspectives, experiences, and outcomes of an environmental education intervention.

2. Background

In this first section of the background, the idea of biosphere reserves as training sites for pre-service early childhood teachers will be presented and explored. The second section will provide a brief overview of the scientific literature of ECEE teacher training.

2.1. UNESCO Man and Biosphere Program

The UNESCO Man and Biosphere Program (hereafter MAB) is an intergovernmental scientific program "that aims to establish a scientific basis for enhancing the relationship between people and their 'environments'" [16]. As part of this effort, biosphere reserves have been established, in part, to serve as opportunities for global challenges to be considered on local scales in order to make meaningful links between local, regional, and global concerns/efforts tangible. These areas are viewed as places that attempt to reconcile the conservation of biological and cultural diversity, and economic and social development through partnerships between people and nature [16]. The biosphere reserve program emphasizes conservation, sustainable development, and logistical support as three critical functions in this partnership effort (see Figure 1).

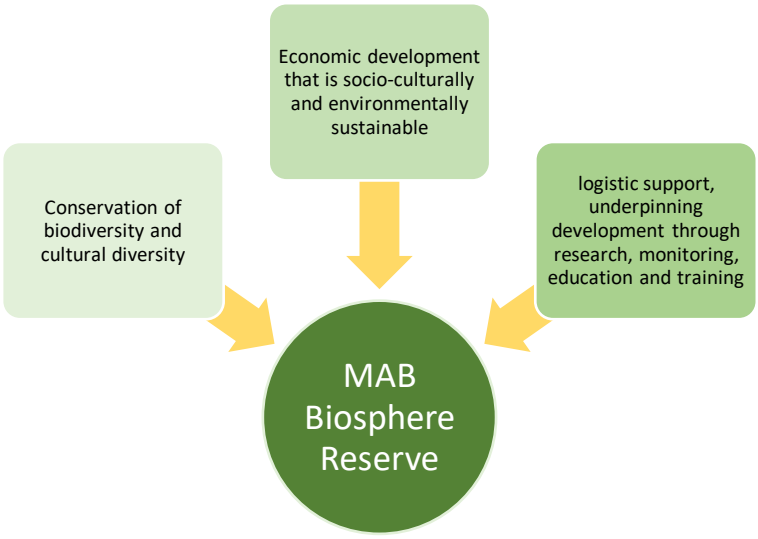

Figure 1. Biosphere reserve functions [16]. MAB: UNESCO Man and Biosphere Program.

2.1.1. Kristianstad Vattenrike Biosphere Reserve

The Kristianstad Vattenrike Biosphere Reserve (hereafter referred to as KVBO) is one of 714 biosphere reserves in 129 countries that collectively serve 250 million people [16]. Note, the term "reserve" is not used in the Swedish language name, instead, the Swedish program uses the term "område," the "O" in KVBO, which translates to "area" in English. This use of language is deliberate to avoid creating the misinterpretation of exclusionary management,

i.e., the perception that people are not a part of the system [17]. The name Vattenrike translated into English is "water kingdom," thus, acknowledging the intertwined natural and cultural focus on the abundance and importance of aquatic systems in this region of Sweden. The KVBO features the lower Helge River watershed and coastal regions of Hanö Bay of the Baltic Sea, an area of over 100,000 hectares and corresponding almost directly to the Kristianstad municipality's boundaries. The biosphere area is noted for its extensive and ecologically sensitive wetlands, productive agricultural land, and one of the largest groundwater reserves in northern Europe [18]. Given the expanse of wetlands, proximity to the Baltic sea, and overall variety of habitat types, this area has a very high biodiversity value [18].

Throughout this area, the KVBO has established 21 outdoor visitor sites. These sites vary in size and provide park-like settings for outdoor recreation, outdoor education, and active conservation [19]. The sites showcase the breadth of ecosystems and habitat types of the region. Relatedly, the KVBO supports public access to nature via trail development of the Skåne trail [20]. In addition to the visitor sites, other environmental restoration sites can be found throughout the KVBO, such as the sandy soil habitat restoration sites in Åhus [21]. In addition to the expansive outdoor sites, the Naturum in Kristianstad provides an indoor interpretive center for the KVBO. This center provides information and interactive educational displays and serves as a gateway to the KVBO (Link to the Naturum: https://vattenriket.kristianstad.se/naturum/ accessed on 9 April 2021).

The source of effort and inspiration for forming the KVBO is found in its educational roots, dating back to the 1980s [22]. This legacy continues and there are numerous examples of educational efforts as part of the on-going work of the KVBO.

For example, one focus of this on-going educational effort involves initiatives to support the broader societal understanding of the concept of ecosystem services. This effort includes active conservation work, such as habitat restoration, research into municipal planning and decision making, and education to raise awareness and understanding [23]. A variety of specific methods have been used in ecosystem services educational outreach, including interpretive signage, public programs, on-line resources (For example, films are available on the KVBO website: https://www.youtube.com/watch?v=s_xfPpUfgQY accessed on 9 April 2021), and educational curriculum [24]. This potential broad-based outreach is important given the concern that the concept of ecosystem services is not well understood [25]. The Vattenrike Flower (link to the pedagogical material: https://vattenriket.kristianstad.se/pedagogiskt-material/ accessed on 9 April 2021) (see Figure 2) is one of the educational tools developed by the Vattenrike for outreach to a broad range of public audiences. The flower provides a tool that can be used as part of active outdoor experiences by students to represent the results of ecosystem service investigations and understanding. Use of the flower includes specific field investigations of various ecosystem services, observations, counts, values discussions, and more. The flower activity provides a tangible way for students to explore, consider, and discuss ideas such as nature's value, nature's contribution to people, and the human role as a part of ecosystems.

2.1.2. Educational Research and Biosphere Reserves

As noted, the logistical support function of the BR model promotes the use of the reserves for research and education, and as reported early in the UNESCO MAB history, environmental education and training have been vital elements since the inception of the MAB program in 1971 [26]. Schultz and Lundholm [27] concluded that BRs have the potential to provide insights on the practical dimension of supporting social–ecological resilience educational efforts; they noted a variety of audiences and stakeholders that could benefit from the learning opportunities provided in the BR context.

