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CHILDREN'S ACQUISITION OF ETHNOBOTANICAL KNOWLEDGE IN A CARIBBEAN HORTICULTURAL VILLAGE

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Subsistence horticulturalists learn considerable local ecological knowledge by early adulthood. We investigate the relationship between children's family environments and learning of their plant environment. In a rural village in Dominica, West Indies, children of ages four through 17 (N = 51) participated in a "plant trail" along a route containing 50 core local plants marked for identification. Plants in question resulted from village adults' freelists on members of local plant domains found via nominal group technique (i.e., trees, staple foods, vegetables, condiments, medicines, and ornamentals). Individual children's ethnobotanical knowledge was assessed through proper plant identification with a local term. Findings indicate that children learn botanical domains differentially. They identify trees and staple crop plants early in life. As they develop, they learn other plant domains, and trees and staples decrease in proportion to total ethnobotanical knowledge. Boys retain a larger proportion of tree knowledge, as tree care is part of the masculine labor division. Children's, especially girls', proportion of medicinal plant knowledge grows steadily into adulthood. As predicted, children with homes in extended family compounds demonstrate more ethnobotanical knowledge than children whose neighbors are not close kin. Contrary to predictions, a father's presence in the household is not an indicator of the children's plant identification ability. Having younger siblings predicts learning more plants. Trees form a smaller proportion of total plant knowledge for family-compound-living children and those with lower birth order, who tend to have greater overall ethnobotanical knowledge. Ethnobotanical learning relates to gender, birth order, and extended kin access.

Keywords: *ethnobotany, child development, social learning, cognitive domains*

Introduction

The long developmental period of childhood, characteristic of the human species, relates to the importance of ethnobiological learning. Unusual among lifeforms, humans adapt to most ecosystems. Childhood allows developing humans time to fill their "baskets of competencies" with varying locally relevant ecological knowledge (Bock 2002:168) before struggling with mating, parenting, or earning a living in their ecosystem (Bock 2010; Flinn et al. 2007; Kaplan et al. 2000). Ethnobiological skills strongly affect individual success in economies with less market involvement. In horticultural communities, every family gardens and gathers plants for subsistence and life essentials. Much horticulturalist ethnobiological knowledge is thus local ethnobotanical knowledge (LEK) (McDade et al. 2007). Adults rely on ethnobotanical knowledge to live, so children must learn LEK.

Interest in children's ethnobiological skill is accelerating, yet remains relatively rare, particularly regarding how and when children learn about their biophysical worlds (Zarger 2011). Botanical competence is a practical form of "embodied

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capital" (Kaplan et al. 2003), or "cultural capital" (Bourdieu 1973, 1986), otherwise termed "experience-based embodied capital" (Bock 2002, 2005, 2010; Gurven et al. 2006). Bourdieu (1973, 1986) asserts that cultural capital is instilled in the home through the process of socialization. But what constitutes "the home" cross-culturally? Children's homes vary from one dwelling containing one nuclear family to multi-generational households to extended-family camps or compounds with several structures. Further, the composition of families varies, not only cross-culturally but within single communities, as is the case throughout the Caribbean (Barrow 2000). Here, we examine the effects of different household composition (in parents, siblings, and extended kin) on children's ethnobotanical learning.

We measure variation in Dominican children's plant knowledge, specifically assessing the impact of a child's age, gender, and household composition on the child's general LEK and on children's modular learning of particular plant domains (c.f. Ellen 2009). How does children's knowledge vary? What is the progression of children's LEK, individually and categorically, by emic plant domain? Which plants are basic, common knowledge and which are indicators of advanced or sophisticated knowledge?

Learning Local Ethnobotanical Knowledge

Some debate surrounds research of ethnobiological learning in small-scale societies. Ethnography of children typically finds "the absence or great rarity of teaching children in the village setting" (Lancy and Grove 2010:145). Children appear to learn predominately on their own, with only indirect teaching (e.g., shame and folktales) (Lancy 1996, 2010), which is perplexing. As long as others' behavior remains successful in an environment, then natural selection should favor social (cultural) learning (from others), as opposed to individual learning (Boyd and Richerson 1988; Kline et al. 2013; McElreath and Strimling 2008). Ethnobotanical learning in particular should be social (taught) because individual trial and error in randomly ingesting or otherwise using the myriad plant species in one's environment could prove deadly as well as inefficient.

Children's acquisition of LEK depends on their developmental stage, as each phase provides a new opportunity for exploration, observation, and learning[1]. Children's individual differences (i.e., health and learning capacities) would also impact acquisition of LEK (Reyes-Garcia et al. 2009).

Children under the age of three begin learning LEK by identifying and acquiring easily attainable resources (Bock 2002, 2010). Tzeltal two-year olds, for example, begin to learn LEK through daily life activities and language learning (Zarger 2010), and can identify common fruits, corn, beans, squash, and wild vegetables that they eat, as well some produce plants (Stross 1973).

LEK increases at ages four and five as children's interest in exploring their environment expands (Munroe and Gauvain 2010), increasing learning opportunities. As children age, they contribute more to the family economy (Hewlett et al. 2011). They engage with their environment, through the "chore curriculum," as they run errands and do scaled-down versions of adult work (Lancy and Grove 2010:154). For example, Hadza children begin to forage and complete chores separately from their parents at age three, and a five-year-old Hadza child collects water, wood, and enough fruit for about half of his/her own calories (Blurton Jones 1993). As they prepare food, Tzeltal women task children with collecting cultivated and non-cultivated plants (Zarger and Stepp 2004). Four-year-old Tzeltal children's botanical vocabularies thus reach nearly 100 terms, and by six they start to distinguish between specific plant types and can identify some medicinal plants (Stross 1973). Dominican children similarly begin running errands at about age four or five, and many (if not most) errands involve fetching or delivering plants or plant parts (roots, fruits, herbs).

Entry into family tasks also initiates children's sexual division of labor. The types of activities that people assign to each gender by age impacts learning LEK. Girls often transition from play to work activities earlier than boys (Lancy 1996; Zarger 2007) and have duties that might provide more opportunities to learn about home plants. Among the Kpelle, five-year-old girls assist their mothers with chores, while boys play until about eight years old, when they begin to accompany their fathers on hunting and trapping trips (Lancy 1996). Play might provide additional opportunities for environmental learning and exploration. In northeastern Thailand, for example, boys spend more time wandering and collecting fruit to eat as they play and can name more plants and animals than girls (Setalaphruck and Price 2007).

By age seven or eight, Dominican children's food chores become more active, as do their opportunities to forage while playing. Children are expert tree climbers and fruit-pickers by middle childhood. In many families, children learn to garden in small plots near their home. These may be mini-provision gardens with dasheen (taro, *Colocasia esculenta*, the primary staple), other tubers, and vegetables, or children may have a section of an existing home garden (door yard garden) to plant, weed, and harvest. We have observed mothers, fathers, grandmothers, grandfathers, aunts, uncles and, most often, older siblings demonstrate gardening techniques for children, including planting seeds and cuttings, weeding, and harvesting. This kind of teaching and learning involves modeling and imitation. It is critical for children to observe these skills well—besides feeding people, all of these gardening skills employ a "cutlass" (machete). Indeed, children, especially little boys age seven and up, regularly stroll the village carrying a cutlass, which they use during play breaks to drink a coconut, cut fruit, etc. (Little girls may carry cutlasses too, but they leave their homes less often [Quinlan et al. 2005]).

Cross-culturally, LEK increases substantially between the ages of nine and 12, reaching adult levels sometime during adolescence (Hewlett and Cavalli-Sforza 1986; Luczaj and Nieroda 2011; Stross 1970; Zarger 2002; Zarger and Stepp 2004). Many children in subsistence societies are masters of their natural environment by the age of 12 (Hewlett and Cavalli-Sforza 1986; Hunn 2008; Stross 1973). Nicaraguan Mayangna and Miskito children learn fishing early in life with knowledge plateauing as young adults (Koster et al. in press). Merriam Island children collect shellfish and other marine items just like adults do (Bliege Bird and Bird 2002) and Aka forager ten-year-olds have the knowledge and skills to thrive in the forest by themselves (Hewlett and Cavalli-Sforza 1986). Tzeltal twelve-year-old children can identify 95% of the plants on a plant walk whereas nine-year-olds identify only 50% of the plants (Zarger and Stepp 2004). Older Tzeltal children can do a variety of cognitive tasks associated with LEK, e.g., organize plants into conceptual use-categories (Zarger 2002), identify plants' morphological features, differentiate edible versus harmful parts of plants, name additional uses for a given plant, and can recognize different plants' growth seasons and patterns (Stross 1973). Dominican boys can usually climb palm trees to pick coconuts by late childhood or adolescence. Adolescent boys and girls are strong enough to pick fruit with long bamboo poles which have knives or hooks attached, while younger children scramble to catch the falling fruits or run down mountainsides after them. Fathers and uncles are often present during tree-fruit picking and children regularly laugh and smile at these events.

