Exploring the Senses of Taste with Young Children: Multisensory Discoveries of Food

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The Version of Record of this manuscript has been published in Food & Foodways on 24 January 2024 and is available at https://www.tandfonline.com/doi/full/10.1080/07409710.2024.2298175

Abstract

Offering children multiple occasions and settings to approach new or least-liked foods has value both from a taste development perspective as well as a pedagogical one. New food experiences in positive atmospheres foster pleasure, curiosity and willingness to interact with these ingredients in multiple manners, not only eating or tasting them. This qualitative case study reports 4 and 5-year-old children's articulation of their experiences in exploratory food ateliers at their preschool. During the study the children's ideas and perceptions about their sensory experiences with food were documented, while keeping the children at the center of their explorations, in line with the Reggio Emilia approach. Results indicate that the children reflected on changes in their own attitudes and taste towards least-liked foods, as well as including meta-reflections on complex phenomena such as multisensory perception, cross-modal correspondences and taste development. Thus, by promoting multiple multisensory explorations, the study suggests that children can become more open-minded and self-aware, broadening the spectrum of food experiences.

Keywords: food education; multisensory perception; Reggio Emilia approach; taste development; preschool

Introduction

Research maintains that not only do parents influence their children's diet, food choices and eating habits (Peters et al. 2012), but from age two, children begin to exercise autonomous choice regarding which foods they are willing to eat, usually accompanied by a reduction in the range of foods consumed compared to the first year of life (Cashdan 1994; Addessi et al. 2005). Thus, developing positive food-related attitudes from early childhood - especially towards fruits and vegetables- is considered to be of importance for health and well-being. Taste development, however, is not confined to the home and family, but is also subject to development in formal and non-formal educational contexts, both as part of deliberate food-oriented pedagogical activities and through meals eaten during the time spent at preschool and school. In a critical review essay on food education, Leer and Wistoft (2018, 331) highlighted how common approaches to taste education are focused on modifying children's eating habits in order to "improve" the children and/or their habits, thus demonstrating "a reductive understanding of taste… that (is) mistrustful of children's taste. Taste is seen as a barrier to the adoption of 'correct' eating habits and is not recognized as an important sense, a source of pleasure, or a central way of sensually understanding and approaching the world."

Taste, in the present study, refers to physical sensation, sensory perception and *experience-with* the senses, involving physiological, socio-cultural and especially subjective aspects. The objective of this case study was to promote sensory-based food education with young children by designing, implementing and documenting multisensory food ateliers featuring sense-based, exploratory activities.

Taste education, the Reggio Emilia approach and its ateliers

Our study is situated in the context of Reggio Emilia, Italy, a city known for its innovative approach to education for children aged 0-6. The Reggio Emilia approach began after WWII and became the educational approach of the entire municipality in the 1970s. The educational philosophy is based on specific ideas about children between the ages of 0-6, recognizing them as competent citizens with rights whose ideas and points of view deserve to be listened to. Childhood is considered a time of immense potential where, through relationships with peers and adults, indoor and outdoor environments, "the 100 languages" and encounters with materials, children construct their personalities within learning groups (made up of children and adults), in settings which aim to integrate the body and the mind, doing and thinking, play and learning, and to learn with joy (Giudici et al. 2001). The 100 languages is a concept underlying all aspects of the Reggio Emilia approach, based on the idea that there are multiple ways through which children can express and explore their thoughts, feelings and theories about the world- verbally, physically, through various forms of art, using digital tools, etc. Among the 100 languages, food offers both content and a context for exploration, learning and creating relationships with nature, people and oneself.

While Italy has promoted taste education since the 1980s and the Italian Ministry of Education (MIUR) has published guidelines regarding food education, currently there is no obligation to include it in school curricula (Ueda 2018). The Reggio Emilia approach, since the beginning, has always considered food, meals and food experiences pedagogically significant and meaningful moments of the day and an important part of the curriculum (Cavallini and Tedeschi 2007), but their effectiveness has not been subject to academic research. This study is an effort to start filling the gap in research-based knowledge.

Sense-based food education is among the defining characteristics of the Reggio Emilia approach. In addition, sensitivity on the part of the adults, to listen to, document and valorize children's ideas and perceptions, refers to the "pedagogy of listening", another pillar of the Reggio Emilia approach (Rinaldi 2005). In the ateliers described herein, this is expressed by keeping children at the center of their learning processes within a group regarding their sensory experiences and explorations with food. By cultivating and engaging in such "reflective taste pedagogy" (Leer and Wistoft 2018), critical awareness and reflection can be promoted (Christensen 2019; Christensen and Wistoft 2016), and children's thinking and learning processes are made visible as they inquire into, and make meaning of, their worlds (Hedges 2014). In this way, the apparent gap between dominant perceptions in food education (i.e. as a "correction" of learners' taste) and pedagogy (taking the perspective of the learner, a characteristic of both constructivist and socio-cultural learning theories) might be reduced.

How can the Reggio Emilia approach to food and taste education be situated with regard to other experiences and movements? Nature, gardening and food were part of the pedagogical philosophies actuated by Dewey and Montessori at the turn of the 20th century. Dewey described food as an excellent medium for the development of critical thinking and at the Lab School in Chicago he emphasized practical skills, inquiry, democracy and rights (Dewey 1956 [1900, 1902]). While practical life skills and inquiry were also main focuses of her method, Montessori also underlined the sensuous/sensory experience of nature and the senses, advocating paying attention to the senses, linked to pleasure, happiness and harmony with the surrounding natural environment, including gardening and food (Montessori 1988 [1950]). Connected to these notions are several more recent efforts. Les Classes du Goût, developed in the 70s by Jacques Puisais to preserve French national taste and identity, subsequently revised

in 1999, focuses on the individual experience of taste and inspired the Sapere Network (1995). The Slow Food Movement (1985) aims to raise awareness and promote local food traditions. The Edible Schoolyard (1996) is focused on gardening, harvesting and cooking. Jamie Oliver's Food Revolution (2010) combats obesity, sugar consumption and reforming school lunches. The Danish Taste for Life project (2014) misson statement[1] says that it "(focuses) on the flavor of food as a driving force for learning, education, food literacy, and good practice (…) to create a better and richer life (…) starting from children". In the thinking of Reggio Emilia, starting from the opening of the first school after WWII (Barazzoni 2018), school kitchens have always been places with great symbolic and cultural power, capable of expressing care for others, valuing traditions and promoting well-being. Over time, food and taste education and lunchtime at school have become central to this pedagogical approach. Although not yet extensively documented in the research literature, Reggio Emilia approach food ateliers, centered on multisensoriality as well as democratic and self-regulated learning, have much in common with both the Dewey and Montessori perspectives, and have traits especially similar to Les Classes du Goût/Sapere Network and Taste for life.