Biosphere reserves appear within the environmental education research literature [28–30]. Additionally, BRs also appear in research in the closely related and overlapping literature of outdoor recreation [17,31] as well as eco-tourism [32–34]. However, BR-based research specifically considering opportunities for ECEE or early childhood educator training is

missing. Therefore, part of this current research study aims to broaden the BR audience and consider stakeholders; it is important to see early childhood educators as essential stakeholders in the ongoing BR process. Chang-Kredl [35] argues that early childhood education is undervalued; she explores how childhood educators' roles need more focus and attention if we hope to improve children's educational opportunities. Such focus and attention may serve BR efforts to address power imbalances in terms of stakeholders, rightsholders, and knowledge-holders [30]. We argue that early childhood educators should be viewed as having both a critical interest and potential role in the success of BR efforts. Previous research has been conducted on the perception of early childhood educators as stakeholders and critical to community decision making [36], however, no evidence of a clearly identified role for early childhood educators as stakeholders in the context of biosphere reserves was found.

Figure 2. The Vattenrike Flower (Photo credit: Naturum Vattenriket).

2.2. Pre-Service Early Childhood Environmental Education Training

The noted lack of pre-service early childhood training in BRs appears to extend into the broader literature of environmental education. Research into pre-service, ECEE teacher training, in general, is limited. Ernst and Tornabene [37] studied pre-service early childhood educators' perceptions of outdoor settings in the context of encouraging the use of natural spaces for educational experiences with young children. Another study by Ernst [38] found that early childhood educators' values in regard to the use of natural outdoor settings in early childhood education did not need to be a focus, but rather heighted the practical considerations. These educators needed support to reduce access barriers in order to make the use of outdoor educational settings more feasible. Ernst's results are supported by related studies of nature access and proximity for early childhood education facilities. For example, Beery [39] considered the role of early childhood education in disrupting the disconnection from nature trajectory. Beery's results indicated that nature-rich daily routines for young children need to be prioritized but also made possible through consideration of proximity and access. Related to nature site access and proximity, results from Torquati et al. [40] highlighted a focus on place-based education, noting that place-based education values students' daily experiences and perceptions.

In addition to the focus on settings, Torquati et al. [40] emphasized that pre-service training would benefit from the inclusion of content on nature, science, and environmental education, including the interrelatedness of human and natural systems. Finally, Torquati et al. [40] emphasized providing training experiences in nature that help teachers develop confidence implementing activities in nature with children. Álvarez-García et al. [41] conducted a review of environmental education training for pre-service educators (not exclusively early childhood pre-service educators, but inclusive of this grouping), noting that such training is an essential element to introduce environmental education in schools. Unfortunately, they reported a lack of environmental competencies amongst pre-service teacher students and gaps in the environmental education teacher training curricula Pérez-Rodríguez et al. [15] also noted deficiencies in early childhood and primary pre-service training and preparedness for environmental education teaching.

3. Methods

3.1. Intial Planning

The combined lack of ECEE pre-service training research and research considering early childhood educators as stakeholders in BR efforts provide the underlying motivation for the explorative study. In addition, initial research planning for this study considered KVBO interest in research that would explore the effectiveness of educational materials with various audiences. Of particular interest was the effectiveness of the ecosystem services education tool, the Vattenrike Flower (see Figure 2). These research motivations led to a series of collaborative planning discussions [30] and pilot studies.

Pilot studies were undertaken to explore the use of the Vattenrike Flower. An educator from KVBO and the university research team led these sessions. The pilot sessions included outdoor programs using the Vattenrike Flower and follow-up interviews and discussions with students (both high school and university-aged students, which included pre-service early childhood educators) to explore data collection and analysis strategies. Ten pilot sessions were conducted with small groups of early childhood and primary school pre-service educators during the autumn of 2019 and spring 2020 (with accommodations for COVID-19 precautions). Researchers shared their interests with students during the pilot phase; all of the groups involved had an understanding that both methods for instruction and methods of data collection were being investigated. Ultimately these pilot sessions helped shape the research methodology, as presented in this section, highlighting the following outcomes:

- Identification of activities appropriate to introduce the KVBO to pre-service ECEE students.
- Identification of an appropriate site for outdoor excursions with the early childhood pre-service educators.
- A plan for the use of the Vattenrike flower activity.
- Review of possible survey questions; pilot testing of questions.
- A simple and efficient data collection strategy.

Based on results from the initial investigations and development of research questions, a linear one-group pretest, intervention, posttest, delayed posttest design was used to explore questions related to ECEE pre-service training in a BR. Figure 3 provides a simple diagram.

Figure 3. Research Design Model. KVBO: Kristianstad Vattenrike Biosphere Reserve.

3.2. Participants

All participants were students in the first semester of an early childhood teacher training program; the program is a full-time, 3.5-year campus-based program. A total of 173 students were included in the study. Early childhood education students in the program come primarily from the southern region of Sweden, Scania. The gender breakdown of the program was overwhelmingly female; for example, in the course examined in this study, the gender breakdown was 95% female and 5% male.

3.3. Pre-Testing

An electronic survey was sent to all enrolled students before the research intervention (course excursion). The email contained information about preparing for the excursion and requested students to complete a short pre-excursion survey. Students were not required to participate in the survey and were provided with information about confidentiality and their right to decline participation.

Data were collected electronically using the Eva-Sys online platform. The survey questionnaire was designed to be extremely short in the hope of boosting student participation; recent campus-based survey efforts have had a low response rate; thus, precautions, such as length, were taken to promote participation [42]. Seven questions were asked in the pre-test; two questions aimed at concept familiarity, for example: *Are you familiar with the concept of biosphere reserve?* (*No/Yes/Not sure*); both of the concept questions included open-ended follow-up questions to allow participants to elaborate their understanding. Two questions were asked related to prior visits to the Vattentike, for example: *Have you ever been to one of the Kristianstad Vattenrike visitor sites before the course started?* (*No/Yes/Not sure*). Moreover, one demographic question was asked regarding whether the participant was a resident in Kristianstad municipality.