Ethnobiological learning depends on contact with one's natural resources (Atran et al. 2004), observations, and experiments in the environment (Atran and Sperber 1991). Formal schooling often comes at the expense of ethnobiological knowledge (Giovannini et al. 2011; Quinlan and Quinlan 2007; Reyes-Garcia et al. 2010; Turner and Turner 2008; see Wyndham 2010 for a different result). As with any educational form, children's LEK learning outcomes vary. Rarámuri children of Tarahumara, Mexico, have great LEK variability by age, though most share knowledge of a core set of culturally and ecologically salient plants (Wyndham 2010). Findings among Dominican adults are similar (Quinlan and Quinlan 2007).

Hunn (2002:604) suggests that children in subsistence communities learn natural environmental knowledge precociously relative to children from industrial, market societies. Zapotec (Hunn 2002, 2008) and Tzeltal (Stross 1973) children know significantly more botanical terms than US children (Dougherty 1979). Dominican horticulturalist children likely know many more plants than industrial children too; however, our aim is to account for intra-cultural variation in children's ethnobotanical acquisition. How might social factors contribute to children's differential rates of learning?

Study Site and Context

The Commonwealth of Dominica is a small island nation in the Lesser Antilles, located between Guadeloupe and Martinique (1078 km southeast of the larger Dominican Republic). The island is mountainous, supports little agriculture or tourist industry compared to other Caribbean islands, and is among the least developed Caribbean islands (Quinlan 2004). Nearly all 72,000 Dominicans (World Bank 2015) are of blended African, European (French and English), and Native American (Island-Carib [Kalinago]) descent (as is true in the study site). Dominicans are bilingual in Creole English and Patwa (or *Kwéyòl*), a French Creole.

This research took place in Bwa Mawego, an eastern (windward) coastal village with between 250 and 380 cm of rain per year, making for lush vegetation. The approximately 500 residents earn their living through subsistence gardening, fishing, growing and harvesting West Indian bayleaf (bay rum, *Pimenta racemosa*; Table 1) and distilling its oil (Macfarlan et al. 2012), and some residents engage in occasional wage labor. Almost everyone gardens, including those with other work. In addition to subsistence gardens at the village periphery, most land within the village is cultivated with fruit trees and other plantings and families maintain house-gardens[2] for ornamental and medicinal plants, as well as vegetables and herbs for cooking.

Table 1. Most commonly recognized plants among rural Dominican children.

Common name in Dominican English	Species name	Total recognized	μ	S.D.
Dasheen	*Colocasia esculenta*	51	1.000	0.000
Banana	*Musa acuminate*	51	1.000	0.000
Cane	*Saccharium officinarum*	51	1.000	0.000
Coconut	*Cocos nucifera*	51	1.000	0.000
Guava	*Psidium guajava*	51	1.000	0.000
Bayleaf	*Pimenta racemosa*	50	0.980	0.140
Lime	*Citrus auruntifolia*	50	0.980	0.140
Tomato	*Lycopersicon escuelantum*	49	0.961	0.196
Rose	*Rosa* ssp.	49	0.961	0.196
Cabbage	*Brassica oleracea.*	48	0.941	0.238
Coffee	*Coffea arabica*	47	0.922	0.272
Orange	*Citrus sinensis*	44	0.863	0.348
Spice	*Cinnamonum zeylanicum*	44	0.863	0.348
Pawpaw	*Carica papaya*	44	0.863	0.348
Glorisida	*Gliricidia sepium*	43	0.843	0.367
Yam	*Dioscorea spp.*	41	0.804	0.401
Pear (Avocado)	*Persea americana*	41	0.804	0.401
Plantain	*Musa* × *paradisiaca*	37	0.725	0.451
Tania	*Xanthosoma sagittifolium*	35	0.686	0.469
Tidite	*Lippia micromera*	33	0.647	0.483
Godite	*Plectranthus amboinicus*	30	0.588	0.497
Sime kontwa	*Chenopoduim ambrosiodes*	29	0.569	0.500
Caster	*Rincus communis*	28	0.549	0.503
Aloes	*Aloe barbadensis*	28	0.549	0.503
Lily	*Dracaena fragrans*	26	0.510	0.505
Ginger	*Zingiber officinale*	26	0.510	0.505
Potato	*Solanum tuberosum*	23	0.451	0.503
Celery	*Apium graveolens*	23	0.451	0.503
Cucumber	*Cucumis sativus*	23	0.451	0.503
Black cotton	*Gossypium barbadense*	22	0.431	0.500
Sive	*Allium schoenoprasum*	19	0.373	0.488
Rosemary	*Rosmarinus officinalis*	18	0.353	0.483
Twef	*Aristolochia trilobata*	18	0.353	0.483
Anise	*Pimpinella anisum*	15	0.294	0.460
Kouklaya	*Peperomia pellucida*	13	0.255	0.440
Planten	*Plantago major*	12	0.235	0.428
Guinea pepper	*Costus* sp.	11	0.216	0.415
Malestomak	*Cordyline fruticosa*	8	0.137	0.348
Malvina	*Lepianthes peltata*	7	0.117	0.331
Vengveng lachewat	*Stachytarphete jamaicensis*	5	0.098	0.300
Koupiye	*Portulaca oleracea*	5	0.098	0.300
Kojourouk	*Petiveria alliacea*	3	0.059	0.238
Japana	*Eupatorium triplinerve*	3	0.059	0.238
Pachuri	*Hyptis pectinate*	3	0.059	0.238
Comfrey	*Symphytum officinale*	2	0.039	0.196

Bwa Mawego is a remote, relatively isolated, self-sufficient village. Its location limits residents' access to the Dominican market system and to biomedicine. A local health center offers inoculations and a short supply of first aid materials and common medications, but the nearest pharmacy is a one-and-a-half-hour drive away. Few villagers own a motor vehicle. Rides are expensive and sometimes difficult to arrange. Hence, villagers rely heavily on herbal home remedies, just as they rely on plants for other practical uses (Reyes-García et al. 2006).

Health depends on local plants in Bwa Mawego. Plants are necessary for craftwork, firewood, food, and medicines. Thus, once a child is weaned, a vital part of subsistence and childcare involves acquiring, processing, provisioning, and administering local plants for one's children, as tends to be the pattern in traditional societies (e.g., see Ember 1983; Meehan et al. 2013 [for mothers]; Murdock and Provost 1973 [see activities]). Among the Aka (Central African forest forager-farmers) plant-based activities—collecting firewood, foraging, field work, carrying food and/or wood, food processing, and cooking—constitute 42.5% of mothers' total caloric energy expenditure (this percentage would likely be greater without the various alloparents inherent in Aka extended family camps, composed similarly to family compounds in Dominica) (Meehan et al. 2013).

People only need medicine occasionally, so the domain of medicinal plants is less central than other ethnobotanical domains in terms of time and energy allocation. Medicinal plant knowledge remains crucial in Bwa Mawego because phytotherapy is periodically consequential for health, and local salient medicinal plants are biologically effective for the conditions that the plants treat. The constituents that have undergone pharmacological assessment are efficacious (e.g., Quinlan 2010; Quinlan and Flores in press; Quinlan et al. 2002) and they are locally meaningful which potentiates healing (Moerman 2002). Among Tsimané Amazonian forager-horticulturalists, maternal local ethnobotanical knowledge correlates with healthier children in terms of growth, weight, and immune function (McDade et al. 2007).

Household structure and composition varies in Bwa Mawego (Quinlan and Flinn 2003). Most children live with their mothers. Some children live with a grandparent(s) with no parent present. No children live with single fathers. Fathers (i.e., both parents) live with their children in about 40% of households. Although most mothers are not in permanent relationships, there are few (around 10%) truly "single" mothers because women often continue to live with their natal families and raise their children with extended family. Over time, a "family compound" of related dwellings may result. The society is matrifocal so that mothers and adult daughters often form the household core (Quinlan 2006). Family compounds are not matrilocal for all people though, as grown sons, their wives, and children may live near the grown son's parents and siblings. A compound may contain father-present and father-absent grandchildren (with or without grandfathers). The majority of village houses are not in family compounds, however. The village is kin-based so that all children live "near" kin, but emotional and geographic distance from non-resident kin varies.

Caribbean gender-culture permeates village socialization. Although Dominican parents say that they treat girls and boys equally, data on several measures (e.g., time allocation, breastfeeding duration, investment in secondary school) point to a female bias in parental investment due to male-specific risk and marginality. Girls get more attention in that they spend more time at home, often working, while boys enjoy more freedom, play more, and spend less time with their parents or kin in their compound (Quinlan et al. 2005).