Regarding architectural design, both in schools built specifically or existing buildings that were repurposed, the school kitchen is visibile thanks to glass walls/partitions, allowing children and cooks to see one another. Children have daily contact with cooks and carry out meal-related activities like setting the table, taking turns distributing bread and serving themselves from shared communal dishes during lunch. Besides preparing meals, school kitchens are open ateliers where cooks spend

[1] Source: https://taste-for-life.org/mission

time exploring foods using many different "languages" during dedicated ateliers with small groups of children, *atelieristas*, and teachers.

The term "atelier" refers to a learning context or environment dedicated to the exploration of a specific topic- in this case, food- but it can also be dedicated to nature and natural phenomena, digital dimensions, manual activities, single materials, etc. (Giudici et al. 2001). The *atelierista*, often a person with an arts background, works both with the children and the teachers to develop and document school projects. The school cook is also considered an *atelierista*. Documentation also plays a significant role as a tool and a strategy to make the children's learning processes visible, shared in real time with parents, colleagues and the children. It shows what the children know and do, both individually and as a group, highlighting content and process, not the end result (Giudici et al. 2001). By spotlighting and reflecting on the relational, emotional, pleasurable aspects of food and eating, children may gain new perspectives on something they do every day. Food is thus not only nourishment but becomes possibility, experience, inquiry, knowledge; an object of exploration for the mind, the senses and the emotions (Cavallini and Tedeschi 2007).

This case study was carried out in two phases at Nidoscuola Clorofilla, a private Reggio Emilia approach preschool in Milan, Italy, together with the research team from Pause Atelier Dei Sapori, a permanent food education and research lab that is part of Fondazione Reggio Children, based in Reggio Emilia, Italy. Pause Atelier Dei Sapori designs and carries out ateliers, projects and informal research around themes linked to food and taste (sustainability, regeneration, cultural identity, the safeguarding and promotion of local traditions and customs, the role of the senses in exploring and investigating food, community building and social cohesion, health and well-being, promotion of healthy eating habits and participation in the struggle against childhood

obesity) in formal and non-formal contexts, nationally and internationally. The photos are of atelier contexts designed by Pause. One of the authors worked as an *atelierista* in a Reggio Emilia approach school starting in 2010, before joining the research team at Pause Atelier Dei Sapori in 2018, so had first-hand, direct experience with the contexts described.

Research questions

The main purpose of this study was to explore the concept of the Reggio Emilia approach *atelier* as pedagogical context and children's food experiences through a multisensory journey investigating varieties of fruits and vegetables. The main question this paper addresses is: How do multisensory food explorations in a Reggio Emilia approach atelier affect young children's conceptions of their food experiences?
In order to explore this research question, we formulated the following sub-questions: How do young children/participants in the multisensory food ateliers articulate their taste experiences (broadly speaking)? How do young children/participants in the multisensory food ateliers articulate changes in their taste experiences as result of this pedagogical intervention?

Research design and methods

Prior to the intervention, parents filled out a questionnaire about their children's food preferences (Phase 1). The results were used in the design of the activities in Phase 2, which were organized during the regular school day for twenty 4 and 5-year-old children over a five-week period. The operational team conducting the ateliers included the school cook, a musician, the *atelierista,* the class teacher and the pedagogical coordinator.

Phase 1 - Food preferences questionnaire (family participation)

The questionnaire distributed to the parents (Table 1) was a reworking of the ICFNS - Italian Child Food Neophobia Scale (Laureati, Bergamaschi and Pagliarini 2015). It gave insight into the parents' conceptions of their children's eating habits and food preferences, specifically regarding new or unfamiliar foods and which fruits and vegetables tended to be rejected. The focus on fruits and vegetables was motivated by the importance of fostering life-long, positive food attitudes during childhood (Wadhera et al. 2015).

Phase 2 – Food ateliers

After summarizing the questionnaire results, the teachers, the school cook and the *atelierista* held conversations with children in order to probe the children's perspectives as well (Irwin and Johnson 2005). The multisensory food exploration was divided into five ateliers, one each week for five weeks. Each atelier, dedicated to a different area of sensory inquiry, took place during the morning and lasted at least 40 minutes. The children worked together as a group during class discussions and were subsequently divided into smaller groups for the food ateliers. Each atelier took place once, with 3-6 children together with 2-3 adults (teacher, *atelierista* and/or school cook), so that each of the 20 children took part in one atelier. After each atelier, the small group shared their experiences with the rest of the class. The data collected included the teacher's and *atelierista*'s photographs, notes and observations during the class conversations, audio recordings during the atelier dedicated to sound and documentation from each of the food ateliers.

Analysis of the data was carried out by way of reflective thematic analysis drawing on guidelines proposed by Braun and Clarke (2006): the qualitative data

collected was inductively analyzed by identifying themes that could explain the children's experiences and perceptions in order to answer the research questions. This choice is supported, at the methodological level, by an epistemological paradigm that considers "human experience to be, as a whole, an interpretative activity mediated and supported by signs" (Baškarada 2014, 15), consistent with the cognitive framework upon which the Reggio Emilia approach is built.

Ethical considerations, validity, reliability and limitations

Following an initial meeting to present the study, the families were asked for their consent since participation was voluntary, in line with the ethical parameters for qualitative research (Santiago-Delefosse et al 2016). The adults carrying out the ateliers verified that the children understood the research project. In Reggio Emilia approach schools, children are accustomed to their words and actions being documented by teachers and the resulting documentation is regularly shared with the class as projects develop (Giudici et al. 2001). Thus, the children in the case study were used to their activities and actions being documented. The project adheres to Fondazione Reggio Children rules and regulations regarding research ethics and it was approved by the scientific committee of Fondazione Reggio Children.

Recent research on the impact of context and environment on children's eating behavior has indicated that these strongly influence liking and food perception (Laureati and Pagliarini 2019). Thus, the parents' reports of their children's attitudes towards various foods may have variable reliability as their answers may not encompass what their children like or accept eating when they are with others, i.e., at school. The parents might have sought to give the best possible impression of their children's food preferences, i.e., over-reporting broadness in food acceptance. Counihan (2004), in her research also set in Italy, found there was a positive moral value on children eating what

was put before them, while Ochs, Pontecorvo, and Fasulo (1996) found that Italian parents generally supported their children's food likes and dislikes and that "Italian adults encouraged children to express individual tastes as part of what it means to have a personality" (Ochs et al. 1996, 7). While this paper is not meant to study Italian cultural food attitudes in-depth, eating and food permeate Italian culture and identity from early childhood, including in school settings. The questionnaire was also a way to promote parent participation, directly involving them in the study and creating a dialogue about their children's eating habits and attitudes towards food, not only between the parents and the school, but also at home with their children.