3.4. Intervention

The excursion was a part of a course module and served as the research intervention. Two course instructors led the university's excursion, and the 173 students were divided into eight different sessions (no more than 24 students per session). The eight 2.5 h intervention excursions were conducted during one week in September 2020. During this time, COVID-19 was an ongoing concern, and measures were taken to reduce risks. For example, the outdoor setting and two instructors allowed for social distancing and managing the maximum 24 number into two smaller groups of no more than 12 students for most of the excursion. Another precaution, hand sanitizer, was made available throughout the excursion (for example, when students shared learning materials or before the snack break). Finally, COVID-19 was discussed with each group in the excursion introduction, and students were asked to participate in the COVID-19 risk management using principals of participatory risk management [43].

The excursion met at the Naturum in a park-like setting along the Helge River and wetlands and proximate to a city park and the business district (see Figure 4). The excursion's goal was to introduce students to the KVBO through an activity exploration of relevant places and topics. The excursion's focus was not on developing students' professional educator skills but instead on allowing the pre-service teachers to be students of the place; the intent was to welcome them to the place as a part of their studies at Kristianstad University. Each excursion session included the following elements:

- A welcome to the KVBO, BR introduction on the outdoor deck of the Naturum, including the topics:
    - COVID-19 precautions.
    - Intro to the biosphere reserve.
- A three km hike (trails on both side of the river)
    - The hike was inclusive of lectures, discussions, and activities.

- Short topical talks with student interaction/discussion interspersed along the hike; lecture topics included: biodiversity, biosphere reserve model and Kristianstad Vattenrike Biosphere Reserve, ecosystem services, and sustainability. For example:
    - The discussion of catfish along the Helge Riverbanks was designed to highlight the lower Helge River system's biodiversity. Biodiversity was presented as a value that broadened into consideration of the river system and wetlands provision of multiple contributions and services to wildlife and people.
    - The Skåne trail (Skåneleden) discussion was a part of the hike and involved a stop at a trail map and subsequent discussion of cultural ecosystem services and KVBO involvement.
- A visit to an outdoor BR visitor site, the Canal House, featuring a discussion of the ecosystem services they relate to the municipality's cultural history.
- Specific small group content-based activities. For example, the Vattenrike flower activity.
- Rest and snack break.

Figure 4. The research site (Photo: Patrik Olofsson).

Various definitions were provided as part of the activities, discussions, and field lectures. Biosphere reserve was defined using a brief history of the UNESCO biosphere reserve program, its global identity, and an emphasis on the three critical functions of a BR as described by UNESCO: conservation, sustainable development, and support (education/research) [16]. The concept of biodiversity was introduced in conjunction with both the BR program and the concept of ecosystem services. Specifically, biodiversity was defined using examples of both species-level diversity and habitat type diversity in the KVBO. Ecosystem services were defined using the four categories approach (supporting, regulating, provisioning, and cultural) [44] as well as the use of the language of relational values and nature's contributions to people [45]. Sustainability was defined using the Brundtland Report, Our Common Future [46] as a guide to describing sustainable development as development that meets the needs of the present without compromising future generations' ability to meet their own needs. A crucial part of the intervention was providing these definitions in conjunction with tangible examples from the KVBO to provide locally relevant detail while hiking, discussing, and engaging in a supportive activity. It

should also be noted that the excursion was referenced in the university classroom as a part of sustainability instruction and study.

3.5. Post and Delayed Post-Testing

Data were collected using post-test surveys administered electronically using the Eva-Sys online platform. Ten questions were asked in the post-test, and nine questions were asked in the delayed post-test. The use of questions exploring participant perception of learning was chosen based on a previous study of biodiversity education programs [47]; however, the questions were exploratory and were not independently validated. Sample questions include (translated from the Swedish):

- Scale Question example: *After today's course meeting, do you feel that you understand the concept of ecosystem services?* Response options included a 4 point scale from *No, not at all to highly increased understanding.*
- Multiple choice example: *Which activity/activities helped you to better understand the concept of ecosystem services (check all that are applicable):*
    - ○ *None helped, I do not understand the concept.*
    - ○ *None helped, I already had a good understanding.*
    - ○ *Instructor field lecture*
    - ○ *Vattenrike flower activity*
    - ○ *Map discussion about the Scania Trail*
    - ○ *Biodiversity discussion about with fish/catfish focus*
    - ○ *Other:*
- Open question example: *If you answered that you have a better understanding of the concept "Biosphere Reserve", Please write down your general understanding.*

The post-test was sent to all students within 24 h of excursion participation, and the delayed post-test was sent out to all participants 90 days after the excursion.

The questions were designed to serve the study's data collection, while supporting student learning. A value in the perception questions is the importance of student metacognition—encouraging students to reflect and identify aspects of their learning process. Questions were designed to support self-awareness of which concepts one has already mastered, what still needs to be learned, and how to best approach the task of learning [48]. Further reasoning behind perception questions was based on timing, as noted, the excursion was an early part of the first semester of the students' program. We did not want the questions to be perceived as an exam, but rather as a reflection of learning, i.e., promoting the practice of metacognition.

Survey analysis was conducted using data from one survey at a time and a comparative approach between the three survey results. The statistical analysis is descriptive and was investigated using SPSS 26. Open-ended survey results were analyzed using Hycner's guidelines for the phenomenological analysis of data [49]. The results were reviewed and initially coded using participant's responses. Initially, each researcher conducted this process separately with no agreed-upon themes; the researchers then compared, discussed, and agreed upon the identification of meaningful chunks of text. These clusters of meanings were then grouped together into general categories and eventually into specific themes. The final step in the analysis process involved considering how the open-ended responses could help interpret the descriptive quantitative data. Note, after analysis, the comments used in reporting the results were translated from the Swedish language.

4. Results

4.1. Pre-Test

Responses from 149 of the 173 students provided an 86% response rate. The survey results show a lack of familiarity with the concept of "biosphere reserve" and generally little direct experience with the KVBO. In addition, results show a lack of understanding of the concept of ecosystem services:

- 83% of participants indicated that they did not live in Kristianstad municipality.
- 88% of participants were unsure or were not familiar with the concept of a biosphere reserve.
- 66% of participants had not visited the nature center (Naturum) of the reserve prior.
- 72% of participants had never visited a biosphere area visitor site prior, and another 9% were unsure whether they had.
- 78% of participants were unsure of or not familiar with the concept of ecosystem services.

Two open ended follow-up questions (in regard to perception of understanding of the concepts of biosphere reserve and ecosystem service provided minimal response).