Garden work tends to have gendered allocation in Bwa Mawego, though it is not strict, as resource flexibility is a strong cultural trait in Dominica (see Mantz 2007). Men (fathers, uncles, and grandfathers) are generally the household's primary subsistence gardeners so that women, especially pregnant ones or mothers with small children, can avoid the steep, slippery clay paths through the bush, as slips result in miscarriages and injuries to little ones (Quinlan et al. 2003).

Women, in the meantime, care more for home gardens (per the norm world-wide) (Brownrigg 1985), except for the home trees. Home gardens include vegetables, cooking herbs, medicinal plants and fruit trees—especially breadfruit (*Artocarpus altilis*), mango (*Mangifera indica*), coffee (*Coffea arabica*), lime (*Citrus auruntifolia*), coconut (*Cocos nucifera*), avocado (*Persea americana*), and guava (*Psidium guajava*). Adolescent and adult females do not climb trees as a matter of propriety (this may change as females wear pants ever more often). Males typically tend the trees.

Predictions for Intra-Village Variation in Children's Ethnobotanical Learning

Our first hypothesis is that *children's plant knowledge will increase with age*. This trend has been evident in the vast majority of examinations of age and intracultural variation of botanical knowledge in children as well as adults (but see Koster et al. in press).

Our next hypotheses stem from the assumption that children gain embodied local ethnobotanical knowledge capital through time with attention from their elders, most likely close kin. Among horticulturalists, much of parenting—especially provisioning, but also home medical care, building, and other chores—entails local plants. Children's plant familiarity will hence reflect their interaction with adults and their degree of kin investment.

In this community, it is rare for a child to live without his or her mother, while most children live without their fathers. A large body of Western-based research establishes that children who grow up without fathers are disadvantaged in a wide range of outcomes, including health, cognitive, and physical development, and education (Sigle-Rushton and McLanahan 2004). Research in this Dominican community demonstrates that children in households with a resident biological father benefit from lower stress levels, better heath, growth (Flinn 2006; Flinn et al. 1999), and longer breastfeeding (Quinlan et al. 2003). Time allocation data in the community shows that children who live with both of their biological parents are better supervised and spend more time engaged in productive activity (Quinlan and Flinn 2003). If children learn more ethnobotanical knowledge from their parents than from more distantly related alloparents, the children in two-parent families would learn more plants. Our second hypothesis is, then, that *father-present children will have greater ethnobotanical knowledge for their age than their father-absent peers*.

Compared to boys, girls in Bwa Mawego tend to receive additional parental investment in terms of breast-feeding, time allocation, and school education (Quinlan and Flinn 2003, 2005; Quinlan et al. 2003). Our third hypothesis is, therefore, that *Bwa Mawegan girls will demonstrate a higher knowledge of the local plants compared to boys*.

Brothers and sisters spend most of their time together (Quinlan et al. 2005) and older siblings are alloparents to the younger ones (Kramer 2011). Siblings teach and learn from one another, so children of larger families have more siblings for teaching, learning, and alloparenting. Fourth, we hypothesize that the *number of siblings children have will correlate with the number of useful plants they know* (alternatively, in smaller families, children may get more adult attention). Elder siblings often act as alloparents in Bwa Mawego, and alloparenting responsibility may require plant knowledge. We predict, then, that *earlier born siblings (i.e., with lower birth order) will know relatively more species for their age than younger ones*.

Finally, we predict that village *children who reside in extended family compound households will display high plant recognition scores during the plant walk due to an increase in available alloparents*. In a large sample of Tsimané adults from the Bolivian Amazon, Reyes-García et al. (2009) examined the cultural transmission of ethnobotanical knowledge and found significant associations between subjects and parents (vertical transmission), and an even larger association with older generations (oblique transmission) in that population. If the same is true in Dominica, extended family households would be advantageous.

Methods

We conducted most fieldwork for this project during the summer of 2010, although it is informed by previous trips to the study site: ten trips for R. Quinlan and eight trips for M. Quinlan between 1993 and 2008, one trip in 2007 by J. Roulette, and four trips between 2008 and 2013 by S. Council. Methodological details follow.

Participant-Observation

We used participant-observation (Musante 2015) to achieve qualitative understanding of the Dominican lifeways and behaviors regarding children and plants. Opportunities for participant-observation with children and plants abound in this community, as both are ubiquitous. Within the participant-observation context, we conducted informal interviews (Bernard 2005). Children especially welcomed opportunities to be experts.

Plant Trail Interview

There is precedence for using the plant trail method to assess children's ethnobotanical knowledge (Hunn 2008; Stross 1973; Zarger 2002; Zarger and Stepp 2004). Setting up a plant trail is a challenge to using the method (see Zarger 2010). Because our sample contained young children who tire easily and have short attention spans, we invested greatly on the front end, designing the plant trail for efficiency (see M. Quinlan n.d.). We kept our interview short in distance and numbers of plants (50 species). We used systematic methods to identify domains of plant knowledge that children should know and to select plants within those domains as prompts. Using nominal group technique (Van de Ven and Delbecq 1972), 10 focus group members listed and consolidated "kinds or categories of plants in the village," into "foods" or "provisions" (i.e., starchy staples, called "provisions" from here forward), "vegetables," "seasonings," "bush medicines," "trees," and "flowers" (i.e., ornamental plants). Then freelists (per Quinlan 2005) with ≥ 20 adults revealed the most salient members of each domain. This groundwork indicated plants that represent an LEK range and increased our short plant trail's validity. Salient species are familiar, while less salient species require more learning.

We expected children's knowledge to vary by domain (per Reyes-Garcia et al. 2013), and to find less knowledge variation on locally-growing food (per Vandebroek and Balick 2012), which includes three of the local domains—provisions (staple starches), vegetables, and trees (most trees in the village proper are food-bearing). Inclusion of common food plants nevertheless encouraged children, increasing their attention span and decreasing their frustration (Fredrickson and Branigan 2005). Meanwhile, we knew that while everyone knows several medicinal plants, there is much intra-village variation in adult phyto-therapeutic knowledge (Quinlan and Quinlan 2007). We biased our interview towards medicinal plants, as they are most diagnostic of local ethnobotany expertise because they have less regular visibility than plants in the other domains (see Nolan 2007).

After determining 50 species to include in the plant trail interview, we found a densely planted route that included most of the plants. Edith Coipel, an elder who is our friend, key consultant, lover of children, and a "focal point" for local ecological knowledge (*sensu* Turner et al. 2013), helped us to map out a route through her own vast home gardens, which contained 42 of the species we sought. Following personal communications from J. R. Stepp and R. K. Zarger, we planted examples of the species not growing in Mrs. Coipel's home garden (e.g., items from bush subsistence gardens) in pots, which we placed along the trail. We tied index cards, numbered 1–50, on each "prompt" plant along the trail, then we wrote our interview schedule in accordance with the marked plants. Figure 1 shows a section of the plant trail.

All plant walks occurred during three days of interviews: one weekend (Saturday and Sunday), and the following Saturday. Children thus saw the trail in about the same state of growth. Fifty-one children, ages 4 to 17, participated in the plant walk. The group contained all the village children (ages 4–17) present during the summer of 2010 whose parents we were able to contact for their assent to prior informed consent. Twenty-five boys and 26 girls comprise the sample. Following Zarger and Stepp (2004), interviewers (S. Council, M. Quinlan, and three local research assistants) walked with children, one at a time, along the route, asking the children if they recognized each numbered plant. If the child did not know the plant's correct name, interviewers were to write down the incorrect name or other identifying info that the child gave about the plant. Unfortunately, at least one interviewer omitted this part of data collection, so we do not have a large enough sample to discuss the kinds of plant identification mistakes children make.

To give back to the community, we wanted the task to be educational. When a child did not know a plant, the interviewer then taught the child the plant's Patwa and English names, perhaps how to recognize it by sight, smell, or touch, and how people in the village use the plant.

At the time of the plant walk, we recorded each child's age, sex, birth order, and number of siblings on his or her interview schedule. We obtained household composition data (father presence or absence, siblings' presence or absence, and whether the child lived in a multifamily compound) from a village census and confirmed with key informants.

Analysis

We used multiple linear regression or Ordinary Least Squares (OLS) regression to tease apart relationships among variables predicting plant knowledge. Initially we used the counts of total correct plant recognition as the dependent

Figure 1. Section of plant trail showing four numbered plants, 34–37 (downhill from top-right to bottom-left, 34 *koupiyé* [*Portulaca oleracea*]; 35, *godité* [*Plectranthus amboinicus*]; 36, plantain [*Plantago major*], in pot because Mrs. Coipel weeded just before we set up the trail; and 37, *chadon beni* [*Eryngium foetidum*]).

variable with children's ages, sex, number of siblings, father presence or absence, and whether the child resides in a family compound as predictor variables. OLS was acceptable rather than Poisson or negative-binomial regression because the mean was relatively high and the distribution approximates a normal distribution.

