Paper Title Using Place for Developing Learners: Early Findings From the Integration of a Campus Farm

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ABSTRACT

Having a STEM literate society, capable of questioning and being caring and compassionate citizens of the world is vital in a global society. This project utilized place-based education (PBE) and experiential learning, via a campus or community farm, to provide college students with contextual learning experiences that enhanced content knowledge, course engagement, critical thinking skills, and civic mindedness. The research in this paper focuses on the outcomes of a second year ecological biology course, at an urban institution, that integrated an approximately six week lesson incorporating the college's urban farm. When compared to a control group, derived of students from the previous year, students in the treatment group had greater attachment to the farm, greater knowledge around civic activities, and statistically significant increases in scientific literacy skills.

INTRODUCTION

Place-based experiential (PBE) learning allows students to connect and identify with the particular environment in which they are interacting. These place-based experiences can increase student engagement in the learning process, as well as their attachment to the learning space and the meaning they place on said space (Powers, 2004). The experiential learning model is designed such that students are reconstructing content gained from their learning experience in a particular environment to generate knowledge. Thus, exposing students to PBE learning opportunities transcends the classic, static classroom setting and allows for students to identify at a deeper level with their research and its applicability to broader, real-world problems and solutions.

The true goal of education is creating learners with the ability to apply learned knowledge in new contexts (Kober, 2015). While American adults' knowledge of science facts has improved, only 25% of the population possesses scientific literacy (Board, 2002; J. Miller, 2012; J. D. Miller, 2004; Ross, Hooten, & Cohen, 2013). This low rate, can result in an uninformed decision making process done through the use of ideas informed by values and perceptions and not critical thinking skills (Impey, Buxner, Antonellis, Johnson, & King, 2011; Lindeman & Aarnio, 2007). Critical engagement within the learning environment is necessary to create a citizenry with the skills to effectively transfer knowledge (Bramble, 2005). By utilizing a local environment from which students can build attachments and meanings, situated experiences can create learning while increasing civic-responsibility and action (Borden & Serido, 2009; Colby, Beaumont, Ehrlich, & Stephens, 2003; Harkavy, 2006; Youniss, McLellan, & Yates, 1997).

PBE learning can provide a cross-disciplinary approach to foster academic achievement and engagement. It can be used to effectively train the next generation of global professionals (Sobel, 2004; Stedman, 2002). Because PBE learning has a specific geography, ecology, sociology, and politics based upon a specific location, it allows students to connect the with the location (Orr, 2004; Smith & Williams, 1999), enhance ties to their community, create greater appreciation for nature, and develop a heightened commitment to serving as active, contributing citizens (Sobel, 2004; Stedman, 2002). This is particularly true when the learning is placed within school gardens or campus farms (Angstmann, Rollings, Fore, & Sorge, 2019).

However, even with their interdisciplinary potential, current instruction implemented within these farms is primarily in courses for agriculture or sustainability majors, independent projects, and/or co-curricular activities. This shortcoming minimizes the role agriculture spaces can hold within cross-curricular learning to build scientific literacy, civic mindedness, and interdisciplinary collaboration. By utilizing a campus farm or school garden within the PBE learning environment, students can develop an ecological and community identity allowing them to reflect on the impact of their choices and the impact their knowledge generation has on real people and their communities (Thomashow, 1996).

The overall goal of this project is to implement and assess a cohesive program of interdisciplinary urban agriculture-themed PBE modules in four university courses using a campus farm as a hub for learning and collaboration. Pre- and post- surveys, classroom observations, and focus groups were utilized to understand the impacts of the program on student content knowledge, critical thinking, place attachment, and civic mindedness. As a means to train the future STEM workforce, this project will determine the impacts of a themed PBE pedagogy implemented across institutional curriculum in fostering scientific literacy, civic mindedness, and interdisciplinary collaboration among STEM and non-STEM majors. For this paper, we focus specifically on the quantitative data and course evaluations of a biology and ecology course and the associated findings around this course.

