Environmental education in prison: a comparison of teaching methods and their influence on inmate attitudes and knowledge of environmental topics

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Abstract: This study evaluated whether lecture- or workshop-style presentations were more effective for teaching environmental education (EE) to both male and female inmate students. To compare these styles, we designed pre- and post-engagement surveys quantified on a five-point Likert scale, and open-ended questions to capture qualitative nuances. Our findings revealed significantly improved inmate attitudes after receiving the educational opportunity, and the lecture-style presentations appeared more effective for male students in improving inmate knowledge and attitudes on environmental topics. Overall, we found no significant differences in knowledge or attitudes among participants prior to the presentations or between male and female inmates, which provides evidence for learning independent of prior conditions or gender.

Keywords: environmental education prison; environmental education; prison education; sustainability correctional facilities; recidivism; learning styles; teaching methods; teaching environmental education; environmental education inmates; lecture presentations; workshop presentations; environmental review.

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Carri J. LeRoy is a member of the faculty at The Evergreen State College. She has a PhD in Biological Sciences, a Masters in Liberal Studies (focus in environmental education) and degrees in Environmental Science and International Studies. She is the Co-Director of the Sustainability in Prisons Project (SPP), a program that brings science and nature into prisons and hopes to reduce the environmental, economic and human costs of prisons. SPP is a partnership between The Evergreen State College and the WA Dept. of Corrections, but is now an international network of scientists, educators and prison administrators.

1 Introduction

Education in prisons is primarily focused on programs teaching literacy, basic adult education, GED courses, and vocational training (Cnaan et al., 2008). Many inmates enter prison without basic literacy skills or job training, so a need clearly exists to focus in these areas; however, a great need also exists for environmental education (EE) in prisons. Working with nature and living organisms in EE programs can create a therapeutic environment and engage inmates on physical, mental, and emotional levels that are often lacking in correctional facilities (Deaton, 2005). Further, EE programs can directly benefit sustainable practices within correctional facilities by reducing costs through composting, recycling, and gardening programs (LeRoy et al., 2012) while engaging inmates in jobs and skills that have post-release benefits (Deaton, 2005). In an effort to reduce recidivism, opportunities such as EE, which empower incarcerated individuals with the social and professional skills to succeed after release, should be explored.

The USA has the highest incarceration rate in the world, and also in its history, with a 350% increase in incarcerated people between 1980 and 2010 (Schmitt, Warner and Gupta, 2010). In addition, the cost of prisons has increased dramatically in the past 20 years. In 1996, \$22 billion dollars were spent on state and federal corrections (Cnaan et al., 2008) compared to \$75 billion in 2008 (Schmitt, Warner and Gupta, 2010). Throughout this time, relatively little of that total, roughly 6%, was used on programs such as vocational training, life-skills training, educational programs, social activities, psychological treatments, and recreation (Cnaan et al., 2008). These are programs designed to prepare inmates for life outside prison and research unambiguously reveals that society benefits from preparing inmates for reintroduction to society (Cnaan et al., 2008; Deaton, 2005; Vacca, 2004).

Recidivism rates are closely tracked and are often strongly correlated with the level of educational opportunities offered in prisons and received by incarcerated individuals (Evans, 2010; Newman, Lewis and Beverstock, 1993). As of 2003, approximately 1,600 inmates were released from prison daily and recidivism rates suggest that successful re-entry into society is difficult (Cnaan et al., 2008). Effective education programs help offenders with their social skills, offer techniques and strategies to help inmates deal with their emotions, and emphasise academic, vocational and social education (Vacca, 2004). Moreover, appropriate education can lead to a more humane and tolerable prison environment in which to live and work, not only for the inmates but also for the officers, staff and visitors (Newman, Lewis and Beverstock, 1993, Young et al., 2014).