The results have limited generalizability or transferability in terms of the effect on taste development among children, and should only be considered an example. The educational approach, however, has broader transferability. The model as a whole, or parts of it, provides context and means for meaningful, sensuous, experience-based educational activities in general and for the promotion of taste development more specifically in both formal and non-formal environments.

Language nuances are pertinent when talking about sensory experiences and perceptions. All original data were in Italian and subsequently translated into English by one of the authors. In cases where the Italian word is ambiguous, alternatives have been included. For instance, in Italian "gusto" is usually translated as "taste" (literally and figuratively) and "sapore" is usually "flavor", but they are sometimes used interchangeably. The word "rumore" is usually translated as "noise" and "suono" as "sound", but this distinction is sometimes ambiguous. The Italian verb "sentire" can also be challenging to translate, as it has multiple meanings in English: feel, taste, hear, smell- it seems to express a holistic, all-encompassing conception of taste (Sutton 2010). Thus, in some cases classifications may be affected by such language-based

distinctions, which therefore called for extra attention both when working in the original language and in translation.

Results

The following sections report the results of the questionnaire and the ateliers. Each of the ateliers includes a description of the setting and reports the children's activities, actions and articulations as documented by the adults working with them. One of the authors participated in data collection together with the team involved in the project. The post-atelier results describe how changes in attitudes regarding food was gauged: (i) the children's interest in novel food combinations with the least-liked foods, (ii) the children's meta-reflections about their (changed) attitudes towards new foods and (iii) informal parent feedback about their children's interest in, and openness to, new or different foods following the study period.

Results of the questionnaire

The first part of the questionnaire surveyed the parents' views of their children's openness, acceptance and avoidance of new/unfamiliar foods, fruits and vegetables (Table 1).

Table 1. Questionnaire administered to the parents of the children involved in the study- Part 1

Survey question	No/never	Sometimes	Usually	Always	Sum
Your child avoids new foods	6	6	3	0	15
If there is a new food, your child won't taste it	10	2	1	2	15
Your child likes tasting new foods and different flavors from other countries	0	2	5	8	15
Your child tastes new foods when he/she is at a friend's party	1	2	8	4	15
Your child is afraid to taste a food he/she has never tasted before	8	5	1	1	15
Your child is very picky about food	8	5	1	1	15
Your child will eat almost any food	0	0	7	8	15

From the results in Table 1, the majority of the parents reported that their children would never or only sometimes avoid new foods and that their children were open to tasting new foods. They all stated that their child would usually or always "eat almost any food".

The second part of the questionnaire sought to explore the children's fruit and vegetable preferences according to their parents, asking them to list the three fruits and vegetables, respectively, that their child liked most and least (Table 2). Although explicitly asked to list three fruits/vegetables, the number of foods specified varied between none and four, thus, counts do not add up. Our data do not give insight into the reasons behind the varying numbers, e.g., we cannot conclude that parents listing no fruit/vegetable actually meant that there were no fruits/vegetables that were most or least liked by their child. Some of the foods appear both as most- and least-liked, reflecting that people's taste preferences vary.

Table 2. Questionnaire administered to the parents of the children involved in the study- Part 2

Survey question	No. responses	Food listed
What are 3 fruits that your child likes the least?	4	Pear
	3	Kiwi, mango
	2	Apple, orange, persimmon, pineapple,
	1	Banana
	5	No fruits mentioned
What are 3 vegetable that your child likes the least?	6	Artichoke
	3	Broccoli, peas, peppers, spinach cucumber
	2	Asparagus, garlic
	1	Beets, chicory, eggplant, fava beans, fennel, onions, pumpkin, rocket salad, string beans, tomato
	1	No vegetables mentioned
What are 3 fruits that your child likes the most?	8	Apple, strawberry
	4	Banana, melon
	3	Blueberries, grapes
	2	Mandarins, mango, pear, raspberries
	1	Persimmon, platano, pineapple
	1	No fruits mentioned
What are 3 vegetable that your child likes the most?	6	Carrots
	4	Tomato
	3	Asparagus, broccoli, cucumbers, string beans, zucchini
	1	Beets, hops(?), peas , potato
	1	No vegetables mentioned

Based on the questionnaires and conversations, the least-liked vegetables turned out to be artichokes, peas, cucumbers and peppers. As for fruits, pear, kiwi and mango

were the least-liked. Of these, the fruits and vegetables that were in season at the time of the study were featured in the sensory ateliers described below, with the aim of exposing the children to these particular foods in positively-connoted contexts and explorations. In addition, during the study period, the least-liked in-season foods were included in the school lunch menu, prepared in different ways, either singly or with other ingredients:

- Pear: fresh and dried, spiced pear and apple compote, pear juice
- Kiwi: fresh and dried, kiwi and apple compote
- Peas: creamed peas, Russian salad
- Cucumbers: freshly sliced, *tzatziki*
- Peppers: freshly sliced, baked, in tomato sauce

Food ateliers

On "sensing of" versus "sensing with" and "perception" versus "experience"

In describing the ateliers, we use the term "Exploring (with) the sense of …" because this opens the possibility for both using the senses to explore something external (the food) and also inwardly exploring one's own senses. This shift from the dimension of *experience-of*, that connotes a more detached, abstract relationship to an object- food or, in this case, one's own sense- to the dimension of *experience-with*, opens up to a subjective, direct relationship with the object in question and specifically regards the relationship between the self and the object as well as the "self-in-the-world" (Matteucci 2018). Investigating and defining the relationship between the self and the world underlies children's inquiries in the Reggio Emilia approach. Hence, "exploring with" positions the sense as an action: "smell", for instance, becomes a verb as opposed

to objectivization of the sense, where “smell” is a noun. The sensory perceptions become aesthetic or analytic acts, rather than something that is imposed on the individual (Fooladi, 2020). We distinguish between “perception” and “experience” in that the former is related to the human sense in a narrower and more specific way; to smell something is the process whereby a substance activates receptors in the nose that send a signal to the brain, etc. "Experience”, on the other hand, is conceptualized along with Dewey’s notion of “*an* experience”, of a more holistic character, including memories, associations, and metaphors (Fooladi 2020; Dewey 1980 [1934]). An example could be Proust’s much-cited madeleine-cake-with-tea experience. His perceptions could be the sweetness, softness and juiciness of the tea-soaked cake, perhaps the slight astringency of the tea, by nature physiological, but also psychological. The experience, on the other hand, is more holistic and complete, as Proust is transported back in time and space through memories of times with his aunt, including his perceptions but also much more.