We also examined differences in children's plant recognition by plant domain as a proportion of total knowledge. Examining proportions of plant domains allows us to roughly assess the pattern of knowledge acquisition through development. All plants were categorized as provisions, vegetables, condiments, trees, medicinals, or ornamentals—the locally salient domains of plants. We examined each category as a proportion of total knowledge to indicate the cognitive pattern of knowledge acquisition over the course of development. Because untransformed proportions (ranging from 0 to 1) are not appropriate for OLS regression, we used a logit transformation of the proportions with the following formula: $y = \ln(p/1\text{-}p)$. We added .001 to the proportion of medicinal plants recognized because several children did not recognize any medicinal plants; hence, adding .001 is necessary because it is impossible to take the log of 0.

Regression diagnostics indicate adequate models with residuals approximately normally distributed; hence OLS is an appropriate multiple regression technique for our count and proportion data.

Informed Consent

Prior informed consent was obtained verbally for each task. Washington State University's internal review board examined and approved human subjects' protocol for the protection of the study participants. For the research with children, we obtained parental permission and child assent. The research followed ethical guidelines adopted by the American Anthropological Association (American Anthropological Association 1998) and the International Society of Ethnobiology Code of Ethics (International Society of Ethnobiology 2006).

Results

Plants Children Know

Every child recognized dasheen (taro), breadfruit, banana, sugarcane (*Saccharum officinarum*), guava, and coconut tree/plants (Table 1). These unanimously recognized plants are common foods growing in home gardens in Dominica that a child likely sees several times a day. Usually dasheen (the primary staple crop) grows in subsistence gardens at the village's perimeter, but children see dasheen and its distinctive elephant-ear leaves growing in small convenience patches in home gardens and small village plots.

Every child except for one four-year-old recognized the lime tree, which are common in the yard or home garden. Limes are a condiment more than a staple, and limeade is a common drink. Villagers use lime juice and steeped lime root for fevers and as a general tonic (c.f. Ayensu 1981).

All children except one five-year-old recognized bayleaf (*bwaden*), the village's only significant cash crop. Bayleaf is a small, ubiquitous village tree, and the object of considerable adult attention and labor (Macfarlan et al. 2013; Quinlan 2009). Villagers harvest, haul, and distill the leaves to make bay oil (a fragrance). In addition to selling bay oil, Bwa Mawegans use bayleaf medicinally (c.f. Ayensu 1981); however, only bay oil is a salient local medicine, applied topically for sprains, strains, and rheumatism (Quinlan and Flores in press). They use bay leaves to flavor gravy and to make "tea" that guards against humorally cold illnesses (Quinlan and Quinlan 2006).

Rose was the most recognized ornamental plant. All children except one eight-year-old recognized the rose bush, which had one good-sized flower. Roses have no local use other than ornament and are relatively rare in Bwa Mawego; less than half of home gardens had rose bushes. Children still recognized roses more readily than any seasoning or medicinal plant, including those that are universal in home gardens.

Gliricidia sepium, locally "glorycedar," is the highest ranking mainly medicinal plant (which also has limited fuel and construction use), with about 84% of children recognizing it. Glorycedar is a tree and children here learn trees early. Glorycedar has multiple uses. The etymology of "glorycedar" is probably from the tree's genus and common English name "gliricidia." Locals note that there is "glory" in glorycedar. Cedar trees are mentioned in the Bible, which gives them glory (glorycedar is not a "true" coniferous cedar [genus *Cedrus*] but it is the only Dominican cedar-named tree). Villagers sometimes use glorycedars to construct fencing and outdoor kitchen and latrine frames, and note the branches' distinctive property of producing stems and leaves long after harvest. This apparent miracle of new life, along with glorycedar's miraculous ability to relieve prickle-heat (common in children in this hot village, and used similarly in Jamaica and Curaçao [Ayensu 1981]), further demonstrates the plant's glory.

"Spice" (cinnamon, *Cinnamomum verum*) is tied for sixth in recognition. This tree has distinctive shiny, leathery leaves that the children recognized. Some villagers harvest and sell small amounts of cinnamon bark, but it is mostly a personal condiment and medicine for stomach (c.f. Ayensu 1981) and menstrual problems (Flores and Quinlan 2014).

About 64% of children recognized the popular cooking and tea herbs *tidité* and *godité* (*Lippia micromera* and *Plectranthus amboinicus*), which are medicinal in larger amounts but not for children (see Quinlan 2010).

The most commonly known purely medicinal plant among children is *sime kontwa* (*Chenopodium ambrosiodes*), a common Caribbean intestinal worm treatment (Ayensu 1981). Twenty-eight children (56%) recognized this plant, which is arguably the village's most important herbal medicine. Among adults, "worms" (intestinal parasites) is the most salient local illness, and *sime kontwa* is the worm treatment with the highest cognitive salience (Quinlan et al. 2002). Children drink prophylactic sips of *sime kontwa* tea from infancy. Indeed, a bright five-year-old girl first introduced M. Quinlan and R. Quinlan to the plant.

Predictors of Childhood Plant Knowledge

Regression models of total plant knowledge among Dominican children (Table 2) explain about 61% of variance in plant recognition ($p < .0001$). Age was the

Table 2. Multiple regression showing effects of demographic characteristics on total plant recognition.

Variable	**β**	*p*	η^2
Sex	–0.445	0.748	0.003
Age	1.183	0.000	0.364
Father	0.854	0.580	0.007
Compound	4.455	0.016	0.129
Siblings	0.589	0.228	0.034
Birth-order	–1.473	0.043	0.094
Constant	16.235	0.000	.61*

* = r^2

strongest effect (explaining about 36% of variance): children recognized about 1 additional plant per year. Children living in a multifamily compound knew about 4.5 more plants than did children living in a single-family house (explaining about 13% of variance). Birth order was the last significant predictor of total plant knowledge: Later-born children recognized about 1.5 fewer plants with each additional older sibling. Birth order explained a small proportion of the total variance (about 9%). Father presence in the household has no effect on children's plant recognition. We must therefore reject our hypothesis that children from father-present households know more plants than father-absent children do.

Development of Ethnobotanical Knowledge by Domain

We attempted to identify the pattern of children's acquisition of plant knowledge through development. We examined each plant domain as a *proportion* of children's total plant knowledge to indicate the cognitive pattern (or allocation) of knowledge acquisition. Below are separate models for each plant category.

By far, these analyses account for the most variance in knowledge of trees (58%, $p < .0001$; Table 3). Age had the strongest effect on trees as a proportion of total knowledge explaining about 32% of the variance. As a child develops, trees take up an increasingly smaller proportion of plant knowledge. This suggests that children learn tree species first, and then their botanical knowledge base expands over time. Living in a family compound and birth order were significant predictors of trees as a proportion of total knowledge. Trees were a smaller proportion of total plant knowledge for children in family compounds (explaining 11% of the variance), and trees were a higher proportion of total knowledge for later born children (explaining about 11% of the total variance). Gender was also a significant predictor: Trees were a larger proportion of boys' total knowledge (11% of the

Table 3. OLS multiple regression showing trees as a proportion of total knowledge.

Logit tree	**β**	*p*	η^2
Sex	0.172	0.027	0.111
Age	–0.057	0.000	0.307
Father	–0.102	0.230	0.034
Compound	–0.223	0.027	0.111
Siblings	–0.045	0.095	0.065
Birth-order	0.088	0.027	0.112
Constant	0.633	0.004	.58*

* = r^2

Table 4. OLS multiple regression showing medicinal plants as a proportion of total knowledge.

Logit meds	β	*p*	η^2
Sex	−0.519	0.060	0.082
Age	0.104	0.032	0.105
Father	−0.302	0.317	0.024
Compound	0.489	0.167	0.045
Siblings	0.134	0.162	0.046
Birth-order	−0.225	0.109	0.060
Constant	−3.085	0.000	.33*

* = r^2

variance). Number of siblings was a marginally significant predictor (p = .095) of proportional tree knowledge; trees are a smaller proportion of total botanical knowledge with each additional sibling. These results suggest that children learn trees early in life and, for children of high birth order (younger children of their family), trees tend to remain a relatively high proportion of total knowledge. However, children in multifamily compounds tend to expand their botanical knowledge more rapidly than do children in single family compounds such that tree-knowledge becomes proportionately smaller.

Demographic variables also explained substantial variance in the proportion of medicinal knowledge (about 33%, p = .0007; Table 4). Age was a significant and positive predictor of medicinal plants as a proportion of total knowledge (explaining 11% of the variance), suggesting that the learning of medicinal plants increases over the course of development. Children's gender was a marginally significant predictor (p = .06, about 8% of the total variance); medicinal plants are a smaller proportion of total knowledge for boys compared with girls.

