DOES AGRITOURISM INCREASE CHILDREN'S AGRICULTURAL LITERACY? PRELIMINARY INSIGHTS

DOES AGRITOURISM INCREASE CHILDREN'S AGRICULTURAL LITERACY? PRELIMINARY INSIGHTS

INTRODUCTION

Over the years, the connection between food producers and consumers has weakened, to the point that many citizens, especially children, do not know where their food comes from. Increasing the agriculture literacy of citizens can help narrow this gap, which is critical considering the socio-economic and environmental vulnerability of food systems (Powell et al., 2008). Agricultural literacy comprises the knowledge and understanding of agricultural concepts and processes individuals need to make informed decisions and participate in civic, cultural, and economic affairs (Meischen & Trexler, 2003). Hence, increasing agricultural literacy can help individuals and communities transition to more sustainable food systems (Meek et al., 2017). Research into strategies to build agricultural literacy is crucial to achieving food security and sustainable agriculture–top priorities of the sustainable development goals (Mbow, 2019).

Tourism has the capacity to become an agent of social change, notably by educating tourists on a variety of issues (Higgins-Desbiolles, 2006). For example, nature-based tourism experiences strengthen tourists' environmental knowledge, which may lead to inclinations towards nature conservation attitudes and behaviors (Ardoin et al., 2015). Agritourism—defined as visiting a working farm for education or recreation (Gil Arroyo et al., 2013)—has the capacity to build agricultural literacy by facilitating the direct engagement with agricultural landscapes through hands-on activities (Barbieri et al., 2018). Thus, agritourism may be an effective means to restore the relationship between food producers and consumers.

Although elevating the agricultural literacy across citizens is needed, it is particularly urgent to educate them at an early age (Meischen & Trexler, 2003) because the prime years of cognitive flexibility can influence life-long engagement and interest in food systems (Gopnik et al., 2017). Measuring the potential of agritourism to build agricultural literacy in children may help determine the best strategies for early intervention. Furthermore, investigating the suitability of agritourism as a learning space for children is opportune because farm visits occur in family leisure and in elementary school environments (Hess & Trexler, 2011).

Despite the multiple opportunities nested in agritourism to advance pedagogical tourism scholarship, the knowledge gap persists. Thus, we seek to address this gap by measuring the influence of agritourism experiences on agricultural literacy with an emphasis on local foods among children in upper-elementary school. Through a pre-post quasi-experimental design, we account for three possible learning contexts: farm visits with families, school-based field trips, and virtual farm visits. Doing so will contribute to a full assessment of the pedagogical potential of agritourism in different contexts (Barbieri et al., 2018).

LITERATURE REVIEW

Agritourism appears as an appropriate space for experiential learning about agriculture, local foods, and local food systems (Halpenny & Yan, 2021). Farmers frequently see education as a major driver of agritourism development agriculture (McGehee & Kim, 2004). Farmers' interest in increasing tourists' knowledge on rural and agricultural topics and building connections

between producers and consumers is so strong (Liang, 2017) that education has become part of their identity as farmers and agritourism operators (Ohe, 2018).

Agritourism lends itself particularly well to reaching a wider audience, as farm education provides an authentic learning environment that "does encourage learning and support learners who differ in their learning preferences" (Smeds, Jeronen, & Kurppa, 2015, p. 400). Furthermore, the social interactions centered on collective enjoyment and shared experiences occurring in agritourism spaces foster family and peer-to-peer learning opportunities (Liang, 2017) that contribute to informal education about food and agriculture. In this context, agritourism as an agricultural literacy medium can serve to foster a lifelong learning process beyond the school-based experience (Mars & Ball, 2016).

With the COVID-19 restrictive measures in the U.S., school field trips to farms were canceled in many states, including North Carolina. This limited children's educational gains through agritourism experiences and resulted in significant income losses for farmers who typically host school-field trips. Consequently, some agritourism operators developed virtual farm visits as an option to in-person field trips. There is scant knowledge about the virtual school field trips' educational impact on children (Dillon et al., 2003), which deserves further scrutiny as they may contribute to expanding the access to agricultural knowledge when there are economic, spatial, or even temporal limitations for school-field trips.