Design of multisensory food ateliers

The design of the ateliers was informed by data from Phase 1. In line with the “pedagogy of listening” (Rinaldi 2005), the children’s articulations of their ideas and perceptions as they described their sensory experiences during the ateliers were documented by the adults. Each atelier primarily explored one of the senses and included the posing of questions aimed at inspiring and provoking thought and attentiveness to the role of the respective sense when exploring different foods. Sample questions are listed in Table 3 together with relevant senses and sensory phenomena that could potentially be activated by the questions.

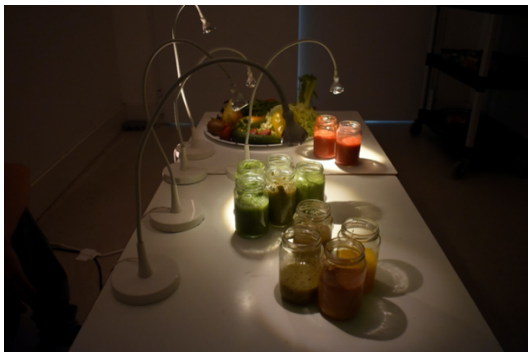
Table 3. Questions posed for possible activation of sensory phenomena

Examples of questions posed	Relevant senses and sensory phenomena
"Can we only taste foods with our mouth?" (class discussion)	Taste, multiple senses, sensory integration
"What are the senses of taste?" (Class discussion)	Taste, multiple senses (sensory integration, crossmodal correspondences)
"Do fruits and vegetables make sounds?" "What sounds do fruits and vegetables make?" (Sound atelier)	Hearing (sensory integration, crossmodal correspondences)
Conversations about what color suggests about taste (Sight atelier)	Sight, multiple senses, sensory integration, crossmodal correspondences
"Is taste (flavor) the same as smell?" (Smell atelier)	Taste, smell, sensory integration
"How can your nose tell you if something is good or not?" (Smell atelier)	Smell
"How do we perceive smells and tastes/flavors?" (Smell atelier)	Taste, smell, multiple senses, sensory integration
"If fruit loses its juice, what does it taste like?" (How does taste/flavor change from fresh to dried foods?) (Taste atelier)	Taste, smell, multiple senses
"What do green things taste like?" (Taste atelier)	Sight, taste, multiple senses, sensory integration, crossmodal correspondences
"What textures do different foods have and what do they remind you of?" (Touch atelier)	Touch/somatosensation (texture and mouthfeel), multiple senses, sensory integration, crossmodal correspondences

Exploring (with) the sense of smell

Researchers generally agree that olfaction is a dominant aspect of taste, since "as much as 80-90% of the taste of food comes from the nose" (Spence 2015, 25). A group of six children were presented with a range of fresh, blended and pulverized fruits and vegetables and were invited to explore these with their sense of smell in semi-darkness, reducing visual cues in order to encourage them to focus on the act of smelling (Figures 1 and 2). The underlying question for this context was: What is the relationship between smell, taste, flavor and the experience, or perception, of foods?

Figures 1 and 2 - A semi-dark context was set up, so the children could focus on their sense of smell without being too conditioned by shapes and colors.



The children's explorations and talk led to discussions around three themes: How our noses tell us if something is "good", how exactly we are able to smell and taste, and multisensory perception and cross-modal correspondences linking smell and color. Regarding their ideas about how we can tell whether something is "good" or "bad", the nose became a sort of independent entity, capable of analysis and "communication", with anthropomorphic and/or zoomorphic traits:

> If my nose likes it, I taste it and if it doesn't like it, I don't eat it _S, 5.6[2]
> (This) looks like cucumber (salad puree) which I don't like, but my nose told me it was good _S, 5.6
> (Your nose) tells you because there's something it likes and you taste it. In my opinion, my nose likes something better, it tells a man inside your nose who tells me, maybe I like it or maybe I don't. When I taste something, there's another man telling me whether to go ahead or not, he's in my mouth, he tells us the things he doesn't like _M, 5.4

Other children mentioned feelings of pleasure and desire inspired by a smell in order to explain how something could be considered "good":

> Maybe if you feel like you really want to eat it a lot, it means it's good _A, 4.10

[2] The children are identified by first initial and age: S, 5.6 = S (initial of first name), 5(years).6(months)

> Your nose doesn't open up, but breath comes in, if you like (the smell) it's good, if not it stinks _V, 5.3

Another theme that the children discussed was how the senses of smell and taste actually work, where their sensory perceptions were localized and where smells and tastes were elaborated in their physical bodies:

> You can smell and taste with your nose. I can smell when I breathe, when I feel it with my teeth it has different taste (from the smell). I put something in my mouth but my nose feels it too! _M, 5.4
> When I put something in my mouth, I feel it in my nose too, but it tastes better from my mouth _R, 4,11
> It has to go here (in your cheeks) then you have to chew, it goes to the back of the mouth and then to your nose _S, 5.6
> There are smells like tomato, orange, carrot, strawberries, apple, mint that you smell with your nose, with your mouth you smell salad, or potatoes, or eggs, you only smell these things with your mouth _B, 5.10
> I think it's all done by the nose. We have a smell, even the nose has a smell, the same for fruits or vegetables, but actually you smell the seeds, the seed becomes a plant and then little tiny strawberries and after some time bigger strawberries, and if you smell them it's the seed that made that effect, because the smell is inside _N, 5,9
> There has to be something to smell, if there's nothing, you can't smell or taste and you don't know if you like it or not _M, 5.4

One child alluded to a more cross-modal perception, likening a smell to a color:

> This pepper smells green _E, 5

The *atelierista* working with the children took this opportunity to ask the group: "What do green things smell like?" and the other children shared their ideas, shifting to a more abstract discussion about links between color and taste.