METHODS

Data were collected in the fall of 2016 (Baseline) and fall 2017 (Treatment) for the course. During the baseline year, faculty taught the course in the traditional way it had been taught which did not include the lesson incorporating the farm. During the second or treatment year, faculty implemented the lesson that integrated the urban farm into the course. During the last ten minutes of the first class meeting each semester, representatives of the research team presented students with information about the research being conducted and the potential for their participation. This included 5 extra credit points at the end of the semester if at least 80% of all students in their section completed the pre- and post-surveys. Students who agreed to participate in the research, by signing the IRB consent form, were sent an email with an individual link to an online version of the surveys in Qualtrics. Two reminder emails were sent over the following 10 days to students who had not yet completed the survey. For the post-surveys, the research team visited each section two weeks before the end of the semester to remind students about the surveys and the potential extra-credit. As with the pre-surveys, students were sent individual links for the surveys with two follow-up emails being sent to students who hadn't completed the survey during the following 10 days. Faculty provided course evaluation (open-ended questions) from the treatment year. Student demographic data were provided by the office of institutional research and assessment and matched to the participating students using identification numbers provided by that office.

Instruments

Three different surveys were utilized to collect data: the Civic-Minded Graduate Survey (CMG) (Steinberg, Hatcher, & Bringle, 2011), the Test of Scientific Literacy Skills (TOSLS) (Gormally, Brickman, & Lutz, 2012), and a place meaning and place attachment survey (Semken & Freeman, 2008). The Civic-Minded Graduate (CMG) survey has four primary domains: knowledge, skills, dispositions, and behavioral intentions (Steinberg et al., 2011).
TOSLS originally was designed with 28 questions focused on 9 skills. A modified version of TOSLS was utilized in this research that included 22 questions and 7 skills. The constructs kept included:

1. Identifying a valid scientific argument (3 questions)
2. Conducting an effective literature search (5 questions)
3. Evaluating the use and misuse of scientific information (3 questions)
4. Understanding elements of research design (4 questions)
5. Solve problems and interpret graphical representation of data (4 questions)
6. Understand and interpret basic statistics (3 questions)
7. Justify inferences, predictions and conclusions based on qualitative data (2 questions) (Gormally et al., 2012).

The place attachment survey (Semken & Freeman, 2008) contains two sub-constructs: place identity and place dependence. The place meaning survey was designed specifically for this project to explore students' perceptions towards urban farms with sub-constructs for sustainability's main aspects of environmental, social, and economic themes.

Sample

Fifty-six students completed surveys in the baseline year while 52 completed surveys in the treatment year. Gender/sex (Table 1), race/ethnicity (Table 2) and student level (Table 3) information for students who completed the survey for each year are provide below. A Chi-squared test showed no statistically significant difference in any area between the two years.

INSERT Tables 1-3

Table 4 provides the cumulative GPA of the students who completed the survey. An independent samples t-test showed no statistical difference between group GPAs.

INSERT TABLE 4

RESULTS

CMG

Independent samples t-tests were run using SPSS v 25 to compare scores between the baseline and treatment groups for each of the four domains the CMG and the overall score. Table 5 provides the mean, standard deviation, and standard error mean for each group on all domains and overall score.

INSERT TABLE 5 HERE

While the treatment group had higher mean scores for all domains as well as the total score, only the knowledge domain was statistically significant ($t(106)=-2.187$, $p<.05$). Table 6 provides additional output from the t-tests.

INSERT TABLE 6

Place Meaning/Place Attachment

The place attachment/place meaning survey was given only to the treatment group. The surveys were analyzed via SPSS v25. Cronbach's alpha was run for both pre-place identity ($\alpha=0.902$) and post- place identity ($\alpha=.932$), pre-place dependence ($\alpha=0.920$), post-place dependence ($\alpha=.876$), overall pre-place attachment ($\alpha=0.937$), and post-place attachment ($\alpha=0.950$). The overall alpha for the pre-place meaning was 0.937 and for the post-place meaning was 0.952. Thus, overall place attachment and sub-constructs as well as overall place meaning constructs were highly reliable.