Education in prison is important both in preparing inmates for life after release and in providing meaningful activities and focus during incarceration. In addition, prison education may change the attitudes of inmates and lead to improved self-esteem, confidence, and self-awareness. Prison education, in parallel with the values of adult education, encourages negotiation and choice, and builds self-confidence and worth, and critical thinking (Duguid, Hawkey and Pawson, 2000). Currently, non-profit groups provide diverse faith-based, art, athletic, and vocational programs in prisons; but the one important area of education and training that has received little attention is EE.

Environmental education is defined as "the study of nature, earth systems, sustainability, and individual roles in making decisions and critical thinking related to environmental literacy and actions" (Heimlich and Horr, 2010). The objectives of EE go

beyond learning content, and extend to changes in attitude, life-style and behaviour. Environmental education opportunities in prisons are growing in popularity, but they are still a stepchild to the other educational foci. The most common types of EE in prisons are in the form of dog training and rehabilitation, and gardening programs. But one program expands on these to also include: science lectures, sustainable operations such as composting and recycling, green job training, and endangered species conservation programs (LeRoy et al., 2012). The Sustainability in Prisons Project (SPP) leads a national movement of sustainability and science in prisons. The SPP, which began as a partnership between the Washington Department of Corrections and The Evergreen State College, has grown to encompass a vast network of corrections institutions with academic and community partners across the US and beyond. This novel program was recently awarded a National Science Foundation grant funding their proposal to host a conference focused upon creating a national and international SPP Network. This has allowed for collaboration, sharing of ideas, and further evaluation of the impacts the EE and science projects within the prisons are having upon incarcerated individuals and communities.

Prisons house individuals who may lack training in animal rehabilitation, gardening, or science but who do have time and a need for intellectual stimulation that supervised research can fill (Ulrich and Nadkarni, 2008). Ulrich and Nadkarni (2008) report on a three-part study of environmental programs that took place at Cedar Creek Correctional Centre (CCCC) for men in Washington State. The three projects included growing moss in prisons, implementing and maintaining a composting and vermiculture system, and a monthly science lecture series that resulted from partnerships among ecologists, sustainability practitioners, correctional administrators, and inmates (Ulrich and Nadkarni, 2008). All three projects received positive responses from inmates, prison staff, and the media. Inmates were engaged and patient in the tedious and repetitive task of watering and growing various mosses, which was attributed to their being active and valued participants in solving an environmental problem (Ulrich and Nadkarni, 2008). Upon learning composting and gardening techniques, many inmates expressed the desire to continue the practice outside prison, and one participant went on to enrol in a horticulture program upon release (Ulrich and Nadkarni, 2008). The lead author of the paper, Ulrich, who was incarcerated at the time, has now completed a doctoral degree in the sciences.

As growing human communities continue to tax natural resources, the need to move toward environmental sustainability globally has become increasingly pressing. The controlled environment of a prison creates an opportune setting to integrate the study of sustainability with science programs, of which EE is a fundamental part. Considering that the majority of inmates will be released, it benefits both them and society to give them skills that can help them procure green jobs, increase their environmental awareness, and motivate them with the knowledge to seek out and participate in environmental activities. While in prison, EE learning opportunities and programs can give inmates the opportunity to feel connected to the outside world, both intellectually and physically. Questions remain however, in determining the best pedagogical methods for reaching incarcerated adult audiences.

The general belief in EE is that hands-on, free-choice, workshop-style experiences are more effective modes of teaching and learning about various environmental topics (Lord, 1999; Taylor and Neil, 2008; Zeppel, 2008). Enabling an EE student with the opportunity to engage their senses and to take an active role in their learning is rewarding to both

teacher and student, and often results in a formative experience for the learner. Hands-on experiences may give the learner confidence to act on the knowledge gained in the learning environment in a way that learning inside a classroom cannot, but these methods may be limited for in-prison audiences and because of limitations placed upon us as researchers working in a prison, we had to frame our workshop-type interactions intercalated within short lecture pieces. This may not have allowed as much free-choice sensory experience as an entirely workshop style lesson might, but it did allow for substantial hands-on, active engagement. Regardless, based upon the notion that experiential learning environments are more effective in teaching EE, we hypothesised that workshop-style presentations would be more effective in:

- 1 conveying environmental content and improving scientific knowledge, and
- 2 improving environmental attitudes of participating incarcerated students compared to more standard lecture-type formats.