> They smell like leaves because they come from plants _B, 5,10
> They smell like bits of green, like nature _G, 5.10

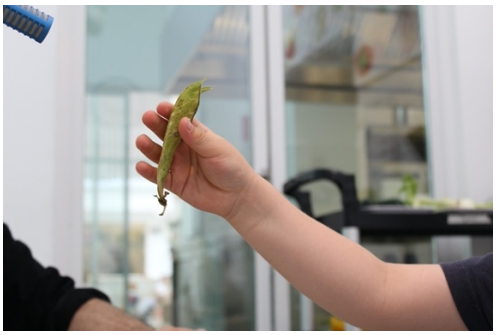
> Green things are vegetables, not fruits, smell green, like minestrone _I, 5.8
> This (lettuce puree) doesn't taste like anything, it can't be salad because the color is different. (Tastes it) But it tastes like salad! _A, 4.10

The theme of color and taste was also part of the sense of sight, discussed below.

Exploring (with) the sense of hearing

Putting something in one's mouth is a highly multisensory experience, also subject to cross-modal correspondences/associations. For instance, Fooladi (2020) studied cross-modal correspondences between sound and taste among elementary school students, posing the question of where one sense ends and another begins. In the atelier dedicated to sound and hearing, the two questions explored were whether fruits and vegetables make sounds, and if so, which sounds can they make. Here, a group of four children investigated the auditory properties of fruits and vegetables (raw and cooked, fresh and dried) by manipulating them with their hands or other tools (Figures 3 and 4) while the sounds were captured by an omnidirectional microphone and recorded, as well as heard through earphones.

Figures 3 and 4 - Children investigated the auditory properties of different fruits and vegetables by manipulating them with their hands or other tools



The children's descriptions can be divided into three main themes: onomatopoeia, anthropomorphism/zoomorphism and free associations based on their imagination. Examples of the first are:

> If you touch a soft fruit it makes a splash because there are drops of water _V. 5.3
> If you bite into a strawberry with your teeth you hear crac cronck _V, 5.6

Other children either anthropomorphized/zoomorphized the fruits and vegetables, or the opposite, that foods are *not* bodies with the ability to make sound, thus bringing in the concept of body/embodiment and bodies' ability to make and perceive sounds:

> Vegetables don't make sounds because they don't have mouths, but a guitar has a mouth _G, 5.11
> Vegetables make sounds that are in their bodies _G, 5.11
> I feel/hear *(sento)* the strawberry seeds that come off the strawberry's body and go into our body _V, 5.3

One child commented about who can *hear*, rather than who can make sound:

> You need ears with eardrums to understand the noises you hear in your mouth _V, 5.6

Many of the children's comments were images and sensations that came to their minds inspired by the sounds they were making with the foods. Several images were inspired by nature:

> I hear the sound of the fire burning _M, 5.4
> I hear the sound of water _V, 5,6
> Pear juice is like snail slime and the noise crawls in my hand _G, 5.11
> If you crush a bell pepper with water in it, you hear bubbles rising and then falling _A, 4.10
> Wet, crushed leaves make the sound of water dripping from the leaves after the rain _G, 5,11

Other images were more abstract, linked to other properties, like hardness/softness or cross-modal correspondences/associations between food properties and sounds or music:

> Hard things make sounds because they're juicy inside _V, 5.3
> I hear the softness of the vegetables _V, 5.3
> When you make the sounds, the vegetables are like notes _M, 5.4
> Things that ripen in the sun have the sound of dry leaves _M, 5.4

The children created a catalog of food noises related to actions (e.g., tapping, rubbing, mashing) and named the sounds they recorded:

- "Slamming noise" (bell pepper)
- "Opening noise" (bell pepper)
- "Splashing noise" or "finger-cracking noise" (spinach)
- "Flowing water noise" (pea pods)
- "Little strawberry noises" (strawberry)
- "Crunchy like squirrels' acorns" (dried fennel)
- "Purple crunchy noise/sound" (raw fennel)

Exploring (with) the sense of sight

The question underlying this atelier was: What does color suggest about taste? A group of three children explored jars of fruit and vegetable purees and pulps, vinegar, lemon juice, milk and baking soda. These could be mixed in small, transparent plastic containers using droppers to create other colors, as a number of colors found in plants (e.g., anthocyanins/anthocyanidins and chlorophyll) are pH dependent (Figures 5 and 6). The unrecognizable foods were identified by their tastes, smells and, especially, their

colors.

Figures 5 and 6 - Exploring fruit and vegetable purees and pulps based on color

The children commented on the chromatic properties of the foods that created a color palette:

> This is a rainbow of fruit. These are the colors you can eat _A, 5.2
> The yellow one looks like pasta _B, 4.9
> One is water and mint _V, 5.6
> One is leaf-colored and one is lemon-green _A, 5.3
> There are many greens, different ones, dark green and normal green _V, 5.6
> There are also two reds, but they’re almost the same _A, 5.2

At one point, one of the children wanted to do a taste test. She chose a jar filled with a bright red puree:

> It's red pepper! I thought it was a strawberry _A, 5.2

Two other children decided to mix some colors- in this case, they chose a red puree and white powder (baking soda) to make pink:

> Wow it sizzles! _B, 4.9
> I want to taste it, it’s making bubbles… yuck, it’s salty! _A, 5.2
> I’ll add some lemon- look, it changed color! _V, 5.6

These examples show how color was not necessarily an indicator of an expected or a

pleasing taste. The children were interested in continuing to experiment and mix different colors and substances. This possibility to mix ingredients introduced an experimental aspect, allowing the children to explore in a laboratory-like manner. Also, using purees removed visual information about the origins of the respective foods, while at the same time focusing on other visual aspects (see the quote above by participant A, 5.2 perceiving red pepper when expecting strawberry).

> Take a fruit, cut it, take the taste from inside or you can dry it and then you have the color of fruit _B, 4,9
> Taste goes around the world and then comes back with lots of little pieces of colors. _V 5.3

After creating a wide range of colors, one of the children suggested using some brushes to create visual marks on strips of paper with the materials and colors. Distinctly from the other ateliers, here the children *produced, created,* visual and tangible expressions, in addition to verbalizing their perceptions and experiences of what they sensed and how food, taste and color could be intertwined.