4.2. Post-Test and Delayed Post-Test

A total of 133 post-test results provided a 77% response rate. Fifty-five respondents completed the delayed post-test, a response rate of 32% (note, this number is an approximate based on the original number of students; during the 90 day period, at least five students dropped out of the course; thus, we cannot confirm the exact number that received the 90-day follow-up survey via email). Given this drop between the post and delayed-post, we will not directly compare the results to prevent misrepresenting or skewing the outcomes.

Three questions were asked about concept understanding in the post-test survey. The results were positive and indicated that participants perceived increased understanding of biosphere reserve concepts, ecosystem services, and sustainability (see Figures 5–7).

Similarly, three questions were asked about concept understanding in the delayed post-test survey. The results were positive and indicated that participants maintained a perception of increased concept understanding (see Figures 5–7). Note, we want to reiterate that the post-test and delayed post-test results cannot be directly compared given the significant difference in the response rates.

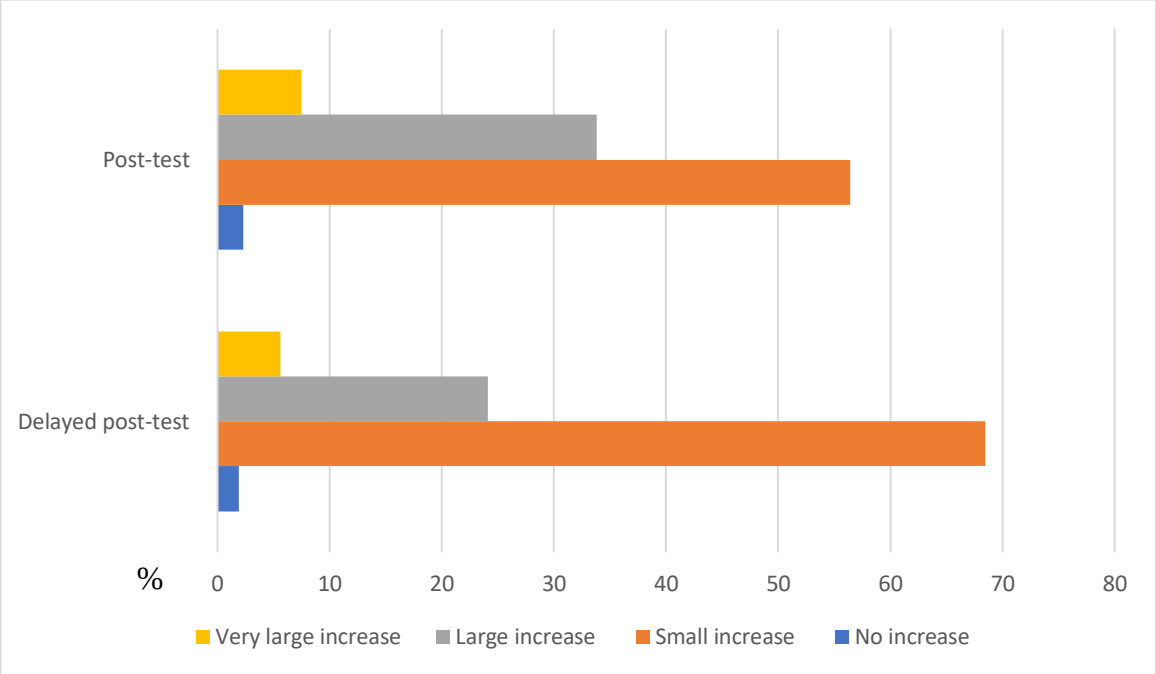

Figure 5. Perceived change in understanding of the concept "Biosphere Reserve" (n = 133/55).

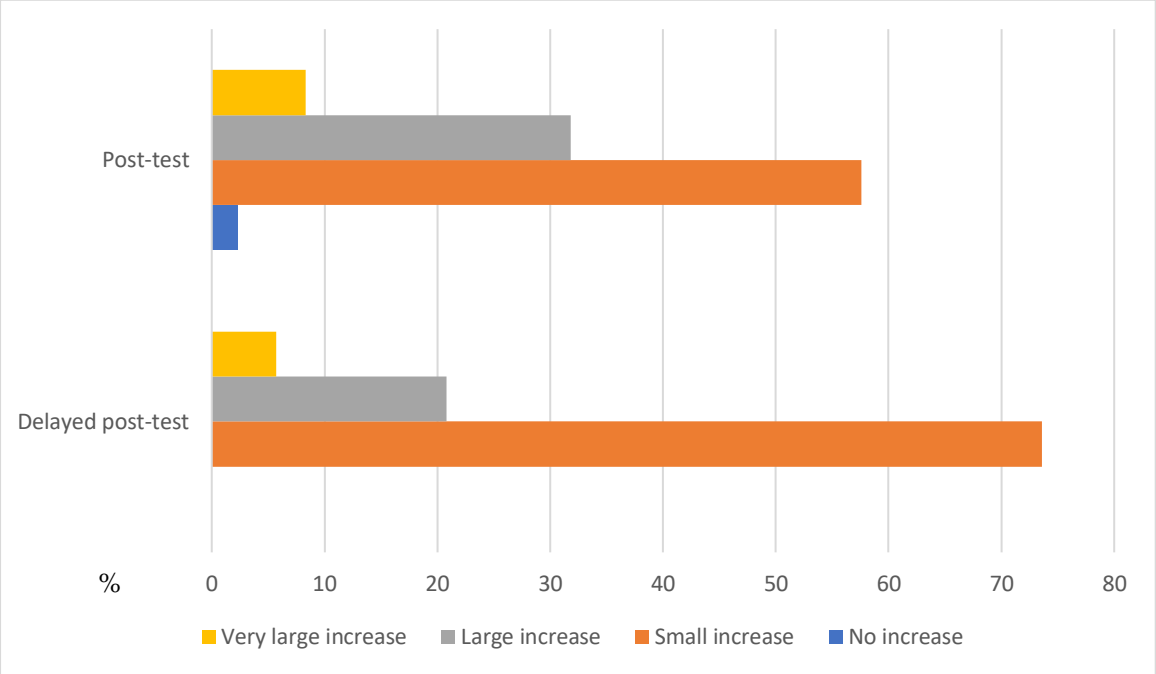

Figure 6. Perceived change in understanding of the concept of "Ecosystem Services" (n = 133/55).