A paired samples t-test showed a statistically significant difference in place attachment scores for pre-implementation ($M = 25.53$, $SD = 7.22$) to post- implementation ($M = 29.07$, $SD = 8.71$); $t(29) = -2.53$, $p < .01$ for a one-tailed test with a power of 0.796 and an effect size of 0.46.

TOSLS

ANCOVA's were run to compare post-TOSLS results between the baseline cohort and the treatment cohort on overall scores and each skill. No statistically significant difference was found between the post-scores overall or for any of the skills. However, the treatment group did show a statistically significant gain in their overall score increasing from a 15.56 (70.73%) average on the pre-TOSLS to a 16.63 (75.59%) on the post.

DISCUSSION

These findings suggest integrating an urban farm into a biology course can enhance student knowledge as it relates to civic-mindedness, place-meaning, place-attachment, and potentially better enhance student knowledge towards research design. However, greater gains may be found upon further revision and enhancement of the lessons. Student comments such as "I like that we often got to go outside and explore in a less traditional lab setting as it kept the course casual and emphasized the diversity in biology…" expressed the enjoyment students got out of being able to apply their classroom skills around the urban farm.

Several students expressed a desire to have been more involved with the farm and to have had more time to learn about the farm, the people who worked there, and what was done at the farm. By modifying the lessons to allow for more time to interact with the farm and allow students to apply their classroom learning there, additional gains may be made not only in the students attachment to the farm but their civic-mindedness and scientific literacy as well.

These findings suggest that the integration of urban outdoor spaces into educational setting can not only enhance student scientific thinking, attachment to such places, but civic mindedness as well. Further research should be conducted to better investigate the relationship between place and civic-mindedness as well as with expansion outside of STEM focused courses.

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Table 1. Gender/Sex.

	Females	Males
Baseline	41 (71.9%)	16 (28.1%)
Treatment	35 (67.3%)	17 (32.7%)

Table 2. Ethnic Breakdown.

	Non-White	White
Baseline	6 (10.5%)	51 (89.5%)
Treatment	11(21.2%)	41 (78.8%)

Table 3. Student Level.

	First-Year	Sophomore	Junior	Senior
Baseline	1 (1.8%)	31 (54.4%)	22 (38.6%)	3 (5.3%)
Treatment	1 (1.9%)	32 (61.5%)	15 (28.8%)	4 (7.7%)

Table 4. Cumulative GPA

	N	Min	Max	Mean	Std. Dev
Baseline	56	2.408	4.000	3.57561	.431254
Treatment (Year 2)	52	2.591	4.000	3.46421	.369969

Table 5. Domain Means by Year.

	Year	N	Mean	Std. Deviation	Std. Error Mean
Knowledge	Baseline	56	27.9821	6.43143	.85944
	Treatment	52	30.6731	6.34227	.87951
Skills	Baseline	56	26.8214	5.52715	.73860
	Treatment	52	27.5577	6.08248	.84349
Disposition	Baseline	56	29.8571	6.45383	.86243
	Treatment	48	31.1250	6.30307	.90977
Behavioral Intentions	Baseline	56	9.4107	2.59914	.34732
	Treatment	52	9.8462	2.42846	.33677
Total	Baseline	53	93.8868	19.28198	2.64858
	Treatment	48	97.8125	18.72836	2.70321

Table 6. t-test Findings

	t	df	Sig (2-tailed)	95% confidence interval of the Difference	
				Lower	Upper
Knowledge	-2.187	106	.031	-5.13022	-.25165
Skills	-.659	106	.511	-2.95115	1.47862
Disposition	-1.010	102	.315	-3.75890	1.22318
Behavioral	-.898	106	.371	-1.39702	.52614
Total Score	-1.036	99	.303	-11.44589	3.59447