2 Theoretical framework

Duguid, Hawkey and Pawson (1996) suggest that an inmate assumes the mantle of their particular offense and identifies with their individual label such as 'thief', 'addict' or 'sexual offender.' Automatic placement of inmates into specific courses that cater to their particular offense may exacerbate the focus on that identity, whereas the label of 'student' avoids the negative connotation (Duguid, Hawkey and Pawson, 1996). In correctional education, the environment created in the classroom can have a direct effect on the success of the class. Incarcerated students highly value a classroom, where they can both voice and debate their opinions (Rose and Voss, 2003). While in the learning environment, Rose and Voss (2003) encouraged teachers and students to push aside socio-economic and racial barriers. Receiving the desired level of commitment from incarcerated students hinges upon the teachers' ability to communicate and engage students in an active environment, and allow them to feel both safe and comfortable in the learning environment (Mageehon, 2006).

Many challenges present themselves to students, educators and facilities as they seek to give and receive educational opportunities, such as inadequate access to computer equipment, complicated security routines, repeated transfers between prisons, disturbances in prison and lack of access to literature (Vacca, 2004). Overcrowded prison populations, ineffective prison conditions, and inadequate funding for teaching personnel, supplies, and materials may hamper education in prison, and the improvement of such problems may be a critically important contribution to increasing educational quality (Diseth et al., 2008).

3 Description of the program

3.1 The Sustainability in Prisons Project

The Sustainability in Prisons Project (SPP) is a partnership between The Evergreen State College and Washington State Department of Corrections (WSDOC). The mission of SPP is to bring science and nature into prisons through scientific research and

conservation, green-collar education and training, lecture presentations, and sustainable operations of prisons (LeRoy et al., 2012). Inmates involved with sustainable operations and conservation projects (such as composting, recycling, gardening, and the rearing of endangered species) are engaged daily while green-collar training and science and sustainability lecture presentations are presented to interested incarcerated individuals monthly throughout the year. All of the SPP programs and educational opportunities involve inmates, college students, community partners, and scientific professionals.

The SPP green-collar job training and science and sustainability lecture series are designed to reach a larger number and broader spectrum of the inmate population. Green-collar trainings have included presentations on arboriculture, energy efficiency, urban horticulture, and other areas in an effort to give inmates skills they can use as contributing members of society. Lectures cover many topics from climate change to habitat restoration to ecology in an effort to spark an interest in participating inmates that may lead them to seek further education, become involved in an on-site conservation project, or join an organisation with common environmental values upon release. To assess the effectiveness of these science and educational programs, knowledge, behaviour, and attitudes of participating inmates are evaluated. The SPP hopes that the information gathered will direct their on-going effort to bring nature into prisons.

3.2 Scope of study

The green-collar trainings and lectures offered by the SPP are presented in two styles: Hands-on workshops in which inmates move around, discuss presented material with one another as well as the instructor(s), and sometimes engage in a physical activity; and in traditional lecture formats with a presenter, a power point presentation, and an opportunity for questions and brief discussion at the end. In this study we wished to determine whether the lecture-style or workshop-style classes would prove more beneficial in effectively teaching environmental topics to inmates. To obtain data, lectures and workshops were co-presented with a Washington Department of Fish and Wildlife (WDFW) senior research scientist at two minimum-security prisons in Washington State. The presented material focused on the endangered Oregon spotted frog (OSF), the multiple causes of its population decline, the involved political processes, and the steps being taken to augment OSF populations in the Puget Sound region. The research questions with which we approached this study were:

- 1 Do science lectures and workshops improve content knowledge and attitudes of participating incarcerated students?
- 2 Is there a difference in content knowledge or attitudes between participating male and female incarcerated students that receive the educational opportunity?
- 3 Do content knowledge and attitudes of inmates show greater improvement via lecture-style or workshop-style educational opportunities?

