Paper Title Place-Based Experiential Learning: A Pathway to Sustainability and Environmental Literacy

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Abstract

When implemented effectively, Place-Based Experiential Learning (PBEL) pedagogies have been shown through different studies to enhance student content knowledge, course engagement, critical thinking skills, and civic-mindedness. This research followed 10 semester-long university courses, during one academic year, implementing PBEL pedagogies with a focus on urban farming. Courses came from a wide array of disciplines including courses focused on science, technology, engineering, or mathematics as well as many non-STEM courses. Students completed pre- and post-assessments to measure change in civic-mindedness, place attachment, situated sustainability meaning-making, and environmental scientific literacy. Statistically significant positive change with small to moderate effect sizes were found in student's environmental scientific literacy, situated sustainability meaning-making, place attachment, and civic-mindedness.

Introduction

To have a well-functioning democracy, citizens need to be informed on civic issues and willing to contribute to carefully addressing global, national, and local needs and problems (Wandersman & Florin, 2000). In the past decade, there has been increased undergraduate interest in sustainability and community which has coincided with a more than 13-fold increase of college campus farm projects (LaCharite, 2016) resulting in over 300 college farms. Of these farms, 80% cover less than 5 acres and 86% are located on campuses with no agriculture school (ASSHE, 2021). In the workforce, especially within the science, technology, engineering, and math (STEM) fields, civic-minded employees have been recognized, as being a critical part of 21st century learning and vital to the global economy (Bringle & Steinberg, 2010; Casner-Lotto & Barrington, 2006; Gould, Jamieson, Levine, McConnell, & Smith, 2011; Torney-Purta,

Cabrera, Roohr, Liu, & Rios, 2015). Campus farm spaces may provide a space where students can explore personal and professional civics through the lens of sustainability.

Theoretical Framework: Experiential Learning

By designing educative experiences that connect students to a shared "social enterprise" (Dewey, 1986), experiential learning approaches can demonstrate values of participation and partnerships, and provide students opportunities to witness and reflect on the impacts of these civic engagements (Bringle & Steinberg, 2010; Gould et al., 2011; Kirlin, 2003). This research builds upon Dewey's (1986) principles of continuity and interaction where experiences are shaped by the experiential continua of individual students and the interactions occurring between each student. Building a deep awareness of learning experiences as well as using experientially-constructed skills to expand one's experiential capacity and knowledge are important objectives of experiential learning (D. A. Kolb, 2014).

Specifically, this project utilizes experiential learning as framed by Kolb's (2014) work where a topic is iteratively explored through concrete experiences, which are reflected upon to identify questions or problems of interest. These are then tested through the collection of data, reinterpreted with newly acquired knowledge, which refine and expand our lines of inquiry. Through this iterative process students learn to adapt their knowledge to the context of the environment in which the concrete experience is occurring (A. Kolb & Kolb, 2012).

Place-based Experiential Learning

Place-Based Experiential Learning (PBEL) pedagogies have been shown to enhance student content knowledge, course engagement, critical thinking skills, and civic-mindedness, especially when situated in school gardens (Athman & Monroe, 2004; Ernst & Monroe, 2006; Gruenewald 1, 2008; Gruenewald, 2003; Poulsen, 2017; Sobel, 2004). Urban farms are an ideal place for

PBEL due to their broad disciplinary potential and connection to local and global social sustainability phenomena (Martin, Clift, & Christie, 2016) as well as their impact to ecosystems and socio-economic conditions (Artmann & Sartison, 2018).

Place-based learning emerges from the context in which it is situated; it is multidisciplinary and experiential; it encourages learning beyond the career-ready skills needed to navigate the workforce; it connects place with self and community (Woodhouse & Knapp, 2000). PBEL uses what is familiar, connects science to other fields, provides a local context with global connections (Semken, Ward, Moosavi, & Chinn, 2017), and increases environmental awareness and connectedness to the place (Dolan, 2016). Place is a contextualized location that includes the history, culture, environment, people, politics, and economy to which individuals create attachments and meaning through personal reflection (A. Y. Kolb & Kolb, 2006).

This paper explores changes in student's civic mindedness, environmental scientific literacy, attachment to their home, school, or campus farm, and situated sustainability meaning that they put on a place. This research took place at a private, teaching university in a large, U.S. Midwestern city and collected data from ten different courses. All courses interacted with the campus farm or other local, urban farms as part of a 4-6-week PBEL module that integrated farms as a place for undergraduates to conduct discipline-specific projects (Author). Additionally, faculty were expected to have their students critically reflect upon and discuss the realities of the larger global industrial food system and the relevance of local diversified urban agriculture to the particular focus of the course.