Exploring (with) the sense of touch

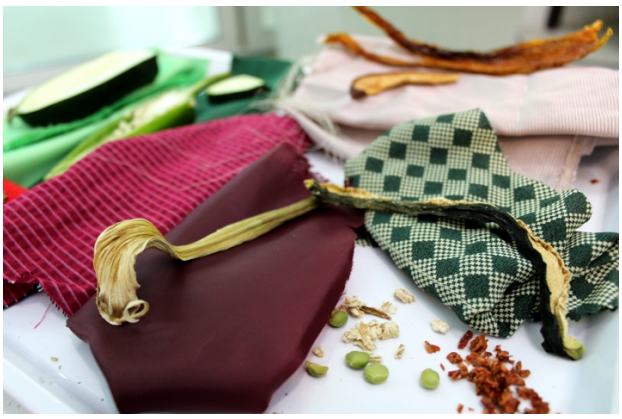
Different fresh and dried foods and fabrics were set up on a table, together with a scanner pen connected to a computer as the context to explore touch through texture. The scanner pen was used to magnify patterns and textures not easily seen with the naked eye. The three children involved in this atelier were invited to explore the tactile qualities of foods and textiles:

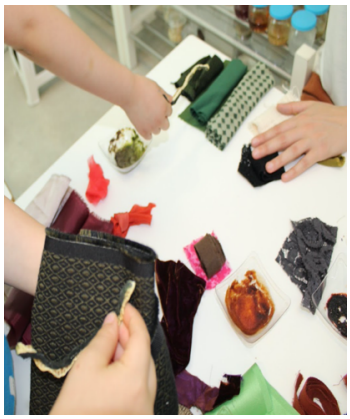
> You can feel the pepper’s skin on your tongue, it's like a hand when it touches things _B, 4.9

The children compared the skins and peels of the vegetables to the fabrics, conjuring up

tactile and visual textures and patterns (Figures 7 and 8):

Figures 7 and 8 - Fresh and fried foods and fabrics to explore touch through texture





> See this skin of the pepper is the same as this cloth, it looks like a turtle shell _C, 5.11
>
> The dried vegetables have wrinkles that I can feel on the fabrics too, sometimes they're smooth like cucumber skin, shiny like peppers and dotted like strawberries _C, 5.11
>
> Vegetables have veins, sometimes seeds and threads _B, 5.8
>
> The green is sparkled with light, the families of greens are different because it depends on their skin: striped, veined, lined and full of roads _B, 4.9
>
> Vegetables' skin is the peel, there are smooth, soft, rough, scratchy, striped, and dotted skins _C, 5.11
>
> We can make families: the family of living vegetables, dry ones, with similar colors, with similar tastes, smooth, rough, that grow differently from plants. You take them and then see how you can join them together. Like (playing) memory _E, 5.7

The scanner pen and the children's observations of images allowed them to explore aspects of touch visually, in addition to feeling textures, providing a bridge between the visual and the tactile (Figure 9). One child, (B, 4.9), described them as "images from the inside of a world".

Figure 9 - Images of fresh and dried foods and fabrics were explored with a scanner pen: (potatoes cooking in eggplant sauce (strawberry) - a piece of meteorite in space (dried pepper)- chicken juice (fresh pepper) - striped stones (dried peas) - snail slime (salad) - light seeds (kiwi)

Exploring (with) the sense of taste

This atelier stands out compared to the other ateliers in that, rather than singling out one specific sense, it was designed in a more wide-ranging, multisensory way. In this respect, the atelier explored the notion of "flavor" more broadly, covering the senses of taste (in the mouth), smell, touch/texture/mouthfeel, color (expectation) and hearing (e.g., when biting or chewing). Thus, this atelier could be said to encompass and combine aspects from the other ateliers in multisensory perception and experience.

For a group of four children, fresh and dried, whole and sliced vegetables and fruits were arranged on a light table, enhancing the visual properties of the foods (Figure 10), while also allowing them to taste, smell and touch them. The light table made visible the veins and translucencies of the leafy greens and sliced foods, usually not visible.

There are peppers full of little tubes, with different shapes but still peppers, I can recognize it by the smell _R 5.5

There is a cucumber with prickles, they look like seeds but they still need to grow _G, 5.11

The little holes in the cut cucumber tell you its years, this one without holes is zero years old _R, 5.5

The children's expressions suggest the possibility of recognizing and valorizing cross-modal associations through explorations where the senses are connected to one another through associations, in an attempt to grasp the sensory fullness of the foods encountered. As the children engaged in their explorations about the senses of taste, they expressed their theories about taste in general, stemming from the body outward into the environment and the world:

If you take a bite, you taste and smell the taste _F, 5.10

You can sniff taste, you can smell it and tell if you like it or don't like it _B, 4.11

Your nose makes you smell, your mouth makes you taste and they are connected by the brain _M, 5.3

Taste is made of flavor *(sapore),* it contains the whole world of taste _V, 4,5

Figure 10 - Fresh and dried, whole and sliced vegetables and fruits were arranged on a light table, to enhance the visual, olfactory and gustatory properties of the foods being explored

Another theme the children discussed was the difference between the taste "living" foods and dried ones. Their word choice, using "living" rather than "fresh" to describe juicy or succulent fruits and vegetables, suggests a sort of anthropomorphism/zoomorphism of these foods that also emerged in their discussions regarding the other senses:

> There are dried vegetables and live vegetables _R, 5,5
> Dried pear tastes sweeter and stickier, the sugar went away and left its taste _R, 5.5
> A living strawberry is sweet and tart, dried it's crisp. There are fruits that are better dried _G, 5.3
> If you don't eat living fruit, you can eat the dried fruit _R, 5.5

In summary, these explorations- uni and multisensory at the same time- offered the children a new way to consider, explore and develop a new way of relating to foods in their everyday lives.

Post-atelier results

Summarizing the findings from the food atelier experiences, we identify two main outcomes. Firstly, the children verbally expressed interest in novel food combinations with the least-liked foods they had explored. Thus, a least-liked food could be perceived as more agreeable when combined with a liked food. Secondly, during the subsequent full-class meta-reflection session, the group took time with the teachers and the *atelierista* to reflect on the experiences and talked about whether and how their attitudes towards new or least-liked foods had changed. In the first case, some of their suggested combinations were:

- Pear: in a smoothie with cookies and bananas; cooked with cinnamon and chocolate; with cheese.

- Kiwi: sliced with sugar, strawberries, pineapple, blueberries and banana; kiwi, strawberry and orange juice.
- Peas: pasta with meat sauce and peas; peas with rice and potatoes; a salad with tomatoes, peas, walnuts and goat cheese; split pea soup with bacon and breadcrumbs.
- Cucumbers: a salad with walnuts, raisins, onions and lettuce; with green salad and a small leaf on top.
- Peppers: with tomatoes, cucumber, salt and pepper; stuffed with ricotta and tuna; cooked with eggs and zucchini.