4 Methods

4.1 Study design

In April 2012, lectures and workshops were presented at two minimum-security prisons in Washington State (Mission Creek Corrections Centre for Women; MCCCW and Cedar Creek Corrections Centre for Men; CCCC). Both facilities are organised as work camps where inmates from the Washington correctional system are sent to spend the last few years or months of their sentences and as such, inmates are encouraged to work and attend classes prior to their release. Both of these facilities are also involved in SPP (LeRoy et al., 2012), and so receive regular visits from scientists, college students and community partners who are running programs inside the prison, such as endangered species rearing, organic gardening, beekeeping, dog rehabilitation, and recycling. Because of the interest created by SPP, we knew that at each prison we would have some attendees who were involved with or exposed to the conservation projects within those facilities, and some that were not.

Informative flyers were posted throughout each prison inviting inmates to attend one of the two presentations. The inmates were not aware that there would be different presentation styles; they chose simply based upon what time slot they preferred. Given that the presentations were in conflict with rest time, recreation time, and in the case of Mission Creek Corrections Centre for Women (MCCCW) with other classes, our attendance was relatively low, but similarly so at both prisons. At MCCCW, we had a total of 23 women attendees: 10 attendees at the workshop presentation and 13 at the lecture, and at Cedar Creek Corrections Centre for Men (CCCC), we had a total of 30 men attende: 16 attendees at the workshop presentation and 14 at the lecture, for an overall total of 53 participants.

Each session lasted for two hours and included time to complete pre- and postengagement surveys. The lecture-style presentation was 90 minutes and we utilised PowerPoint, with 15 minutes for questions at the end. The workshop-style presentation was also 90 minutes and utilised PowerPoint to present some of the same slides as the lecture; however, throughout the workshop, handouts were used for groups of four or five inmates to discuss the material. Leading questions were asked about the content of each handout to facilitate conversation among the inmates and between inmates and presenters. During the lectures, inmates sat together, but faced the presenter whereas during the workshops, inmates faced the presenter at times, and at other times faced each other. In both presentation types, substantial interaction occurred among inmates, though it appeared more focused and purposeful during the workshops.

Operating under the SPP Human Subjects Review with the Washington Department of Health and Social Services (2012), pre- and post-engagement surveys were designed using a five-point Likert scale. Evaluation of the surveys allowed for the analysis of whether inmates gained improved knowledge or attitudes toward environmental topics after receiving instruction via lecture-style or workshop-style presentations. The surveys consisted of both quantitative and qualitative questions, some of which were repeated between pre- to post-engagement survey to determine if answers changed after receiving the presentation. The surveys were developed utilising a template provided by the SPP, and tailored to suit this topic and area of interest. The surveys were submitted to both MCCCW and CCCC for their approval prior to providing them to inmates at the presentations.

4.2 Statistical analysis

Mixed methodologies were utilised to measure the knowledge base of participating inmates in the workshops and lectures. Quantitative data were generated from comparison of the five-point Likert scale questions on the pre- and post-engagement surveys, and qualitative data were generated from open-ended questions included on the post-engagement survey.

In order to determine if content knowledge increased following an educational experience, paired t-tests were used to compare pre-engagement and post-engagement scores for each individual between groups (female vs. male, workshop vs. lecture). Statistical tests were conducted in JMP Pro 11 (SAS Institute, Inc. 2013).

To assess changes in whole assemblages of attitudes and knowledge for each individual, we used multivariate analyses. We used a Bray-Curtis distance measure (Faith, Minchin and Belbin, 1987) to determine similarity among knowledge base and attitudes for inmates receiving different educational opportunities, and at male and female institutions. Multi-response permutation procedures (MRPP) were used to determine if significant differences in knowledge base or attitudes were apparent between pre- and post-engagement surveys, lectures compared to workshops, and males compared to females. These statistical analyses were paired with non-metric multidimensional scaling ordinations (Faith, Minchin and Belbin, 1987) to visualise differences between groups. Multivariate analyses were conducted in PC-ORD 5.32 (MJM Software Design 2010).