Demographic variables explained about 27% (p = .003) of the variance in condiments as a proportion of total botanical knowledge (Table 5). Age was the only significant predictor at the .05 level explaining about 10% of variance. Condiments increased as a proportion of total knowledge over time indicating that children learn condiments relatively later in development. Birth order was a marginally significant effect (p = .07) explaining about 8% of variance. This may reflect the somewhat dependent position of later-born children and hence slower learning of useful plants.

Table 6 shows the effect of demographic variables on provisions as proportion of total botanical knowledge (p = .03, 16% of variance). Age was the only significant predictor, explaining about 12% of the variance in provisions as a proportion of total knowledge. Children recognize the edible part of provisions (mostly

Table 5. OLS multiple regression showing condiments as a proportion of total knowledge.

Logit cond	β	*p*	η^2
Sex	−0.039	0.699	0.004
Age	0.038	0.035	0.101
Father	0.103	0.364	0.020
Compound	−0.029	0.824	0.001
Siblings	0.023	0.517	0.010
Birth-order	−0.096	0.071	0.075
Constant	−1.625	0.000	.27*

* = r^2

Table 6. OLS multiple regression showing provisions as a proportion of total knowledge.

Logit prov	β	*p*	η^2
Sex	0.089	0.165	0.045
Age	−0.026	0.024	0.115
Father	0.031	0.660	0.005
Compound	0.024	0.769	0.002
Siblings	0.004	0.860	0.001
Birth-order	0.008	0.816	0.001
Constant	−1.187	0.000	.16*

* = r^2

tubers) early in life, but provisions (with the exception of dasheen) usually do not grow in home gardens. Provisions grow in "bush gardens," swiddens outside the residential village. Youngest children are not familiar with the aerial parts of provision plants, but learn the plants by middle childhood.

Number of siblings is the only predictor of vegetables as a proportion of total knowledge, and it is only marginally significant (p = .051), explaining a modest 9% of variance (Table 7). This finding suggests that children from larger families learn more about vegetables than do children from smaller families.

Demographic variables explain little variance in the recognition of ornamentals as a proportion of total botanical knowledge (Table 8). Ornamentals are a smaller proportion of boys' knowledge than girls' knowledge, but the association is marginally significant (p = .07) and the proportion of variance explained is 8%.

Figure 2 shows that children especially learn trees and condiments (cooking and tea herbs) early on, along with some vegetables and medicinal plants. These all grow in the home garden. Trees decrease as a proportion of total knowledge, as do condiments to a lesser degree, while medicinal plants grow steadily as a proportion of knowledge with age (a trend that continues in adulthood to about age 50 [Quinlan 2004]).

Discussion

In this community, children who live in father-present nuclear families have no additional plant-recognition ability compared to children with absent fathers. This surprising result indicates that ethnobotanical knowledge is an experience-based, embodied capital that does *not* appear to result from father-child transmission. Indeed, if ethnobotanical knowledge were largely a matter of parental investment,

Table 7. OLS multiple regression showing vegetables as a proportion of total knowledge.

Logit veg	β	*p*	η^2
Sex	0.043	0.523	0.010
Age	−0.017	0.160	0.047
Father	0.043	0.564	0.008
Compound	−0.059	0.493	0.011
Siblings	−0.047	0.051	0.087
Birth-order	0.040	0.247	0.032
Constant	−1.653	0.000	0.09*

* = r^2

Table 8. OLS multiple regression showing ornamentals as a proportion of total knowledge.

Logit Orn	β	*p*	η^2
Sex	−0.216	0.071	0.079
Age	0.019	0.350	0.022
Father	−0.001	0.994	0.000
Compound	0.160	0.287	0.028
Siblings	0.008	0.835	0.001
Birth-order	0.087	0.145	0.052
Constant	−3.221	0.000	.06*

* = r^2

a father's cooperation should increase children's environmental knowledge even if the mother was the major provider, similar to breast-feeding (Quinlan and Quinlan 2008; Quinlan et al. 2003). Fathers had no statistical effect on plant recognition. Rather, the constant availability of extended family in family-compounds is the factor that augments children's knowledge of useful local plants.

Extended family compounds in Bwa Mawego function nicely for cooperative childrearing (Meehan 2009) or cooperative child care (Lamb and Ahnert 2007), which is when individuals other than the biological parent provide care for children (Crittenden and Marlowe 2008). Parents face trade-offs between subsistence and economic activities and childcare. Gender culture in Bwa Mawego makes this trade-off particularly taxing for mothers, especially the majority of mothers who are unmarried (or not pair-bonded). Few mothers are "single," however, because they live in compounds with other family. Alloparents partially offset potential risks associated with the maternal children/work trade-off (Meehan 2009). From a child's perspective, compounds appear to be more fun because, in addition to siblings, there are cousins to play with and several (usually) supportive adults. From the local ethnobotanical learning perspective, family compounds may form a natural "classroom" for learning in the traditional, child-driven manner, especially with time allocation to group work.

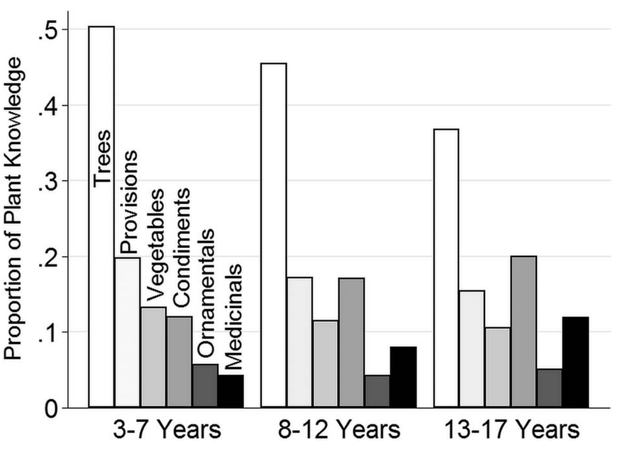

Figure 2. Domains of plants as a proportion of total botanical knowledge for 3 to 7-year-old children, 8 to 12-year-old children, and 13 to 17 year-old adolescents.

Raising children and teaching children has become synonymous in Western culture (see Lancy 2008). Many developmental psychologists who study populations in the West conclude that early childhood is an important period of exploration, and that teaching is an important element of children's learning (Lancy and Grove 2010). The assumption that *most child learning* results from active *teaching* (modulated behavior to affect another's learning) is a flawed one that stems from a bias of behavioral science research with children from large-scale, WEIRD populations (i.e., Western, Educated, Industrialized, Rich, and Democratic populations, per Henrich et al. [2010]). Meanwhile, teaching is rare in both the anthropological (Lancy and Grove 2010) and historical (Lancy 2010) literatures. Rather, smaller societies tend to follow a *laissez faire* attitude towards learning that relies heavily on the child's natural curiosity and the child's own observation and motivation to emulate elders (including siblings) (Gaskins and Paradise 2010; Lancy 2010; Lancy and Grove 2010). Lancy further notes that the kind of adult-delivered, nuanced, student-centered, developmentally appropriate instruction that forms our operational definition of teaching nowadays (e.g., pointing to pictures in a book and repeating the words) is actually a recent product of a long process of educational change. In village life and throughout human history, "teaching has been largely superfluous in the process of cultural transmission" (Lancy 2010:96, see also Lancy 2007). If parents are not primarily "teachers" in a village setting, then it is not surprising that living with both parents is not an advantage for learning local ethnobotanical knowledge.

If parents are not actively teaching children, why then is compound life—living with additional potential teachers—advantageous in learning TEK? Whereas most researchers would agree that adult-delivered, student-centered teaching is a relatively novel phenomenon, it is doubtful that teaching, in any form, is absent in small-scale societies. While in her classic work with the Manus Margaret Mead argued that the Manus were not a "teaching" culture, she nonetheless mentions several instances of teaching, including teaching physical skills, subsistence activities, and social values, such as the respect of property (Mead 1964). Hewlett et al. (2011) submit that learning by observation and imitation is not always enough and that some critical tasks must be learned through guided teaching. Complex knowledge, such as medicinal plant knowledge, is often acquired through apprenticeship (i.e., observation/imitation, scaffolding/social coaching) alongside parents, grandparents, or non-kin specialists (Lancy 1996; Lozada et al. 2006; Zarger 2007, 2010). Csibra and Gergely (2006, 2011) argue that teaching is a human universal and that certain forms of teaching, such as natural pedagogy, are an innate feature of human cognition. Natural pedagogy is a teacher providing a learner with explicit cues conveying information about how to use an object or perform a task. In a recent study of teaching among Aka hunter-gatherer caregivers and infants, natural pedagogy regularly occurred during interactions and natural pedagogy and other forms of teaching increased Aka infants' rate of imitation (Hewlett and Roulette in press). The Aka frequently employ natural pedagogy when transmitting knowledge between children and their non-kin (Boyette 2013). In Dominica, we have recorded observational and natural pedagogical ethnobotanical learning, but it is unclear how children learn ethnobotany most often.