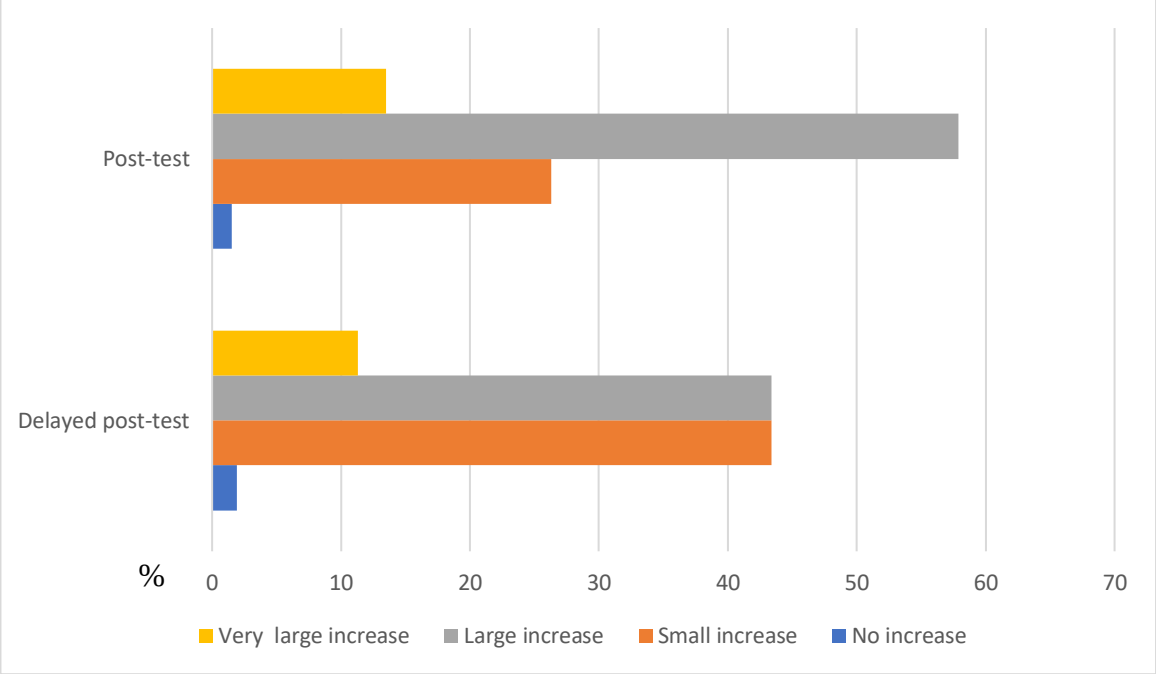

Figure 7. Perceived change in understanding of the concept of "Sustainability" (n = 133/55).

Participants who reported experiencing a large increase in their understanding of the concept of a biosphere reserve in the post-test were asked to provide details of their understanding; 23% (n = 30) provided an open-ended response. The most robust theme highlighted from these open-ended responses was the understanding of the BR protect/develop/support approach. A couple of examples of this theme:

- "Biosphere reserve is about nature and development. An area that is under development. Like a model where you can research and learn. They strive to preserve,

develop and support. A biosphere reserve is about sustainable development, e.g., to preserve biodiversity".

- "A biosphere reserve is not only a place where natural resources are preserved but it is also about developing communities where they are located and that people learn to preserve nature and develop environmentally friendly solutions".

Another theme highlighted the outdoor classroom aspect of the BR, for example, consider this response that combines the previously noted Protect/Develop/Support theme with the outdoor classroom theme:

- "It was cool to have nature as a classroom. It creates a better understanding of how nature works and how the Earth's ecosystem can be preserved and developed".

Another theme noted by participants highlighted the unique aspect of BRs or KVBO in particular, for example:

- "I gained a better understanding of the importance of wetlands".
- "It is an area that has something special that you want to protect and preserve. Thanks to, for example, nature here in Kristianstad, you are also involved and support the work at the same time as you learn".

This last example combines the value of the particular place and the ideas of protection and education. Thus, the response captures many of the aspects of the KVBO emphasized in the excursion activities.

A follow-up to the question of perception of ecosystem services understanding in the post-test and delayed post-test provided participants with a list of the methods used to develop student understanding. Survey participants were asked to indicate all of the activities they felt were effective in improving their understanding of the concept. The top three responses in the post-test were instructor lecture (71%), Vattenrike flower activity (60%), and discussion of catfish at the riverbank (56%) (see Figure 8 for results and a listing of all methods). In the delayed post-test results of this question were quite similar; instructor lecture dropped slightly to 66%, Vattenrike flower activity remained at 60%, and Skåne trail discussion ranked as the third most effective method at 55% (discussion of catfish at the riverbank dropped to fourth, 49%).