Open-ended questions were evaluated qualitatively through coding of specific words found in answers to those questions. Coded words were chosen based upon the content of the presentations and learning objectives. The coded words were tallied and compared between lecture-style or workshop-style presentations. Using this method we were able to evaluate whether communication and presentation of content remained consistent between the lecture-style and workshop-style presentations.

5 Results

Both types of environmental engagement resulted in increases in content knowledge. Paired t-tests reveal that post-engagement scores were higher than pre-engagement scores on average for both genders and both workshops and lectures. Overall, gender had a notable influence on content knowledge scores, with female scores increasing more substantially than male scores (paired $t_{(51)} = 6.96$, p < 0.0001). In addition, lecture scores were higher than workshop scores overall (paired $t_{(51)} = 6.95$, p < 0.0001). Interestingly, female and male students responded differently to the two types of environmental engagement. Female student content scores increased more dramatically for those students who received the workshop-style engagement (paired $t_{(21)} = 5.06$, p < 0.0001); while male student scores showed higher increases for those students who received the lecture-style engagement (paired $t_{(29)} = 4.79$, p < 0.0001; Figure 1).



Figure 1 Mean content score improvement for students exposed to either lecture- or workshopstyle environment programming on endangered frogs and conservation (see online version for colours)

Note: Female students (panel A) showed higher content knowledge scores when material was delivered in a workshop-style format, but male students (panel B) showed higher content knowledge scores when attending a lecture-style presentation. Mean improvement scores were determined by comparing pre- to post-engagement survey responses. Values represent means +/-1 standard error of the mean.

Interestingly, when you collectively examine survey responses as reflecting combined knowledge and attitudes using multivariate statistics, we see a significant shift in overall responses following both presentation types (Figure 2). Using ordination methods to create a visualisation of the entire assemblage of inmate attitudes and knowledge at an individual level, each grey triangle represents an individual's pre-presentation attitude and knowledge and each black triangle (connected by a black line) represents the same individual's post-presentation attitude and knowledge (Figure 2). The ordination reveals that prior to exposure to this opportunity, inmates had highly variable attitudes and knowledge bases (as illustrated by the widely scattered grey triangles). After the educational opportunity, their attitudes and knowledge converge in the lower left of the

Figure, representing a new assemblage of more similar attitudes regardless of presentation style. Analysing all data collectively reveals that pre- and post-test results are significantly different (A = 0.050, p < 0.0001).

Figure 2 NMDS Ordination plot showing every participating inmate's responses prior to (▲) and after (▲) receiving a lecture-style or workshop-style presentation (see online version for colours)





Examining each type of educational experience separately shows a similar shift and convergence of attitudes and knowledge post-experience. Both pre- and post-engagement survey responses for lecture-type presentations (Figure 3A) and workshop-type presentations (Figure 3B) show a convergence of attitudes and knowledge following the educational experience. The assemblage of survey responses is significantly different prior to the educational experience compared to the following for both the lectures (A = 0.054, p < 0.001) and workshops (A = 0.035, p = 0.001), but the difference appears larger for lectures than workshops (when comparing A values and visual scatter in Figures 3A and 3B).

It is important to note that the assemblages of attitudes and knowledge did not differ between groups prior to the educational experiences at the outset of our study, that is, groups compared started at the same baseline. Using NMDS ordinations and MRPP analyses, we found no significant differences between lecture and workshop participants' attitudes or knowledge based on pre-engagement surveys (A = -0.002, p = 0.558; Figure 4). This confirms that no obvious bias existed in our random selection of participants for each engagement type. In contrast, post-engagement survey responses did differ by presentation type, showing that lectures and workshops might influence attitudes and content knowledge differently overall (A = 0.027, p = 0.012; Figure 5).