The courses implementing place-based experiential learning were:

1. 400-Level Biology Course (Bio)
2. 400-level Pharmacy Course (Pharm)
3. 400-Level Chemistry Course (Chem)
4. 300 & 400-level Education Course (Ed)
5. 200-level Environmental Studies (Env St)

6. 400-level Business Marketing Course (Mkt)
7. 200-level Ecology and Evolution Course (Eco)*
8. 200-level Ecology and Evolution Course (Eco)*
9. 300-level Communications Course (Comm)
10. 300-level Religious Studies Course (RL)

*denotes courses with same number but taught by different instructors with different content.

Methods

Students were recruited during the first week of courses in fall 2020 and spring 2021 semesters. During the fall, all recruitment took place online, while in the spring it was conducted in-person. A member of the research team visited each class, either via recorded video, Zoom, or in -person, and spoke with students about this project and provided study-informed consent forms. Students were then emailed an individual link via Qualtrics to a pre-survey. Three additional reminder emails were sent to students who had not completed the survey over the next ten days. The research team then visited each course two weeks before the end of the semester to remind students about the research as well as the post-survey. As with the pre-survey, emails were sent via Qualtrics to students with periodic reminders over a 2-week period.

Participants

One hundred and sixty-six students (43% of potential population) completed both the pre- and post-survey. Demographic data by course and combined for the 166 students is provided in Table 1. One student was in two courses and their data were counted in each course but only once in the overall analysis.

Instruments

The pre-/post-Qualtrics surveys that students took were composed of five different surveys. The Environmental Literacy Survey (Liang, Fang, Yeh, Liu, Tsai, Chou, & Ng, 2018) was a national survey developed in Taiwan with a specific focus on Environmental Literacy in undergraduate students. Our version of this scale was composed of 42 questions. The place attachment survey

(Williams & Vaske, 2003), contains two sub-constructs: place identity and place dependence. It examines student's attachment towards the place they call home, Butler University, and the campus farm (or other urban farm in some classes). The situated sustainability meaning-making survey (SSMMS) was created during the Exploration and Design funding of this project to understand students' perceptions towards local farm (Kudryavtsev, Krasny, & Stedman, 2012; Stedman, 2002; Young, 1999). The survey was developed because there was no previous survey instrument for this purpose. The SSMMS was designed with sub-constructs for sustainability's main aspects of environmental, social, and economic themes. The Civic-Minded Graduate (CMG) survey (Steinberg, Hatcher, & Bringle, 2011) is used in this research in its unidimensional format. The survey focuses on students' knowledge, skills, disposition, and behavioral intentions towards civic participation.

Results

Seventy-six and one-half percent of students responded on the pre-survey that they were aware that [School] had an urban farm (Figure 1) while only 36.75% had previously visited the farm.

Cronbach's Alpha was run on each of the pre- and post-constructs to look at internal consistency and all $\alpha>0.90$ (see Table 2).

Paired-sample t-tests were run for all students for each instrument using SPSS v27 and Cohen's d was calculated to determine effect size. Table 3 provides the pre- and post means.

Table 4 provides the results of the paired sample t-tests and Cohen's d. All assessments showed statistically significant increases with small to moderate effect sizes.

Discussion

The above results strongly suggest that our farm-based PBEL framework has statistically significant impact on students in a variety of disciplines as measured by our instruments. In this discussion, we will use themes from our initial analysis of qualitative data (i.e., focus groups) to attempt to explain and/or expand upon why there was statistically significant change across constructs.

Change Across Constructs

Near the end of the Spring 2021 semester, three focus groups and an interview of 60-90 minutes each were conducted. The interview was conducted with a student from the second 200-level ecology course. One focus group was comprised of all students in the 300-level religious studies course. The other two focus groups included students representing every course except the chemistry, environmental studies, and pharmacy courses. Within these qualitative data, we identified themes that deepened our understanding of the quantitative results.

Civic-Mindedness

When students spoke about civic engagement, it was often discussed relative to two different contexts: 1) care for the environment (i.e., environmentalism) and 2) U.S. civil unrest and national protests against police brutality. For the former, students often expressed concerns

around, and interest in personally addressing their own role in, anthropogenic climate change and unsustainable food systems. The students in the religious studies course also brought up a deeper problematization when they discussed the relation between worldviews (e.g., subject-object vs subject-subject) and human interaction with the environment. With the latter, students articulated connections between current social justice issues and their own thoughts on, and intended actions within, civil society. In short, it seems that the PBEL farm modules, when situated in relation to the complexities of the pandemic period, produced a learning environment that was particularly effective at increasing pro-environmental thought and action, as well as the willingness to engage in social justice issues, such as food (in)security.