The family unit, "home," or compound, is an environment made up of members who influence knowledge and beliefs about one's biophysical world. In Fiji, teaching occurs most among kin and relates to the importance of the skill for basic survival (Kline et al. 2013). Kpelle elders (parents, older siblings, extended and non-kin family members) all contribute, guide, and assist in children's development of adult-like skills and behavior (Lancy 1996:21). Although the logic is clear—larger compounds have more family members in and around a home to provide more learning opportunities for children—it is still not clear exactly from whom the children are learning.

Typically, children begin to learn local ethnobotanical knowledge vertically from their mothers (Cruz Garcia 2006; Zarger and Stepp 2004). In rural Argentina, for example, the majority of the transmission about edible and medicinal plants involves mothers (Lozada et al. 2006). In the Central African Republic, Aka forager mothers often lay out edible and inedible foods (e.g., mushrooms [Agaricomycetes class], yams [*Dioscorea* spp.]) and show children which ones are safe and which ones are not (Hewlett et al. 2011). Mothers might play a prominent role in the acquisition of local ethnobotanical knowledge among Dominican children, regardless of father presence.

Additional kin logically increase one's contact with local plants as children living in compounds may have greater contact levels with plants and herbs (i.e., fetching for cooking and medicinal uses). There are thus more plant-use instances to observe—at any given time, a family compound would be more likely to have an adult gardening, gathering or using plant materials, or preparing food. Similarly, Nicaraguan Mayangna and Miskito gain fish knowledge as they spend time accompanying fishers on fishing trips (Koster et al. in press). Aka children, for example, learn bush skills from grandparents 4% of the time and other, non-parent older family members 1.4% of the time (Hewlett and Cavalli-Sforza 1986). In northeastern Thailand, a variety of family members (grandparents, siblings, cousins, and other adult relatives and village members), transmit ethnobotanical knowledge when parents are gone (Setalaphruk and Price 2007).

Cross-culturally, as children age, fathers and other adults play an increasingly larger role in the transmission of ethnobotanical knowledge (Cheikhyoussef et al. 2011; Zarger and Stepp 2004). Dominican fathers, even if they are present household members, do not typically spend as much time at home as mothers and other caregivers do. Fathers are often away from home for fishing, handling bayleaf, gardening, and socializing (Quinlan and Flinn 2005). There are therefore fewer opportunities for fathers to transmit ethnobotanical knowledge to their children. In contrast, mothers and other caregivers who spend the most time around young children provide many more opportunities to transmit local ethnobotanical knowledge.

As children age, they become increasingly interested in associating with children of their own age and sex (Rogoff 1981) and begin to rely less on oblique transmission (from older adults) and more on learning from peers (Harris 1998). Older children often acquire local ethnobotanical knowledge in peer-groups, as they play and engage in subsistence activities with other children. Rural northeastern Thai children, for example, collect and hunt food sources with one another while they play (Setalaphruk and Price 2007). They eat food items on the spot (Cruz Garcia 2006) and share information about local ethnobotany (Setalaphruk and Price 2007). Not all local ethnobotanical knowledge is learned via passive observation of peers, however. As middle childhood and adolescent Aka children age, their learning time decreases and their teaching time increases (Boyette 2013). Children in small-scale populations often play in mixed-age peer groups. Older siblings are an important source of cultural transmission in playgroups (Lancy et al. 2010), often teaching younger siblings how to perform a variety of tasks (Harris 1998). Tzeltal siblings, for example, provide useful information about how to locate, cultivate, harvest, and use plants as younger siblings tag along (Zarger 2007, 2010).

This area requires further research. Time allocation studies of children's learning would be time intensive but would clarify how children learn in terms of frequency. A longitudinal study investigating Dominican children's local ethnobotanical knowledge would provide insights into how children's knowledge and behaviors are first obtained and how their knowledge and behaviors change as they come into contact with new sources of information (Reyes-Garcia et al. 2009). The present study is based on the salient plant members of salient plant domains identified among Bwa Mawego adults. It might be illuminating to conduct similar research among age-based groups of children to learn whether there are children's ethnobotanical cognitions in Bwa Mawego that differ from those of adults.

Cross-culturally, mothers appear to have the greatest influence on young children's local ethnobotanical knowledge, mostly because children are near their mothers throughout the day. Father's influence on children's ethnobotanical knowledge is much more variable. Our Dominican sample did not show any effect of father presence on ethnobotanical knowledge, but the nature and type of father involvement might be important for the development of children's local ethnobotanical knowledge in other cultural milieus where fathers are present and active in direct care or where fathers play an important role in the transmission of complex ethnobotanical knowledge. In a study of ethnobiological transmission[3] in rural Fiji, Kline et al. (2013) find that children learn via multiple pathways. Parent-child teaching, however, accounts for the most basic knowledge that children learn early in life. As children age and begin to play in mixed-age peer groups, they begin to acquire local ethnobotanical knowledge from older siblings and peers. Among Dominican children, ethnobotanical knowledge appears to depend on number of siblings, such that number of siblings predicts some vegetable knowledge, perhaps indicating that children from larger families have more opportunities to learn from siblings. In any horticultural community, increased interaction with people means increased interaction with plants. Children who reside in compounds live around more people and thus have greater contact levels with plants and herbs as there are more plant-use instances to observe. At any given time, a family compound would be more likely to have older family members gardening, gathering, or using or preparing plant materials.

Notes

[1] These stages are constructs of convenience but refer to capability from prerequisite development and progressive scaffolding that children achieve.

[2] We use the term "home garden," rather than the numerous synonyms present in the literature including "homegarden," "back door garden," "back yard garden," "door yard

garden," "house garden," and "kitchen garden." Defining characteristics include the garden being near the residence, maintained by residents for home consumption, and containing diverse plants—several fruits, vegetables, herbs, ornamentals, and often fuels and small livestock (Brownrigg 1985).

[3] Kline et al. (2013) investigated learning domains of knowledge and skills that "make one a well-respected member of the community" (2012:358) in rural Fiji. The domains, or skill sets, involve several traditional home crafts, and traditional food procurement and preparation techniques, all of which involve local plants and animals, and are ethnobiological knowledge.

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References Cited

American Anthropological Association. 1998. Code of Ethics of the American Anthropological Association. American Anthropological Association. Available at: http://www.aaanet.org/profdev/ethics/upload/ethicscode1998.pdf. Accessed May, 2010.

Atran, S., D. Medin, and N. Ross. 2004. Evolution and Devolution of Knowledge. *Journal of the Royal Anthropological Institute* 10:395–420.

Atran, S., and D. Sperber. 1991. Learning without Teaching. In *Annual Workshop on Culture, Schooling and Psychological Development*, edited by L. T. Landsmann, pp. 39–55. Ablex, Norwood, NJ.

Ayensu, E. S. 1981. *Medicinal Plants of the West Indies*. Reference Publications, Algonic, MI.

Barrow, C. 2000. *Family in the Caribbean*. Ian Randle, Kingston, Jamaica.

Bernard, H. R. 2005. *Research Methods in Cultural Anthropology,* 4th edition. Sage, Newbury Park, CA.

Bliege Bird, R., and D. W. Bird. 2002. Constraints of Knowing or Constraints of Growing? *Human Nature* 13:239–267.

Blurton Jones, N. 1993. The Lives of Hunter-Gatherer Children. In *Juvenile Primates*, edited by M. E. Pereira and L. A. Fairbanks, pp. 309–338. Oxford University Press, Oxford, UK.

Bock, J. 2002. Learning, Life History, and Productivity. *Human Nature* 13:161–198.

Bock, J. 2005. What Makes a Competent Adult Forager? In *Hunter-gatherer Childhoods*, edited by B. S. Hewlett and M. E. Lamb, pp. 109–128. Transaction, New Brunswick, NJ.

Bock, J. 2010. An Evolutionary Perspective on Learning in Social, Cultural and Ecological Contexts. In *Anthropology of Learning in Childhood*, edited by D. F. Lancy, J. Bock, and S. Gaskins, pp. 11–34. AltaMira, Walnut Creek, CA.

Bourdieu, P. 1973. Cultural Reproduction and Social Reproduction. In *Knowledge, Education, and Social Change*, edited by R. Brown, pp. 71–84. Taylor and Francis, London.

Bourdieu, P. 1986. The Forms of Capital. In *Handbook of Theory and Research for the Sociology of Education*, edited by J. Richardson, pp. 241–258. Greenwood, New York.