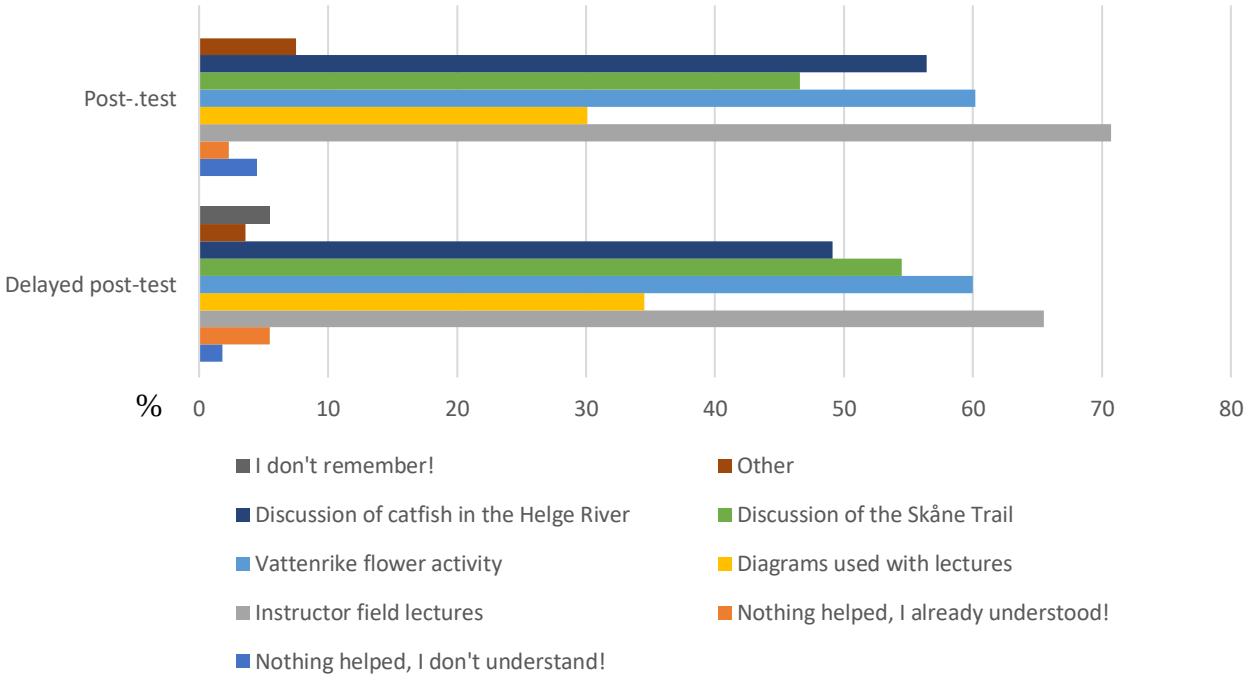

Figure 8. Perceptions of effectiveness: Methods for learning the concept of ecosystem services (n = 133/55).

One question was asked related to participant perception of the biosphere reserve as a potential future resource for early childhood educators. Sixty-three percent of the participants in the post-test indicated a strong perception of potential future resource; an additional 35% indicated a small potential role for the KVBO as a resource; only 2% did not see the KVBO as a potential resource. The same question in the delayed post-test found that 46% of the participants saw a strong role for the KVBO as a professional resource to early childhood teachers, with an additional 43% indicating a small potential role; again, only 2% did not see the KVBO as a potential resource. See Figure 9.

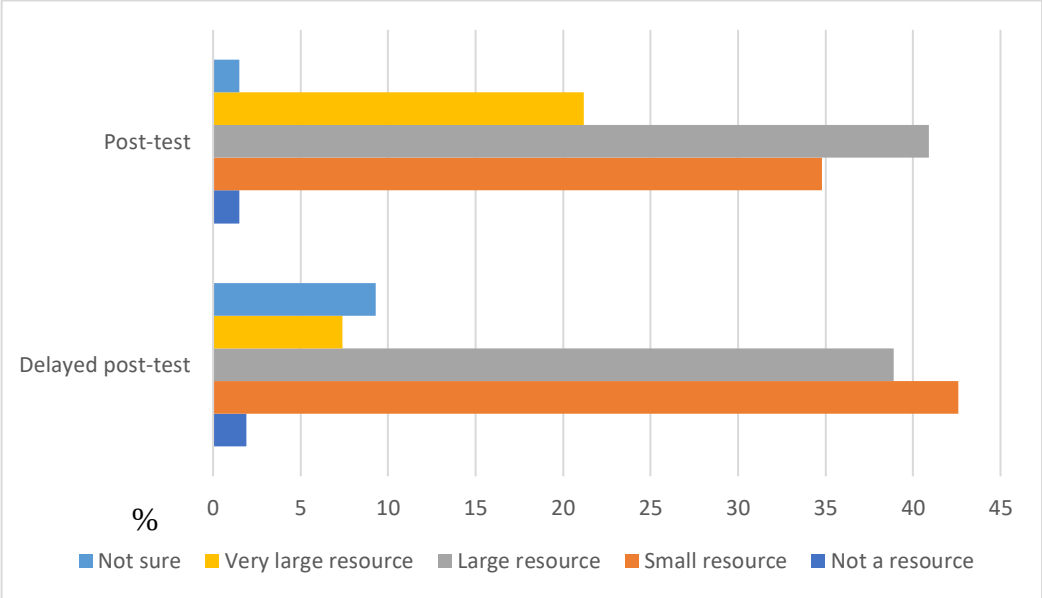

Figure 9. Perception of the KVBO as a resource to pre-school teachers (n = 133/55).

A follow-up to this post-test and delayed post-test question related to the perception of the KVBO as a resource for early childhood educators asked for the participants with a positive view of the resource potential to describe their perceptions. This open-ended question received 46 responses in the post-test (35% of all survey participants). Many of the responses highlight the use of the KVBO for student excursions:

- "A fantastic place to visit to show children how it works in nature, how animals and nature help people and the city".
- "KVBO is a resource to experience nature. Go there with the kids to explore and teach".
- "I can take children to the KVBO and stimulate them to play and feel nature".

Beyond the numerous responses indicating participant perception that the KVBO makes an excellent outdoor classroom, some of the participants indicated that they see value in their learning that can be transferred into their role as an educator, for example:

- "If you work in Kristianstad, you can go there with the children. But for me, I think it feels like a resource because I have a lot to learn about science and sustainable development and it feels like a good place to be able to get new knowledge to teach further to the children".
- "Explore and gain more knowledge about this area as I can benefit from it in my professional role".
- "Even though I will not be active in Kristianstad when I finish my education, I will take the ideas with me".

There were also comments that captured the idea of inspiration from the KVBO that can be used at the early childhood site, for example:

- "Gained an understanding of how to bring nature into early childhood activities".
- "Let the children get out into nature and discover what we have so close to us".

The responses to this open-ended question regarding the perception of the KVBO as a resource in the delayed post-test were fewer in number (in proportion with the noted reduction in response rate), but maintained thoughtful detail, for example:

- "It can be a good resource for theme work, when talking about our city and local environment, also a great destination because it includes so much more than just Naturum. Naturum is also a fantastic place to visit and it is extra good that they often (when it is not a pandemic) organize activities for both private individuals and preschools".

The responses often included ideas directed both toward how the KVBO might be useful for child experiences, but also how the KVBO serves to educate the educators. Consider this delayed post-test response that captures both of these benefits:

- "It has given me greater knowledge about sustainable development. If you work in Kristianstad, you also have the opportunity to walk there with the children and explore the environment".

Additionally, as in the case of the post-test, the idea of the KVBO as a resource for teacher education in and of itself was noted:

- "Also a resource in that we early childhood teachers can go there and then pass on our knowledge to the children".
- "For me, as an early childhood teacher in training, it is important to learn about nature conservation and sustainable development because children are the future of our society and they will have an impact into the future".