Figure 3 NMDS Ordination plots showing every participating inmate's responses prior to (▲) and after (▲) receiving a lecture-style (A) or workshop-style (B) presentation



Note: Lines connect each inmate's pre - to post- engagement survey responses and show a convergence of attitudes and knowledge.

Figure 4 Pre-engagement survey responses show no significant difference in overall environmental attitudes and content knowledge prior to lectures (\blacktriangle) or workshops (\blacktriangle) (A = -0.002, p = 0.558)







Albeit limited in the scale of response, average scores increase for all questions following both types of educational events. However, larger differences in improvement were apparent for some questions. Mean improvement scores for personal action type questions (5–10) such as: "How likely are you to seek information on the environment?" showed overall lower improvement than questions that were more focused on knowledge gained in the presentation (1–4) such as: "How important is education in terms of conservation efforts?" Several notable differences were observed in mean improvement in knowledge-based questions, and some differences in improvement when comparing lecture to workshop presentations (Figure 6; a complete list of questions one to ten can be found in the supporting online materials). In particular, Question 9, which discusses climate change, shows a noticeable increase in improvement for lecture respondents compared to workshop respondents. Though the scale of response is small due to the small sample size, the variation in response is important as it shows each question pushes significantly above zero.

To verify whether content was presented equally throughout the lecture-style and workshop-style presentations, we chose words that we hoped to see in response to the open-ended questions included on the post-surveys. Chosen words were: learn, environment, interest, and conservation (or synonyms). We tallied the number of times we saw these words from participants in the lecture-style and workshop-style presentations, and found the final numbers were very similar (Table 1). From this we conclude that communication of content remained relatively consistent between the two presentation types.

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Note: Values represent means +/-1 standard error. Questions 1–4 represent action items, and questions 5–10 represent content questions.

 Table 1
 Number of times coded words appeared in open-ended survey questions

	Learn(ing)	Environment	Interest(ed)	Conservation
Workshop	14	14	7	2
Lecture	14	12	5	3
Total	28	26	12	5

6 Discussion

Initially, we expected that workshop-style presentations would be more effective than lecture-style presentations at increasing content knowledge, in accordance with a wide variety of EE studies. Although this was true for incarcerated female students, we saw the opposite trend for incarcerated male students. We surmise that participating male inmates may have appreciated the more formal structure of the lecture over the more relaxed environment established in the workshops. In the lecture-style presentations, inmates received knowledge from an expert on the topic, rather than engaging in discussion with their peers, which they were encouraged to do in the workshop-style presentation. This is an interesting contrast to science education with high school and college students, where engagement with peers typically results in better learning in hands-on environments (Duerden and Witt, 2010).

Incarcerated male students may respond positively to authoritative figures in the sciences and may be less willing to judge fellow inmates as sources of knowledge in science and sustainability fields. However, the idea behind this alternative is controversial. Duerden and Witt (2010), who studied the influence of direct (experiential learning) and indirect (lecture-based learning) experiences on the development of environmental knowledge, attitudes, and behaviour, point out that EE practitioners disagree on which methods are most effective in promoting pro-environmental behaviour. A major part of this issue seems to be whether to promote affective (i.e., attitudes and

values) or cognitive (i.e., knowledge) learning (Duerden and Witt, 2010). In their study, Duerden and Witt (2010) examined a program offered in three stages: a preparatory program, an international field workshop, and a post-trip service project. The preparatory program was classroom-based, the field workshop was experiential, and the post-service project was designed and implemented by the students upon their return from the field workshop. Duerden and Witt (2010) found that though the direct and indirect learning experiences were different, individuals experienced similar levels of growth in both environmental knowledge and environmental attitudes, and both of these variables had comparable connections to environmental behaviour.