During the class discussion, the children expressed awareness of changes in attitude towards the foods in this study, mentioning physical sensations in their bodies and mental processes about growth and change. Regarding physical sensations, one girl mentioned the pleasure of tasting something new, as well as the anatomy of her tongue in acquiring a new taste:

> There were vegetables that I didn't eat because they were far away, the taste went in my mouth and I liked it, you have to taste things close up _I, 5.4
> Before I didn't like carrots, now I do, baked ones. I grew up and I changed, my tongue changed, there's a small grid on the tongue that makes you like vegetables _I, 5.4

Other children talked about the importance of the brain/mind or other senses in the process of accepting or developing new tastes and new foods, and the importance of exposure:

> Your thoughts and your mind decide if you should eat it or not. Taste goes from your throat, mouth, nose, head to your mind _F, 5.6
> I didn't like zucchini, now I do. I tasted them 4,000 times, tasting tasting and then you change your mind _I, 5.4

> I didn't like avocados, artichokes or salad but then I ate some purple salad at school. Tasting with your mouth and nose makes the thoughts in your head change. You have to be brave and say "Come on" _G, 5.1
> Smell changes things. People change, they have to change, their tastes change _S, 5.8
> First people don't like things then they get used to eating them, and the more you eat them the more you get used to them _F, 5.6

These quotes highlight the children's (emerging) conceptualizations of multisensory perception (Auvray and Spence 2008); bodily and cognitive processing of food experiences and taste development (Vennerød et al. 2018). Some children mentioned a connection between the development of taste and natural phenomena (Earth, the seaside), memories and places:

> The brain turns and changes, it turns like the Earth around you but you can't feel it, your brain starts turning and sees new things _S, 5.8
> The first time my grandmother made baked sole I didn't like it but now I do, my tastes have changed. Taste changes starting from the mouth, and flavors change over time. In Trani there's the sea and the tide changes, you can taste the sea air _N, 5.8

Finally, of a more anecdotal nature, some of the parents informally reported changes in their children's attitudes and eating habits after the project ended to the class teachers. Some said that, at home, their children were more open, interested and curious about new foods or those different from the ones that they usually consumed. This was not collected as research data, but went into the body of documentation of the teachers and the *atelierista* as relevant for informing pedagogical practice, since it was apparently considered noticeable and significant enough for the parents to mention it explicitly.

Discussion

The main research question for this paper is: *How do multisensory food explorations in a Reggio Emilia approach atelier affect young children's conceptions of their food experiences?* The present study does not intend to give clinically reliable or statistically significant information on taste development in children as result of, e.g., mere exposure effects in the contexts described. While taste development can be conceived as a form of bodily learning, subject to scrutiny from psychological or clinical perspectives using quantitative intervention vs. control group studies, the same can be approached from pedagogical angles. Our aim has been to explore Reggio Emilia approach food ateliers as contexts for pedagogical activities that are sensuous, experience-based and may also promote taste development and convivial and positive experiences around food and taste. Inter/transdisciplinary approaches are also promoted: aesthetic and scientific aspects of taste are naturally woven together because taste experiences are the starting point and context (Fooladi, 2020; Fooladi, Tuomisto and Haapaniemi, 2023). The integration of taste development with other learning is thus important, as this is a dual, or multiple, goal in formal and non-formal learning contexts.

Although learning science and language was not presented as the goal in the activities *per se*, tasting fruits and vegetables was accompanied by open reflection and experience/dialogue-oriented pedagogical approaches with competent adults (teachers, *atelieristas*, cooks). During the ateliers, the children made and tested their hypotheses about how each sense worked, as documented through their words, expressing refined reflections where knowledge from various domains are made relevant. Multiple senses are highlighted as significant, including those seldom valorized as sources of refined insight at school specifically, and the Western tradition in general (Fooladi 2020; Korsmeyer 2004).

Furthermore, giving children's experience a central role in their explorations regarding food and taste highlights their thinking and learning processes and offers vantage points that might otherwise not be valued or documented. As builders of their own knowledge, children need to have occasions and contexts to explore the world around them and develop and test their own theories through practical experience and discussion with adults and peers.

Our study bears witness to an approach to taste education that focuses on direct personal and group experiences, starting from uni and multisensory exploration. The mixing of senses during the ateliers (e.g., sight atelier also using smell and taste to identify otherwise unidentifiable foods, or sound atelier also using touch to create the sounds) meant in the end that none of them was truly only unisensory, which reflects how we sense the world around us. This is made clear in the children's descriptions and reflections when they bring in modalities other than the one in focus: the children's words gave us a complete experience in which all the senses participated. Thus, a relationship emerged between sensory perception and the processes of attributing meaning, which suggests the possibility of grasping - at least *in nuce* - a cross-modal unity of perception, avoiding fragmentation (Spence 2011).

The pleasurable and enjoyable atelier contexts seemed to support the development of positive feelings and experiences with different foods and vegetables, including those least-liked by the group. This optimistic attitude can be inferred in the meta-reflections about the changes the children recognized in themselves towards the foods they had investigated in-depth. During the ateliers, the emergence of cross-modal correspondences, for example between color and taste, seems to have promoted the development of creative, non-linear thinking, thanks to free associations that reveal the children's views and understandings of their own relationships to the world through

food. It seems likely that seeing and experiencing everyday foods with new eyes, new sensations and new ideas enriches the identity building and growth process the children were naturally passing through. This in turn appears to have promoted positive feelings about and interest in food and experiences with it, even those usually avoided. Our results indicate that children aged 4-5 are able to conceptualize, articulate and (self-) reflect on phenomena such as multisensory perception, cross-modal correspondences and taste development if given the opportunity.

Hopefully the rich, open-ended food atelier contexts described will inspire educators, researchers from different fields and parents to consider multiple ways to explore foods together with children using a variety of sensory settings and that these experiences may, in turn, lead to a richer life. Food is a common denominator that everyone can relate to. As such, developing curricula and non-formal outreach activities that include multisensory experiences with food as described above are something to strive for. This paper contributes to the field of food studies by presenting an example of holistic sensory pedagogy and a model for taste education. Sharing this meaningful approach to food and taste can promote dialogue and awareness regarding the impact of our life-long involvement with food and eating, our sense of place which is essential in food culture, as well as the beauty of listening to and valorizing children's ideas, because adults can learn a lot from children, even very young ones.

Summary and further research directions

The results described above discuss how Reggio Emilia approach multisensory food ateliers can foster sensory awareness in young children by cultivating curiosity and taking time for in-depth explorations of the different properties and characteristics of new, familiar and usually avoided foods, as well as the providing the opportunity to reflect on their experiences. By offering children multiple occasions and settings to

come into contact with new, unfamiliar or least-liked foods, this study shows that children express pleasure, curiosity and willingness to interact with these ingredients. In short, food is experience and exploration, not only bodily nourishment and a necessity for physical health.