Sense of Place

Discussions around sense of place – place attachment, place dependence, and situated sustainability meaning-making -- introduced new articulations of place attachment and what contributes to the constitution of that attachment. First, Spring 2021 students were the first cohort to extensively elaborate on the important role our social relations play in the formation of our place attachments. Considering what students had to say about their experiences throughout the pandemic, this new focus on social relations was, in part, due to the isolation and other stressors associated with the Covid-19 pandemic. Secondly, students reporting having taken multiple classes with PBEL farm modules demonstrated the ability to describe the transferability of their place attachment to the campus farm into other ecological, environmental, and food systems contexts. Finally, this cohort of students articulated the role of reciprocity in their formation of place attachment. This means that students were grappling with complex ideas around their responsibilities and their indebtedness to what they receive from the places with which they

interact. In other words, some students expressed that they wanted to "give back" to places that have impacted their lives. In sum, it appears that increases in the sense of place constructs were related, in part, to life experiences during the pandemic that foregrounded the situatedness of student social relationships. However, it is important to note that not only did the scores increase, but students also shared new articulations of their place attachment that included social dimensions, as well as attachment transferability and reciprocity.

Environmental Science Literacy

While the effect size was in the small to medium range, there was still a statistically significant increase in student environmental science literacy. It is difficult to ascertain from the focus group data the depth of students' environmental science literacy; however, it is clear from this data that 1) their appreciation for the environmental sciences and the environment in general increased and 2) their confidence in their own abilities to make a difference and have a positive impact on the environment increased. In sum, our preliminary analysis reveals that the PBEL farm modules provided an educational environment in which knowledge of, and appreciation for, the environment could be constructed and student empowerment to aspire to ecologically sustainable actions could be realized.

Table 1. Student Demographic Data by Course and Overall.

	Bio	Pharm	Chem	Ed	Env St	Mkt	Eco1	Eco2	Comm	RL	Total
Gender											
Female	7	20	6	18	9	17	9	3	5	12	105
Male	3	10	1	0	4	21	4	10	1	5	59
Unidentified	0	2	0	0	0	0	0	0	0	0	2
Race/Ethnicity											
White	7	28	6	17	13	33	11	10	6	15	145
Non-White	3	4	1	1	0	5	1	3	0	2	20

Unidentified	0	0	0	0	0	0	1	0	0	0	1
Level											
Freshman	0	0	0	0	5	0	5	8	0	1	19
Sophomore	0	1	0	1	5	0	2	4	0	2	15
Junior	3	7	3	12	1	0	4	1	2	1	33
Senior	7	20	4	5	2	38	2	0	4	13	95
Professional	0	4	0	0	0	0	0	0	0	0	4
Total	10	32	7	18	13	38	13	13	6	17	167

Table 2. Cronbach's Alpha for Pre- and Post-Assessments

Assessment	**Pre**	**Post**
CMG	.904	.937
Environmental Scientific Literacy	.954	.971
Home Place Attachment	.909	.909
[School] Place Attachment	.932	.930
Farm Place Attachment	.973	.950
SSMMS	.962	.974

Table 3. Pre- and Post-Assessment Means for all Courses Combined.

	Mean	**N**	**Std Deviation**	**Std. Error Mean**
CMG Pre	112.7470	166	13.49733	1.04760
CMG Post	120.5964	166	14.20669	1.10265
Env. Sci. Literacy Pre	168.2590	166	20.63534	1.60161
Env. Sci. Literacy Post	173.5482	166	23.83340	1.84983
Home Place Attachment Pre	41.8313	166	9.10454	.70665
Home Place Attachment Post	45.2952	166	8.57853	.66582
Butler Place Attachment Pre	41.1145	166	9.85250	.76470
Butler Place Attachment Post	44.4096	166	9.52577	.73934
Farm Place Attachment Pre	29.3072	166	10.09750	.78372
Farm Place Attachment Post	32.8133	166	8.96701	.69598
SSMMS Pre	81.5904	166	11.55124	.89655
SSMMS Post	87.5663	166	11.35242	.88112

Table 4. Paired Sample t-test Results for all Courses Combined.

	95% Confidence Interval Difference

	Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	Sig (2-tailed)	Cohen's d
CMG Pre-Post	-7.84940	11.87491	0.92167	-9.66919	-6.02961	-8.516	165	0.000	.661
Env. Sci. Literacy Pre-Post	-5.28916	16.06353	1.24677	-7.75084	-2.82747	-4.242	165	0.000	.329
Home Attachment Pre-Post	-3.46386	9.78288	0.75930	-4.96305	-1.96466	-4.562	165	0.000	.654
Butler Attachment Pre-Post	-3.29518	8.25449	0.64067	-4.56015	-2.03021	-5.143	165	0.000	.399
Farm Attachment Pre-Post	-3.50602	9.48923	0.73651	-4.96022	-2.05183	-4.760	165	0.000	.369
SSMMS Pre-Post	-5.97590	10.80962	0.83899	-7.63244	-4.31936	-7.123	165	0.000	.553

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