As interest in expanding the knowledge about tourism educational potential has arisen, so have the challenges regarding the methods to measure it, mainly related to spatio-temporal limitations such as difficulties controlling for the times elapsed between the experience and survey administration (Ardoin et al., 2015). An additional challenge is the "ceiling" effect—the existing knowledge of tourists about a topic—which complicates detecting a further increase in knowledge after the experience as tourists (Ballantyne et al., 2011). Quasi-experimental designs that capture before-and-after knowledge status can control for these methodological limitations.

RESEARCH METHODS

We assessed the educational gains of agritourism experiences via a pre-post quasi-experimental design across three treatments: children visiting farms with their family on weekends (Family Visit; Treatment 1), children visiting farms with their teacher in school fieldtrips (School Visit; Treatment 2), and virtual farm experiences with their teachers (Virtual Visit; Treatment 3). We used the same questions across all the treatments which were pilot tested and validated (Brune et al., 2020). We operationalized agricultural literacy as the knowledge regarding agriculture and local food systems in North Carolina. The questions gauged knowledge with six items inquiring about local crops' seasonality, weather, and commercialization (Martinez et al., 2010), which were measured as dichotomous variables (correct=1, incorrect=0). The survey also gauged children's demographics.

Sampling and Data Collection

We chose six farms located across the three regions of North Carolina as study sites based on their facilities (e.g., availability of parking for buses), seasonality (i.e., opened throughout the school year), and farmers' willingness to collaborate with the study. We sampled children

between the ages of 9 and 13 years old given the importance of early intervention to sway learning trajectories (Gorey, 2001).

For data collection, we followed different procedures according to the study treatments. For Family Visits (Treatment 1), we collected data among families visiting a farm for recreation during two major agritourism seasons (Fall 2018; Spring 2019) following a target interception procedure (i.e., families composed of at least one parent accompanied by at least one child in the target age). We collected 269 usable pre-post matched surveys.

To recruit participants in the remainder treatments, we contacted schoolteachers from fourth to sixth grade across North Carolina and gauged their interest in participating in the study. This resulted in partnerships with 47 teachers located at 42 schools across the state. To control for self-selection bias of teachers already engaged in agricultural literacy efforts, teachers were assigned randomly to be either School Visits (Treatment 2) or the Control Group (no agritourism experience). The Virtual Visits group (Treatment 3) resulted as an adaptive strategy when COVID-19 hindered the possibility to continue school trips and were replaced with an activity composed of a pre-recorded video of the farm with content usually offered during the school field trips (e.g., pollination) following a question-and-answer session with the farmer through Zoom. Data collection for Farm Visits occurred during the fall of 2019 (n = 113), for Virtual Visits from fall of 2020 to spring of 2021 (n = 158) and for Control Group from spring of 2019 to fall of 2021 (n = 41).

Data Analysis and Sample Description

We analyzed data collected using descriptive statistics to illustrate the demographic composition of respondents and their agricultural literacy scores. We then contrasted pre and post scores across all types of agritourism experiences (no control group) using the McNemar test, corrected for continuity. We used a paired t-test for comparing the pre and post responses using a composite score constructed by adding all correct responses, thus ranging from 0 (no correct answers) to 6 (all answers correct). Next, we conducted a Multivariate Analysis of Variance (MANOVA) to contrast changes in agricultural literacy across treatments, using Wilks's lambda given its suitability to compare more than two groups (Garson, 2012); we ran an Analysis of Variance (ANOVA) to contrast changes in the knowledge index across treatments. All statistical analysis were set at 5% critical value ($p < 0.05$).