5. Discussion

This explorative study investigated student perceptions from a pre-service early childhood educator excursion in a UNESCO designated biosphere reserve, the Kristianstad Vattenrike. The hope was that the results would provide insight into early childhood teacher training, both in the specific context and more broadly, relative to BRs as pre-service teacher training sites. Initial descriptive results indicated that participants were not familiar with the concept of a "biosphere reserve" and had minimal direct experience with the KVBO. In addition, results show a lack of conceptual understanding. Results post-intervention indicate growth in participant perception of environmental concept development and positive perspective on using the KVBO as a resource for their profession. This section will draw on the results to consider the limits of this research, the positive implications for early childhood teacher training, and the implications of the role of BRs to serve a diversity of stakeholders. Finally, opportunities for future research will be considered.

5.1. Limitations

The participants represent one university program, and the specific experiences considered are from one course and one BR. While the initial response rate from the pre-test and post-test was relatively high, the 90 day delayed post-test response rate was considerably lower. We speculate that the first two surveys coincided with the course start and the excursion, and students may have felt an obligation to participate, while 90 days later, they were focused on new course tasks. We are also aware that at least five students dropped the course before the 90 day survey outreach, providing more uncertainty in regard to participant numbers. However, whatever the reason, the drop-in response rate prevents any conclusive data comparison between the two sets of results.

This project represents one intervention and no control group for comparison. We recognize the danger of drawing long-term conclusions from one intervention, and the survey results seem to support that caution. The results are all based on participant perception and future intention to act; no testing of concept understanding nor actual

use of the BR by these pre-service educators was undertaken. We acknowledge that participants' metacognitive perceptions can be error-prone [50] and that students may have influenced by the bias of social desirability; participants' responses regarding the perception of learning may extend beyond the true understanding of concepts.

Participants indicated a modest increase in understanding with many of the questions. This understanding appeared to show a slight erosion over time, considering the delayed post-test results (again, caution urged based on response rate). These results and this possible trend of positive response erosion over time are valuable reminders that follow-up or ongoing experiences are needed to support initial learning.

5.2. Implications

Implications have been developed from combining the intent of this explorative study with the review of the literature and the research results. Three key implications have been developed and are presented this section: ECEE training, connectedness to nature, and broadening the BR audience.

5.2.1. ECEE Training

This study's results indicate that students did not have strong environmental concept understanding at the pre-test phase of the program but perceived their understanding to have grown after the intervention. Participants perceived an increase in understanding and, with one concept (ecosystem services), differentiated between the effectiveness of various outdoor education methodologies in terms of their learning. We found that the Vattenrike flower activity was deemed as the most effective method for learning about ecosystem services (by 60% of both post-test and delayed post-test participants). The activity promotes directed exploration and observation along with discussion and small group interaction. We propose that this sort of activity, taking a potentially complicated environmental topic and making it tangible, is an excellent model for pre-service educators; it not only provides the opportunity for environmental science concept development but also models active and embodied educational methodology. Pre-service educators need to have experience of active and participatory methodologies if we want them to have access to such methods in their role as teachers of young children [51].

Beyond the specifics of one intervention, the implications for an entire integrated early childhood education program need to be considered. As noted previously, this one event experience is limited in impact. However, when seen as part of a 3.5 year program, where additional field experiences in the KVBO and sustainability instruction (inclusive of a range of topics related to the 17 SDGs of Agenda 2030) are a regular part of the programming [52,53], we argue that the excursion is an important beginning. Having such an event at the very start of the program highlights its importance; with repetition and introduction of related content and method, the importance of the learning can be reinforced. Previous research has shown that effective programs in biodiversity education seek to strike a balance between background knowledge development, pedagogical knowledge, and experiential opportunities during teaching practice [47]. We also wish to highlight that the research process pushed participants to think about their own learning (metacognition), a critical skill for educator effectiveness [48].

We argue that this initial excursion supports the idea of the use of sustainability, and specifically, the sustainable Development Goals of Agenda 2030 as a comprehensive conceptual framework [54] to guide the University's early childhood teacher training program. Note, this use of sustainability as a conceptual framework is underway at Kristianstad University, based on both on-going effort and a new emphasis as detailed in the Strategy and plan for sustainability and environmental effort 2021–2024 [55].

A final reflection on ECEE training was the role that the repeated surveys played in the education process. While not designed as action research per se, the initial communication with students that included both the pre-test survey and information about the excursion may have supported learning readiness. The delayed post-test survey captured the value

of outdoor educational experiences. In a final opened ended question that was designed to allow students to add anything additional they wished to comment upon, the outdoor active experience was the leading theme. While only 11 participants responded, six of the 11 addressed outdoor education methodology in positive terms, for example:

- "Fantastic to be out and learn right in the middle of it all instead of sitting in a classroom. I learn best via practical activity so this excursion was highly appreciated".

Relatedly, one student captured the value of the outdoor classroom during the COVID-19 pandemic:

- "This was a very appreciated session. Especially with the pandemic and the reality that we have not been able to meet physically. It was fun to talk with different people from the class at the same time we were learning about nature".

This comment regarding the outdoor classroom and COVID-19 is not surprising, as educators worldwide have turned to outdoor education to address the confines of the COVID-19 pandemic [56,57].

The results presented in this study, coupled with previous study of early childhood education [39], highlight the need to reduce barriers for access to nature in reference to the experiences and training in pre-service ECEE. The KVBO provides an excellent example of why biosphere reserves have such positive potential, largely based on the BR program's educational mission [16]. Beyond its mission, the on-the-ground network of visitor sites, restoration sites, and additional outdoor recreation sites (such as trails), the KVBO provides endless quality outdoor classrooms and play sites for young learners. Many of these possible outdoor classrooms have amenities such as trails, tables, and even bathroom facilities (as was the case of the excursion captured in this research). Additionally, many of these sites feature various habitat types that may support different types of play or learning activities. Access to these outdoor classroom/play sites is supported by the research of Ernst and Tornabene [37], who found that pre-service early childhood educators perceive parks as the most conducive outdoor setting for achieving educational outcomes; they noted that pre-service educators are more inclined to use maintained outdoor settings than wild outdoor settings. Of course, pre-service ECEE training is not dependent upon the existence of a nearby BR; it is simply the role of BRs (and KVBO, in particular with numerous, expansive, and educational/infrastructural rich amenities) as models that remind us of other appropriate sites for pre-service ECEE training; places such as nature reserves, national parks, regional parks, city parks, greenways, school grounds, and other accessible nature sites.