The results of Duerden and Witt (2010) conflict with findings from experiments conducted by Fazio and Zanna (1978, 1981) on the impact of direct and indirect experiences on attitude-behaviour consistency. Fazio and Zanna (1978, 1981) found that direct experiences produce attitudes more likely to lead to changes in behaviour, while indirect experiences were less likely to produce attitudes leading to behavioural changes (Duerden and Witt, 2010; Fazio and Zanna, 1978, 1981). A study conducted by Dettmann-Easler and Pease (1999) also found that students involved in a direct EE program developed significantly more positive attitudes and retained those attitudes up to three months after the program. Conversely, a meta-analysis conducted by Zelezny (1999) suggests that classroom-based (indirect) programs, rather than field-based (direct) programs, more effectively influence environmental behaviour (Duerden and Witt, 2010; Zelezny, 1999).

Clearly, conflicting ideas exist amongst EE professionals as to what makes an environmental learning opportunity or program successful. If attitudes are a direct influence on behaviour, then changing and creating positive attitudes towards the environment and environmental activities is of the utmost importance, considering those attitudes may eventually redirect behaviour. Programs that integrate direct and indirect learning might offer a more robust, meaningful experience to learners allowing them to ascertain knowledge, experience positive attitudes towards the environment, and hopefully change behaviours to the benefit of the environment.

Depending upon the goal of each EE program (positive attitude or behaviour change), the learning opportunity might be structured to focus on the end goal, and the indirect or direct classroom style may be chosen to promote those interests. A key question posed on the post-engagement survey of this study asked participating inmates, "Does the content presented inspire interest and/or action towards environmental stewardship?" Of 53 total responses, 45 said that yes, they were inspired towards environmental stewardship. Eighty-five percent is a large percentage of individuals who received the educational opportunity and felt moved to perform the actions afterwards. This is encouraging from many viewpoints:

- 1 the SPP is clearly reaching people and grabbing their attention
- 2 the DOC benefits from positive behaviour when inmates are focused on an outside interest
- 3 the potential to reduce recidivism by engaging inmates in environmental experiences that they might pursue outside of prison is a benefit to society, both in terms of public safety and a healthy economy.

Improvement on questions may also reveal selected patterns. Lower improvement scores on the personal action questions in contrast to question more focus on knowledge gained

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may reflect inmates choosing to come to a science-based lecture that already had an interest in nature and environmental practices. Moreover, the notable differences in improvement in knowledge-based questions may reflect question content. For example, Question 9, which discussed climate change, may be a topic that is more effectively communicated and understood in a more formal setting such as a lecture. Certain types of information may be viewed as more trustworthy when coming from an expert compared to a peer.

Instructors controlled variation between presentations to the best of their ability; however, different environments within the prisons created different dynamics amongst the inmates, staff, and presenters that could not be controlled for. The instructors also controlled the length of both lecture and workshop-style presentations in an effort to present content as equally as possible. This may have caused more convergence between the presentations than anticipated and may have diminished the experiential aspect of the workshop-style experience for participating inmates. Future studies should explore the alternative of not controlling for time to allow for more in-depth discussion during workshop-style presentations.

Another important limitation to note is that selected biases may have been inherent in this study. All participants volunteered for these educational experiences, which could have made them more prone to be influenced by environmental messages. Also, though we intentionally chose CCCC and MCCCW as the facilities in which to present and gather data, participation by their institution in SPP programs might bias the study. It is possible that the inmate employees of the SPP programs operating in the facility at the time of the study, came to the presentations with previous knowledge and interest gained from their experience in the program. We did not control for whether these individuals were present at the lecture- or workshop-based presentation so do not know if the data were skewed due to their attendance (though at each facility, fewer than four SPP inmate employees existed that might skew the study).

The presentations conducted in this study focused solely on issues surrounding the endangered Oregon spotted frog (OSF). CCCC has had lectures on OSF in the past, which could have kept some inmates from attending a similar presentation, or brought in inmates who already had a wealth of knowledge on the subject. If the SPP is able to repeat this study, it would be interesting to see results after presentations on different topics; particularly ones to which the inmates have not previously been exposed. However, finding presenters willing and able to commit their time to multiple presentations in prisons is always difficult. This reality poses a challenge to conduct studies such as this one in the future.