Participating children had similar gender (51.6% girls) and age distribution across the 8-9 years old (39.8%), 10-11 years old (37.0%), and 12-13 years old (23.2%). Very few (n = 107) provided their racial and ethnic background. Among those, 47.7% were White, followed by Asian (24.3%) and Indigenous (21.5%); a small proportion were Black (2.8%) or multiracial (0.7%). A small proportion (3.1%) reported being Latin.

RESULTS

Results indicate an increase in agricultural knowledge in all six topics assessed after each type of agritourism (Family, School, Virtual) experience (Table 1). However, such an increase was only statistically significant in three items (i.e., type of crop by region; effect of weather; effect of

season). The aggregated agricultural knowledge score also showed a significant increase after the different modalities of agritourism experience.

Table 1. Paired comparisons (post vs pre) across all types of agritourism experiences (family visits, school visits, virtual visits)

Knowledge Indicators	**Pre Visit**	**Post Visit**	**Statistics**	***p*-value**
Match Food with Crop (n = 530) [1]			$x^2 = 3.684$	0.055
Correct (%)	71.6	75.4		
Incorrect (%)	28.4	24.6		
Source of Energy for Crops (n = 536) [1]			$x^2 = 0.105$	0.746
Correct (%)	83.1	84.0		
Incorrect (%)	16.9	16.0		
Type of Crop by Region (n = 533) [1]			$x^2 = 4.793$	0.029
Correct (%)	78.2	82.1		
Incorrect (%)	21.8	17.9		
Effect of Weather – NC Scenario (n = 525) [1]			$x^2 = 7.474$	0.006
Correct (%)	71.0	76.5		
Incorrect (%)	29.0	23.5		
Effect of Season – NC Crops (n = 526) [1]			$x^2 = 5.879$	0.015
Correct (%)	72.8	78.6		
Incorrect (%)	27.2	21.4		
Local Production (n = 452) [1]			$x^2 = 2.258$	0.133
Correct (%)	55.5	59.9		
Incorrect (%)	44.5	40.1		
Aggregated Knowledge (0 – 6; *n* = 427) [2]				
Index (mean)	4.42	4.66	$t = -4.484$	< 0.001

[1] Measured as dichotomous: Correct (1), Incorrect (0). Analyzed with McNemar tests, continuity corrected ($p < 0.05$).

[2] Constructed by adding all correct responses, thus ranging from 0 (no correct answers) to 6 (all answers correct). Analyzed with paired *t*-test ($p < 0.05$).

When comparing the agricultural educational outcomes across all four treatments, results indicated comparable gains, as only two items showed significant differences (Table 2). Specifically, family farm visits had a higher impact on children's knowledge when asked to match a food with the source crop (tortilla chips with corn) than children in the control group (0.41 vs. 0.86; $p = 0.014$). Increased knowledge on the type of crop by region was significantly higher among children receiving a virtual farm visit (1.04) than those visiting the farm with their families (0.81; $p = 0.006$). When contrasting all aggregated agricultural knowledge gains, children receiving a virtual agritourism experience showed a significantly higher increase (0.52) than those visiting the farm with their family (0.16) or their teacher (0.00; $p = 0.002$).

Table 2. Agricultural knowledge change across treatments

Knowledge Change (post – pre)	Control Group (*n* = 32)	Family Visit (*n* = 191)	School Visit (*n* = 95)	Virtual Visit (*n* = 141)	*F*	*p*-value
Individual Indicators Change [1]						
Match food with crop	0.41 [a]	0.86 [b]	0.78	0.74	3.557	0.014
Source of energy for crops	0.91	0.81	0.88	0.94	1.110	0.345
Type of crop by Region	1.06	0.81 [a]	0.90	1.04 [b]	4.256	0.006
Effect of weather – NC scenario	0.94	0.85	0.74	0.94	1.331	0.264
Effect of season – NC crops	0.97	0.87	0.71	0.91	1.669	0.173
Local production	0.62	0.65	0.60	0.63	0.067	0.978
Aggregated Knowledge Change [2]						
Index	0.47	0.16 [a]	0.00 [a]	0.52 [b]	4.960	0.002

[a, b] Different superscripts indicate significant differences in post hoc pairwise comparisons.
[1] MANOVA statistics: Wilks's lambda = 0.925; $F = 1.972$; $p = 0.009$.
[2] ANOVA test ($p < 0.005$) .