5.2.2. Connectedness to Nature

Another aspect of access is the BR philosophic emphasis on people as part of natural systems, highlighting people and communities as integral parts of preserving biodiversity [16]. It is noteworthy that this important aspect of BRs was a leading theme in the participant descriptions of their increased understanding. Many participants highlighted the protect/develop/support functions of BRs in their survey responses, although it was just one of the numerous ways the BR idea was presented during the excursion activities. These responses led us to argue that this protect/develop/support message appears to be an effective approach in communicating the essential BR idea that people are a part of nature, consider this description [58]:

"BRs remind us that we live in a highly interconnected world, and that human beings are part of the biosphere. People living and working in BRs inspire us to think beyond borders, to revisit our values, to cooperate with other life-forms. They propose that humans make choices based on solidarity, including with future generations, for an inspiring future".

This message is not only an essential part of the BR model, but also supports quality early childhood environmental education [59]. Previous environmental and outdoor educational work has highlighted the BR model as an educational support for connectedness

to nature efforts [60]. This convergence of the BR mission and connectedness to nature efforts should not be understated, given numerous environmental education organizations' current efforts to help practitioners understand and measure connectedness to nature in their professional settings [14,59,61]. Beery and Lekies [62] have argued that experiences which support connectedness to nature in young children may have a life-long impact, drawing on research that demonstrates how connectedness to nature in childhood shows a relationship with adult pro-environmental behavior.

5.2.3. Broadening BR Audience

Another important aspect of linking BRs and ECEE is the role of BRs to identify and serve important underserved stakeholders. The term stakeholder has been used in this research, given its reference to any individual, institution, or group institution with an interest or role in the societal decision-making process [63]. It is hoped that the greater perceived awareness of the KVBO, its function, and potential role in early childhood education will support educator involvement, involvement spanning from actual professional environmental education use of sites within the KVBO, to use of available resources for on-going professional development. Such an outcome may challenge the previously noted power imbalances that BRs attempt to address through outreach to diverse stakeholders [64]. The more that BRs connect and serve a diversity of stakeholders, the greater the chance that they demonstrate their value across society. As argued earlier, early childhood educators need to be seen as a part of this diversity, and early childhood education needs to be valued by society [36]. Relatedly, Beery and Lekies [62] argue that children need to be better represented in the perception and action of ecosystem valuation in environmental policy—yet another argument for broadening the BR audience.

It is noteworthy that participants in this study, many of whom were previously unfamiliar with the BRs, came to see the KVBO as a potential resource for their professional development, i.e., and perhaps began to see themselves as stakeholders. A theme from the final open-ended question on the delayed post-test asking participants if they wished to make any additional comments based on their excursion experience was a newfound connection to the KVBO, for example:

- "It was a fun and interesting excursion. I had never been to the KVBO, but I guarantee that I will use it in the future".

5.3. Future Research Recommendations

Given the basic explorative and descriptive nature of this study, the question of future research is a critical outcome. Rather than presenting specific research questions, this study set out to explore the intersection of pre-service training for ECEE and the role of BRs. The exploratory results have pointed to at least three important follow-up directions. More research is needed to assess the effectiveness of the educational tools developed by BRs, for example, the Vattenrike flower, to increase ecosystem service understanding. This interest was at the heart of the initial pilot testing, and while the results of this study indicate that students perceived the flower and accompanying activities to be useful in their understanding, we do not have an exact measure of comprehension. Use of the flower with different groups, ages, and objectives would provide useful information to the KVBO educational team.

Another BR research direction is the continued investigation of how BRs can support ECEE. With a global network, the documented use of BRs worldwide by young children and their teachers' may inspire both the MAB program and ECEE professionals. Moreover, the overall effectiveness of the use of KVBO for environmental concept development progression in the Kristianstad University program should be investigated. Broadening the study to consider how a progression of learning experiences in the early childhood teacher training program serves the University's strategy and planning for sustainability and environmental effort would be useful. Having a better sense of the program graduates'

preparedness for the application of Agenda 2030 in their professional roles could provide useful guidance in higher education programming.

6. Conclusions

With the example of the KVBO, BRs make excellent outdoor classrooms for pre-service early childhood educators. This research indicated that pre-service early childhood educators perceived their training experience in the BR to have increased their knowledge and inspiration for the use of site/materials in the future. For example, the protect/develop/support functions idea (see Figure 1) was useful for helping pre-service educators understand the BR's role and the BR philosophic emphasis on people as part of natural systems [16]. Further, the use of sites in a training context can provide experiences that help pre-service educators see the potential opportunity for the use of these sites (or similar park settings) as outdoor classrooms and educational play-sites in their future professional roles.

This explorative and descriptive study has highlighted the need for additional focus on pre-service educators in the BR program. Early childhood educators can be a part of a broadening of the spectrum of BR stakeholders [64]. A recognition of teacher training using the BR model as content and sites for activity can highlight both the teachers in training and their students as important stakeholders. A critical step in early childhood sustainability education work is finding ways to integrate sustainability in age-appropriate ways, using pedagogical approaches, from free play to direct instruction, to use of appropriate sites as model outdoor classrooms. With 714 sites in 129 countries, an area inclusive of 250 million people worldwide [16], the MAB program has great global potential to highlight pre-service educators and their future students.

Author Contributions: Both authors participated in the entire research process: conceptualization, T.B. and O.M.; methodology, T.B. and O.M.; investigation, T.B. and O.M.; formal analysis, T.B. and O.M.; writing—original draft preparation, T.B.; writing—review and editing, T.B. and O.M.; supervision, T.B.; project administration, T.B.; funding acquisition, O.M. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki and the European Union's General Data Protection Regulation (GDPR) guidelines.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Supporting results are stored on a secure Kristianstad University server.

Acknowledgments: The authors wish to acknowledge the education team at the Kristianstad Vattenrike for their support and guidance.

Conflicts of Interest: The authors declare no conflict of interest.

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