Currently, the SPP focuses primarily on lecture-style presentations with occasional opportunities for hands-on or outdoor workshops. Based on the results of this research project, we recommend that the SPP continue their educational offerings in prisons, with this focus on lecture-style presentations at correctional institutions for men, but that SPP work to increase workshop-style programming at correctional institutions for women. This research may benefit the much broader SPP Network and new practitioners that are developing EE experiences for inmates across the US. We would also encourage the SPP to conduct a study similar to this one with a larger sample size and more participating prison facilities. However, results that appear to make this study controversial need exploration beyond issues of sample size. In particular, special effort needs to address alternative explanations for differences and response categories. Among these include gathering information on the demographics, age, education levels and previous

environmental education experiences of participating inmates to enable more precise interpretation of survey results.

Further exploration of the nature of these results is important because this research project could inform how EE is implemented in prisons, both in the US and the rest of the world. Refined teaching methods may help SPP programs reduce recidivism rates through informing inmates of various environmental, educational and green collar job opportunities. The broader SPP lecture and workshop series contributes to a connection between incarcerated individuals, the scientific community, and project partners (Washington Department of Fish and Wildlife, students at The Evergreen State College, and staff at the Washington State Department of Corrections). This research would also contribute to the literature regarding EE in the prison education system, as well as to the discussion of which teaching methods work best with a variety of adult learners.

7 Conclusion

Though few EE opportunities exist in prisons to date, the SPP and proven public interest through media attention (Johnson, 2012) is providing evidence that a desire and a need exist for such opportunities for inmates and correctional facilities as a whole. The SPP is able to reach demographics that are often underrepresented in terms of science education. They are able to introduce those who have limited educational backgrounds to scientific ideas and in some cases engage them in on-site conservation projects (raising endangered plants, frogs, and butterflies; LeRoy et al., 2012). Ulrich and Nadkarni (2008) comment on the astonishment of corrections centre staff at the energy, interest, and patience incarcerated participants exhibited in caring for moss. Caring for a non-showy, slowgrowing organism such as moss can prove challenging and tedious particularly to individuals lacking formal education and coming from diverse backgrounds that do not include nature study (Ulrich and Nadkarni, 2008). Empowering inmate participants to explore ways to solve critical environmental problems, and enabling them with a real sense of ownership allowed participating individuals to feel dedicated to the task, and successful in their achievements (Ulrich and Nadkarni, 2008). Another important consideration is that the cost of higher education in many states competes with funds that must be allocated to manage inmates, and prisons house an increasing population of stable and 'teachable' men and women (Ulrich and Nadkarni, 2008). This creates a valuable opportunity for outreach to prison communities that do not receive much in the way of science and nature exposure. Most of the inmates incarcerated in the USA today will have an opportunity to create a life outside prison. With the influence of EE opportunities, inmates could have increased knowledge and experience enabling them to be environmental stewards, which would benefit both society and the environment.

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Appendix: Supporting online material

Survey questions 1–10

- 1 How likely are you to seek information on the environment?
- 2 How likely are you to seek information about amphibians and conservation?
- 3 How likely are you to talk to others about issues related to the environment?
- 4 How likely are you to talk to others about amphibians and conservation?
- 5 Because amphibians are sensitive to their environment, they can warn humans of disease outbreak, pollution, and other environmental issues.
- 6 The Oregon spotted frog is an important species to protect.
- 7 Political protection of the Oregon spotted frog is complicated but worth the effort if the species and its habitat are protected in the future.
- 8 The most devastating environmental impact on the Oregon spotted frog is competition with exotic and invasive species.
- 9 Climate change has the potential to create negative effects on a scale much greater than what we have seen historically.
- 10 Education is the most important part of conservation efforts.