DISCUSSION AND CONCLUSION

Given the significantly positive impact of agritourism on agricultural literacy, this study confirms previous speculations about the potential of agritourism to produce educational outcomes (Barbieri et al., 2018), especially among children. Although few significant results were found, overall results indicate that family farm visits have a higher impact than school visits, while virtual visits seem to produce the most educational gains. Virtual agritourism experiences' impact on children's knowledge can be related to the engaging quality of the videos paired with the Zoom sessions. As virtual tourism experiences occurred during times of at-home schooling due to the COVID-19 pandemic, its impact may also be related to being regarded as a novel activity during the lockdown that increased children's attention and fostered their ability to concentrate on the content.

The relatively small impact of agritourism experiences on agricultural literacy regarding local food reveals the challenging task of measuring knowledge gain in the context of tourism experiences. It is worth noting that our survey instrument measured agriculture literacy and local food systems knowledge gains in general rather than the specific thematic discussed during the visit (e.g., pollination). An additional caveat stems from limitations in accounting for the time elapsed between the experience and the post-survey or between the pre-survey and the post-survey in the case of the control group, as this may have influenced how much children remember about the experience or the pre-survey (Ardoin et al., 2015) or just increased knowledge throughout the academic year. Yet, results might also indicate that agritourism operators' well-intentioned programming may need further refining with clear-cut take-aways messaging focused on local food systems.

Overall, this study results indicate that agritourism can be a space where children can acquire first-hand knowledge about the farm's connection to social, economic, and ecological systems and foster a food system bond. More analytical effort is needed to identify whether increased agricultural knowledge is associated with other family attributes, such as family household

income, type of school, or family bonding with agriculture. It is of utmost importance to continue this line of research to further promote the educational gains of agritourism experiences to provide students with a fuller picture of the relationship between agriculture, food systems, and community well-being, as well as a motivation to engage in these systems (Meischen & Trexler, 2003). Future research should assess the impact of agritourism experiences on other constructs such as attitudes and behaviors towards agriculture and local food systems.

REFERENCES

Ardoin, N. M., Wheaton, M., Bowers, A. W., Hunt, C. A., Durham, H., Ardoin, N. M., Wheaton, M., Bowers, A. W., & Hunt, C. A. (2015). Nature-based tourism's impact on environmental knowledge, attitudes, and behavior: A review and analysis of the literature and potential future research. *Journal of Sustainable Tourism*, *23*(6), 838–858.

Ballantyne, R., Packer, J., & Sutherland, L. A. (2011). Visitors' memories of wildlife tourism: Implications for the design of powerful interpretive experiences. *Tourism Management*, *32*(4), 770–779.

Barbieri, C., Stevenson, K. T., & Knollenberg, W. (2018). Broadening the utilitarian epistemology of agritourism research through children and families. *Current Issues in Tourism*, *22*(19), 1–4.

Brune, S., Stevenson, K. T., Knollenberg, W., & Barbieri, C. (2020). Development and validation of a children's agricultural literacy instrument for local food. *Journal of Agricultural Education*, *61*(3), 233–260. https://doi.org/10.1016/j.appet.2020.104848

Dillon, J., Rickinson, M., Sanders, D., Teamey, K., & Benefield, P. (2003). *Improving the understanding of food, farming and land management amongst school-age children: A literature review*. National Foundation for Educational Research and King's College London, Research Report RR422; Nottingham: DfES Publications.

Garson, D. (2012). *GLM Multivariate, MANOVA, and MANCOVA.* Blue Book Series. Statistical Associates Publishing.