Boyd, R., and P. J. Richerson. 1988. An Evolutionary Model of Social Learning. In *Social Learning,* edited by T. Zentall and B. J. Galef, pp. 29–48. Lawrence Erlbaum, Hillsdale, NJ.

Boyette, A. H. 2013. Social Learning in Middle Childhood among Aka Foragers and Ngandu Farmers. Doctoral Dissertation, Department of Anthropology, Washington State University, Pullman, WA.

Brownrigg, L. 1985. *Home Gardening in International Development*. League for International Food Education, Washington, DC.

Cheikhyoussef, A., M. Shapi, K. Matengu, H. M. Ashekele. 2011. Ethnobotanical Study of

Indigenous Knowledge on Medicinal Plant Use by Traditional Healers in Oshikoto Region, Namibia. *Journal of Ethnobiology and Ethnomedicine* 7:10. DOI: 10.1186/1746-4269-7-10.

Crittenden, A. N., and F. W. Marlowe. 2008. Allomaternal Care among the Hadza of Tanzania. *Human Nature* 19:249–262.

Cruz García, G. S. 2006. The Mother-Child Nexus. *Journal of Ethnobiology and Ethnomedicine* 2:39. DOI: 10.1186/1746-4269-2-39.

Csibra, G., and G. Gergely. 2006. Social Learning and Social Cognition. In *Processes of Change in Brain and Cognitive Development. Attention and Performance*, edited by Y. Munakata and M. H. Johnson, pp. 249–274. Oxford University Press, Oxford, UK.

Csibra, G., and G. Gergely 2011. Natural Pedagogy as Evolutionary Adaptation. *Philosophical Transactions of the Royal Society B: Biological Sciences* 366:1149–1157.

Dougherty, J. W. D. 1979. Learning Names for Plants and Plants for Names. *Anthropological Linguistics* 21:298–315.

Ellen, R. 2009. A Modular Approach to Understanding the Transmission of Technical Knowledge. *Journal of Material Culture* 14:243–277.

Ember, C. R. 1983. The Relative Decline in Women's Contribution to Agriculture with Intensification. *American Anthropologist* 85: 285–304.

Flinn, M. V. 2006. Evolution and Ontogeny of Stress Response to Social Challenges in The Human Child. *Developmental Review* 26: 138–174.

Flinn, M. V., D. V. Leone, and R. J. Quinlan. 1999. Growth and Fluctuating Asymmetry of Step-Children. *Evolution and Human Behavior* 20: 465–479.

Flinn, M. V., R. Quinlan, K. Coe, and C. Ward. 2007. Evolution of the Human Family. In *Family Relationships: An Evolutionary Perspective*, edited by C. A. Salmon and T. K. Shackelford, pp. 16–38. Oxford University Press, NY.

Flores, K. E., and M. B. Quinlan. 2014. Ethnomedicine of Menstruation in Rural Dominica, West Indies. *Journal of Ethnopharmacology* 153: 624–634.

Fredrickson, B. L., and C. Branigan. 2005. Positive Emotions Broaden the Scope of Attention and Thought-Action Repertoires. *Cognition & Emotion* 19:313–332.

Gaskins, S., and R. Paradise. 2010. Learning through Observation in Daily Life. In *Anthropology of Learning in Childhood*, edited by D. F. Lancy, J. Bock, and S. Gaskins, pp. 85–118. AltaMira, Walnut Creek, CA.

Giovannini, P., V. Reyes-García, A. Waldstein, and M. Heinrich. 2011. Do Pharmaceuticals Displace Local Knowledge and Use of Medicinal Plants? Estimates from a Cross-Sectional Study in a Rural Indigenous Community, Mexico. *Social Science & Medicine* 72:928–936.

Gurven, M., H. Kaplan, and M. Gutierrez. 2006. How Long Does It Take to Become a Proficient Hunter? Implications for the Evolution of Extended Development and Long Life Span. *Journal of Human Evolution* 51:454–470.

Harris, J. R. 1998. *The Nurture Assumption*. Free Press, New York, NY.

Henrich, J., S. J. Heine, and A. Norenzayan. 2010. The Weirdest People in the World? *Behavioural and Brain Sciences* 33:61–81.

Hewlett, B. S., and L. L. Cavalli-Sforza. 1986. Cultural Transmission among Aka Pygmies. *American Anthropologist* 88:922–934.

Hewlett, B. S., H. N. Fouts, A. H. Boyette, and B. L. Hewlett. 2011. Social Learning among Congo Basin Hunter–Gatherers. *Philosophical Transactions of the Royal Society B: Biological Sciences* 366:1168–1178.

Hewlett B. S., and C. J. Roulette. In press. Teaching In Hunter-Gatherer Infants. In *Social Learning and Innovation among Contemporary Hunter-Gatherers*, edited by H. Terashima and B. S. Hewlett. Springer, Tokyo.

Hunn, E. 2002. Evidence for the Precocious Acquisition of Plant Knowledge by Zapotec Children. In *Ethnobiology and Biocultural Diversity*, edited by J. R. Stepp, F. S. Wyndham, and R. K, Zarger, pp. 604–613. University of Georgia Press, Athens, GA.

Hunn, E. S. 2008. *A Zapotec Natural History*. University of Arizona Press, Tucson, AZ.

International Society of Ethnobiology. 2006. International Society of Ethnobiology Code of Ethics (with 2008 additions). Available at: http://ethnobiology.net/code-of-ethics/. Accessed on January 15, 2015.

Kaplan, H., J. Lancaster, and A. Robson. 2003. Embodied Capital and the Evolutionary Economics of the Human Life Span. In *Life Span*, edited by J. R. Carey and S. Tuljapurkar, pp. 152–182. Population Council, NY.

Kaplan, H. S., K. Hill, J. B. Lancaster, and A. M. Hurtado. 2000. A Theory of Human Life History Evolution. *Evolutionary Anthropology* 9:156–183.

Kline, M. A., R. Boyd, and J. Henrich. 2013. Teaching and the Life History of Cultural Transmission in Fijian Villages. *Human Nature* 24:351–374.

Koster, J. M., O. Bruno, and J. L. Burns. In press. Wisdom of the Elders? Ethnobiological Knowledge across the Lifespan. *Current Anthropology.*

Kramer, K. L. 2011. The Evolution of Human Parental Care and Recruitment of Juvenile Help. *Trends in Ecology & Evolution* 26:533–540.

Lamb, M. E., and L. Ahnert. 2007. Nonparental Child Care: Context, Concepts, Correlates, and Consequences. *Handbook of Child Psychology* IV:3:23.

Lancy, D. F. 1996. *Playing on the Mother-Ground: Cultural Routines for Children's Development*. Guilford, New York.

Lancy, D. F. 2007. Accounting for Variability in Mother-Child Play. *American Anthropologist* 109:273–284.

Lancy, D. F. 2008. *The Anthropology of Childhood*. Cambridge University Press, Cambridge, UK.

Lancy, D. F. 2010. Learning 'From Nobody'. *Childhood in the Past* 3:79–106.

Lancy, D. F., J. Bock, and S. Gaskins. 2010. Putting Learning in Context. In *Anthropology of Learning in Childhood*, edited by D. F. Lancy, J. Bock, and S. Gaskins, pp. 3–10. AltaMira, Walnut Creek, CA.

Lancy, D. F., and M. A. Grove. 2010. The Role of Adults in Children's Learning. In *Anthropology of Learning in Childhood*, edited by D. F. Lancy, J. Bock, and S. Gaskins, pp. 145–180. AltaMira, Walnut Creek, CA.

Lozada, M., A. Ladio, and M. Weigandt. 2006. Cultural Transmission of Ethnobotanical Knowledge in a Rural Community of Northwestern Patagonia, Argentina. *Economic Botany* 60:374–385.

Łuczaj, Ł., and Z. Nieroda. 2011. Collecting and Learning to Identify Edible Fungi in Southeast Poland. *Ecology of Food and Nutrition* 50:319–336.

Macfarlan, S. J., R. Quinlan, and M. Remiker. 2013. Cooperative Behaviour and Prosocial Reputation Dynamics in a Dominican Village. *Proceedings of the Royal Society B: Biological Sciences* 280 (1761). DOI: 10.1098/rspb.2013.0557.

Macfarlan, S. J., M. Remiker, and R. Quinlan. 2012. Competitive altruism explains labor exchange variation in a Dominican community. *Current Anthropology* 53(1):118–124.

Mantz, J. W. 2007. How a Huckster Becomes a Custodian of Market Morality. *Identities* 14:19–38.

McDade, T. W., V. Reyes-Garcia, P. Blackinton, S. Tanner, T. Huanca, and W. R. Leonard. 2007. Ethnobotanical Knowledge is Associated with Indices of Child Health in the Bolivian Amazon. *Proceedings of the National Academy of Sciences of the United States of America* 104:6134–6169.