Regarding the design of learning environments, the experiences described above may offer inspiration for finding ways to offer rich, open-ended sensory exploration contexts that promote a positive, pleasurable, curiosity-based approach to food in general and especially those that are "less liked". "In order to build up an aesthetic childhood capital for later, children need to grow up surrounded by a wide variety of tastes (…) it is precisely these first experiences with new tastes that stick in the memory. …[Children] need to experiment (…) and discover that other senses also play a role in how something tastes" (Van Campen 2014, 84). Over time, these experiences may change attitudes and promote positive life-long habits.

Declaration of interest statement

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors. The authors declare they have no conflicts of interest.

References

Addessi E., A.T. Galloway, E. Visalberghi and L.L. Birch. 2005. "Specific social influences on the acceptance of novel foods in 2-5-year-old children." *Appetite*. 45(3):264-71.

Auvray, M. and C. Spence. 2008. "The multisensory perception of flavor." *Consciousness and Cognition*. 17(3):1016-1031. doi:https://doi.org/10.1016/j.concog.2007.06.005

Baškarada, S. 2018. “Qualitative Case Study Guidelines.” *The Qualitative Report,* 19(40): 1-18.

Barazzoni, R. and L. Malaguzzi, I. Cavallini (ed). 2018. *Brick by Brick. The history of the XXV Aprile Municipal Preschool of Villa Cella*. Reggio Emilia: Reggio Children.

Braun, V. and V. Clarke. 2006. “Using Thematic Analysis in Psychology”. *Qualitative Research in Psychology*, vol. 3: 77-101.

Cashdan, E. 1994. “A sensitive period for learning about food.” *Human Nature*, 5(3): 279-291.

Cavallini, I. and M. Tedeschi, eds. 2007. *The Languages of Food.* Reggio Emilia: Reggio Children.

Christensen, J. H. 2019. “Taste as a constitutive element of meaning in food education.” *International Journal of Home Economics*, 12(1): 9–19.

Christensen, J. and K. Wistoft. 2016. “Taste as a didactic approach: Enabling students to achieve learning goals.” *International Journal of Home Economics*, *9*(1):20-34

Clark, A. and B. Percy-Smith. 2006. “Beyond consultation: Participatory practices in everyday spaces.” *Children Youth and Environments.* 16(2):1-9.

Counihan, C. 2004. *Around the Tuscan Table: Food, Family and Gender in Twentieth Century Florence*. NY: Routledge.

Dewey, J. 1956. *The Child and the Curriculum* (1902) and *The School and Society* (1900), Phoenix Books: University of Chicago Press.

Dewey, J. 1980 [1934]. *Art as experience*. New York: Perigee Books.

Fooladi, E. 2020. “Taste as science, aesthetic experience and inquiry. In *Why Science and Art Creativities Matter (Re-)Configuring STEAM for Future-Making Education*. Pamela Burnard and Laura Colucci-Gray, eds. Leiden: Koninklijke Brill NV.

Fooladi, E., Tuomisto, M., Haapaniemi, J. 2023. “Food in Science, Science in Food - Interdisciplinarity in Science/Chemistry and Home Economics Lower Secondary Curricula Across Three Countries.” *International Journal of Science Education*, in press. DOI:10.1080/09500693.2023.2213801.

Giudici C., C. Rinaldi and M. Krechevsky, eds. 2001. *Making learning visible: children as individual and group learners*. Reggio Emilia: Reggio Children.

Hedges, H. 2014. “Young children's 'working theories': Building and connecting understandings.” *Journal of Early Childhood Research.* 12:35-49. 10.1177/1476718X13515417.

Irwin, L. G. and J. Johnson. 2005. “Interviewing young children: Explicating our practices and dilemmas.” *Qualitative health research*, 15(6): 821-831.

Korsmeyer, C. 2004. *Gender and aesthetics: An introduction*. New York: Routledge.

Laureati, M., V. Bergamaschi and E. Pagliarini. 2015. “Assessing childhood food neophobia: Validation of a scale in Italian primary school children.” *Food quality and preference*, 40:8-15.

Laureati, M. and E. Pagliarini. 2019. “14 -The effect of context on children’s eating behavior.“ *Context*, 287-305.

Leer, J. and K. Wistoft. 2018. “Taste in food education: a critical review essay.” *Food and Foodways*, 26(4):329-349.

Montessori, M., 1988 [1950]. *The Discovery of the Child*. Montessori-Pierson Publishing Company.

Matteucci, G. 2018. “The (Aesthetic) Extended Mind: Aesthetics from Experience-of to Experience-with”. *Proceedings of the European Society for Aesthetics*, vol. 10, 2018, 400-429.

Ochs, E., C. Pontecorvo, and A. Fasulo. 1996, “Socializing Taste”, *Ethnos* 61: 7-46.

Peters, J., N. Parletta, K. Campbell and J. Lynch. 2012. “Parental influences of the diets of 2-5 year old children: Systematic review of qualitative research.” *Journal of Early Childhood Research.* 12(1): 3-19.

Rinaldi, C. 2021. *In Dialogue with Reggio Emilia*. 2nd Ed. Abingdon: Routledge.

Santiago-Delefosse, M., A. Gavin, C. Bruchez, P. Roux, and S.L. Stephen. 2016. “Quality of qualitative research in the health sciences: Analysis of the common criteria present in 58 assessment guidelines by expert users.” *Social Science & Medicine*. 148:142-151.

Spence, C. 2015. “Just how much of what we taste derives from the sense of smell?.” *Flavour* 4(30).

Spence, C. 2011. “Crossmodal correspondences: A tutorial Review.” *Attention, Perception & Psychophysics.* 74(4):971-995.

Sutton, D. 2010. “Food and the Senses” in *Annual Review of Anthropology*. 39:209-223.

Ueda, H. 2018. “A Comparative Analysis of Promotion Systems for Taste Education in Japan, France, and Italy: Suggestions for Japan’s Shokuiku (Food Education).” *Journal of Food System Research.* 25(2)

Van Campen, C. 2014. *The Proust effect: The senses as doorways to lost memories*. Oxford: Oxford University Press.

Vennerød, F. F. F., S. Nicklaus, N. Lien and V.L. Almli. 2018. “The development of basic taste sensitivity and preferences in children.” *Appetite*.127:130-137.

Wadhera D., E.D. Capaldi Phillips, L.M. Wilkie and M.M. Boggess. 2015 “Perceived recollection of frequent exposure to foods in childhood is associated with adult liking.” *Appetite.* 89:22-32.