Gil Arroyo, C., Barbieri, C., & Rozier Rich, S. (2013). Defining agritourism: A comparative study of stakeholders' perceptions in Missouri and North Carolina. *Tourism Management*, *37*, 39–47. https://doi.org/10.1016/j.tourman.2012.12.007

Gopnik, A., O'Grady, S., Lucas, C. G., Griffiths, T. L., Wente, A., Bridgers, S., Aboody, R., Fung, H., & Dahl, R. E. (2017). Changes in cognitive flexibility and hypothesis search across human life history from childhood to adolescence to adulthood. *Proceedings of the National Academy of Sciences*, *114*(30), 7892–7899. https://doi.org/10.1073/pnas.1700811114

Gorey, K. M. (2001). Early childhood education: A meta-analytic affirmation of the short- and long-term benefits of educational opportunity. *School Psychology Quarterly*, *16*(1), 9–30. https://doi.org/10.1521/scpq.16.1.9.19163

Halpenny, E. & Yan, N. (2021). Local- and sustainably-produced agriculture products: The role of an agritourism event in informing consumer's intentions and behaviors. *International Conference of the Travel and Tourism Research Association. Uncharted Territory. Reiminagining Tourism for a New Era*. https://scholarworks.umass.edu/ttra/2021/research_papers/48/

Hess, A. & Trexler, C. (2011). A qualitative study of agricultural literacy in urban youth: What do elementary students understand about the agri–food system? *Journal of Agricultural*

Education, *52*(4), 1–12. https://doi.org/10.5032/jae.2011.04001
Higgins-Desbiolles, F. (2006). More than an "industry": The forgotten power of tourism as a social force. *Tourism Management*, *27*(6), 1192–1208. https://doi.org/10.1016/j.tourman.2005.05.020
Kovar, K. & Ball, A. (2013). Two decades of agricultural literacy research: A synthesis of the literature. *Journal of Agricultural Education*, *54*(1), 167–178. https://doi.org/10.5032/jae.2013.01167
Liang, A. R-D. (2017). Considering the role of agritourism co-creation from a service-dominant logic perspective. *Tourism Management*, *61*, 354–367. https://doi.org/10.1016/j.tourman.2017.02.002
Mars, M. & Ball, A. (2016). Ways of knowing, sharing, and translating agricultural knowledge and perspectives: alternative epistemologies across non-formal and informal settings. *Journal of Agricultural Education*, *57*(1), 56–72.
McGehee, N. G. & Kim, K. (2004). Motivation for agri-tourism entrepreneurship. *Journal of Travel Research*, *43*(November), 161–170. https://doi.org/10.1177/0047287504268245
Meek, D., Bradley, K., Ferguson, B., Hoey, L., Morales, H., Rosset, P. & Tarlau, R. (2017). Food sovereignty education across the Americas: multiple origins, converging movements. *Agriculture and Human Values*, *0*(0), 0. https://doi.org/10.1007/s10460-017-9780-1
Meischen, D. L. & Trexler, C. J. (2003). Rural elementary students' understanding of science and agricultural education benchmarks related to meat and livestock. *Journal of Agricultural Education*, *44*(1), 43–55. https://doi.org/10.5032/jae.2003.01043
Ohe, Y. (2018). Educational tourism in agriculture and identity of farm successors. *Tourism Economics*, *24*(2), 167–184. https://doi.org/10.1177/1354816617729021
Powell, R. B., Agnew, D., & Trexler, C. (2008). Agricultural literacy: clarifying a vision for practical application. *Journal of Agricultural Education*, *49*(1), 85–98. https://doi.org/10.5032/jae.2008.01085
Smeds, P., Jeronen, E., & Kurppa, S. (2015). Farm education and the value of learning in an authentic learning environment. *International Journal of Environmental and Science Education*, *10*(3), 381–404. https://doi.org/10.12973/ijese.2015.251a