McElreath, R., and P. Strimling. 2008. When Natural Selection Favors Imitation of Parents. *Current Anthropology* 49:307–316.

Mead, M. 1964. *Continuities in Cultural Evolution*. Yale University Press, New Haven, CT.

Meehan, C. L. 2009. Maternal Time Allocation in Two Cooperative Childrearing Societies. *Human Nature* 20:375–393.

Meehan, C. L., R. Quinlan, and C. D. Malcom. 2013. Cooperative Breeding and Maternal Energy Expenditure among Aka Foragers. *American Journal of Human Biology* 25:42–57.

Moerman, D. E. 2002. *Meaning, Medicine and the 'Placebo Effect'*. Cambridge University Press, Cambridge, UK.

Munroe, R. L., and M. Gauvain. 2010. The Cross-Cultural Study of Children's Learning and Socialization. In *The Anthropology of Learning in Childhood*, edited by D. F. Lancy, J. Bock, and S. Gaskins, pp. 35–63. AltaMira, Walnut Creek, CA.

Murdock, G. P., and C. Provost. 1973. Factors in the Division of Labor by Sex. *Ethnology* 12:203–225.

Musante (DeWalt), K. 2015. Participant Observation. In *Handbook of Methods in Cultural Anthropology,* edited by H. R. Bernard and C. C. Gravlee, pp. 251–292. Rowman & Littlefield, Lanham, MD.

Nolan, J. M. 2007. *Wild Harvest in the Heartland*. University Press of America, Lanham, MD.

Quinlan, M. B. 2004. *From the Bush*. Wadsworth, Belmont, CA.

Quinlan, M. B. 2005. Considerations for Collecting Freelists in the Field. *Field Methods* 17:219–234.

Quinlan, M. B. 2010. Ethnomedicine and Ethnobotany of Fright. *Journal of Ethnobiology and Ethnomedicine* 6:9. DOI:10.1186/1746-4269-6-9.

Quinlan, M. B. n.d. Best Practices (So Far) for Conducting Plant Trail Interviews with Children (and Adults). Unpublished ms. available from: mquinlan@wsu.edu.

Quinlan, M. B., and K. E. Flores. In press. *Bush Medicine in Dominica*. Society of Ethnobiology, Denton, TX. Available from: mquinlan@wsu.edu

Quinlan, M. B., and R. J. Quinlan. 2006. Balancing the System. In *Eating and Healing*, edited by A. Pieroni and L. L. Price, pp. 197–212. Food Products, NY.

Quinlan, M. B., and R. J. Quinlan. 2007. Modernization and Medicinal Plant Knowledge in Caribbean Horticultural Village. *Medical Anthropology Quarterly* 21:169–192.

Quinlan, M. B., R. J. Quinlan, and J. M Nolan. 2002. Ethnophysiology and Herbal Treatments of Intestinal Worms in Dominica, West Indies. *Journal of Ethnopharmacology* 80:75–83.

Quinlan, R. 2009. Intergenerational Transmission of Bwa Den Small Holdings in Rural Dominica, SFI Memo. *Santa Fe Institute Workshop Papers*. Available at: http://tuvalu.santafe.edu/events/workshops/images/0/00/Quinlan_Dominica.pdf. Accessed January, 2015.

Quinlan, R., and M. Quinlan. 2008. Human Lactation, Pairbonds & Alloparents: A Cross-Cultural Analysis. *Human Nature* 19:87–102.

Quinlan, R. J. 2006. Gender and Risk in a Matrifocal Caribbean Community. *American Anthropologist* 108:464–479.

Quinlan, R. J., and M. V. Flinn. 2003. Intergenerational Transmission of Conjugal Stability in a Caribbean Community. *Journal of Comparative Family Studies* 34:569–583.

Quinlan, R. J., and M. V. Flinn. 2005. Kinship, Sex and Fitness in a Caribbean Community. *Human Nature* 16:32–57.

Quinlan, R. J., M. B. Quinlan, and M. V. Flinn. 2003. Parental Investment and Age at Weaning in a Caribbean Village. *Evolution and Human Behavior* 24:21–16.

Quinlan, R. J., M. B. Quinlan, and M. V. Flinn. 2005. Local Resource Enhancement and Sex-biased Breastfeeding in a Caribbean Community. *Current Anthropology* 46:471–480.

Reyes-García, V., J. Broesch, L. Calvet-Mir, N. Fuentes-Peláez, T. W. McDade, S. Parsa, S. Tanner, T. Huanca, W. R. Leonard, and M. R. Martínez-Rodríguez. 2009. Cultural Transmission of Ethnobotanical Knowledge and Skills. *Evolution and Human Behavior* 30: 274–285.

Reyes-García, V., T. Huanca, V. Vadez, W. Leonard, and D. Wilkie. 2006. Cultural, Practical, and Economic Value of Wild Plants. *Economic Botany* 60:62–74.

Reyes-García, V., E. Kightley, I. Ruiz-Mallén, N. Fuentes-Peláez, K. Demps, T. Huanca, and M. R. Martínez-Rodríguez. 2010. Schooling and Local Environmental Knowledge. *International Journal of Educational Development* 30: 305–313.

Reyes-García, V., A. C. Luz, M. Gueze, J. Paneque-Gálvez, M. J. Macía, M. Orta-Martínez, J. Pino and TAPS Team. 2013. Secular Trends on Traditional Ecological Knowledge. *Learning and Individual Differences* 27:206–212.

Rogoff, B. 1981. Adults and Peers as Agents of Socialization. *Ethos* 9:18–36.

Setalaphruk, C., and L. L. Price. 2007. Children's Traditional Ecological Knowledge of Wild Food Resources. *Journal of Ethnobiology and Ethnomedicine* 3:33. DOI:10.1186/1746-4269-3-33.

Sigle-Rushton, W., and S. McLanahan. 2004. Father Absence and Child Wellbeing. In *The Future of the Family*, edited by D. P. Moynihan, T. M. Smeeding, and L. Rainwater, pp. 116–155. Russell Sage, NY.

Stross, B. 1970. Elicited Imitations in the Study of Tenejapa Tzeltal Language Acquisition. *Anthropological Linguistics* 12:319–325.

Stross, B. M. 1973. Acquisition of Botanical Terminology by Tzeltal Children. In *Meaning in Mayan Languages*, edited by M. S. Edmonson, pp. 107–141. Walter de Gruyter, NY.

Turner, N., C. Robinson, G. Robinson, and B. Eaton. 2013. "To feed all the people": Lucille Clifton's fall feasts for the Gitga'at Community of Hartley Bay, British Columbia. In *Explorations in Ethnobiology*, edited by M. Quinlan and D. Lepofsky, pp. 322–363. Society of Ethnobiology, Denton, TX.

Turner, N. J., and K. L. Turner. 2008. "Where our Women Used to Get the Food": Cumulative Effects and Loss of Ethnobotanical Knowledge and Practice; Case Study from Coastal British Columbia. *Botany* 86:103–115.

Van de Ven, A. H., and A. L. Delbecq. 1972. The Nominal Group as a Research Instrument for Exploratory Health Studies. *American Journal of Public Health* 62:337–342.

Vandebroek, I., and M. J. Balick. 2012. Globalization and Loss of Plant Knowledge. *PLoS One* 7: e37643.

World Bank. 2015. Databank. Available at http://data.worldbank.org/indicator/SP.POP.TOTL Accessed January 2015.

Wyndham, F. S. 2010. Environments of Learning: Rarámuri Children's Plant Knowledge and Experience of Schooling, Family, and Landscapes in the Sierra Tarahumara, Mexico. *Human Ecology* 38:87–99.

Zarger, R. 2007. Building Slingshots and Finding Edible Glue. Paper presented at the annual meeting for the Society for Cross-Cultural Research, San Antonio, Texas, February 22–24.

Zarger, R. K. 2002. Acquisition and Transmission of Subsistence Knowledge by Q'eqchi'Maya in Belize. In *Ethnobiology and Biocultural Diversity*, edited by J. R. Stepp, F. S. Wyndham, and R. K. Zarger, pp. 592–603. University of Georgia Press, Athens, GA.

Zarger, R. K. 2010. Learning the Environment. In *The Anthropology of Learning in Childhood*, edited by D. Lancy, J. Bock, and S. Gaskins, pp. 341–370. AltaMira, Walnut Creek, CA.

Zarger, R. K. 2011. Learning Ethnobiology. Pp. In *Ethnobiology*, edited by E. Anderson, E. Hunn, D. Pearsall, and N. Turner, pp. 371–87. Wiley and Sons, New York.

Zarger, R. K., and J. R. Stepp. 2004. Persistence of Botanical Knowledge among Tzeltal Maya Children. *Current Anthropology* 45: 413–418.