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Multisensory experiences with and of food: representing taste visually and verbally during food ateliers in a Reggio Emilia perspective

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ABSTRACT

This paper offers an example of what a sensuous approach to food and taste education can look like by investigating the role of learners' senses when taste experiences are translated into words and drawings. The context of the Reggio Emilia approach – and specifically the food atelier setting – creates a space to explore food and taste based on the pedagogy of listening and reflective taste pedagogy, where each participant's individual taste experience is central. The authors describe a non-formal, online food atelier gathering data from 92 participants (78 children/adolescents and 14 adults) from 15 countries, focusing on learners' articulated taste experiences of freely chosen foods through their descriptions and depictions of their taste experience. The findings offer insight into learners' multimodal articulations of their experiences of tasting foods, starting from each individual's visual/verbal interpretation, thus building bridges between (abstract) concepts and language on the one side, and sensuous bodily experiences on the other.

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Introduction

Food and taste education, including research about it, has traditionally focused on health-related topics, eating-disorder prevention, the honing of practical skills or aspects of food production and technology (Smith et al., 2022), while the sensory aspects of food and taste have often not been valorised or considered as significant in teaching/learning environments. This study aims to investigate these aspects of experiences of and with food in their sensory richness, thus promoting new awareness and sensitivity about our relationship to food by verbalising, representing and sharing perceptions in a perspective that valorises all our senses.

In Reggio thinking, children possess

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> a hundred ways of thinking, expressing, understanding, of encountering otherness through a way of thinking that weaves together and does not separate the various dimensions of experience. The 100 languages are a metaphor for the extraordinary potentials of children, their knowledge-building and creative processes. (Indications Preschools and Infant-toddler Centres of the Municipality of Reggio Emilia, 2010)

We describe how multisensory experiences in the context of conscious tasting, when explored through expressiveness linked to the concept of 'the 100 languages', promotes sensory education that bridges the sensuous and bodily with language and visual expression: 'Learning processes take place in which several languages . . . interact together . . . encouraging relations between processes and the flow of one into the other . . . giving greater richness and completeness to thought' (Vecchi, 2010, p. 18). This study is focused on an aspect of Reggio philosophy which has not been described in scholarly literature, specifically its approach to food and taste education, thus filling a gap in the existing literature.

The Reggio Emilia approach: a brief overview

The city of Reggio Emilia, Italy, is known for its progressive schools for children aged 0–6, contributing with an innovative constructivist educational approach that has in time developed into a world-wide network. It stems from the vision of Loris Malaguzzi, founder of and guide to the educational experience of the municipal schools in Reggio Emilia. Over the years its educational philosophy has been part of the dialogue in innovating teaching and learning (Krechevsky & Stork, 2000), offering examples of alternative ways of 'doing' school. Among the core values are: the image of the child as a citizen with rights; the role of the teacher as facilitator and co-inquirer; family participation; the environment as the third educator; pedagogical documentation; and group work (Edwards et al., 1998; Giudici et al., 2001; Rinaldi, 2021).

Although particular attention and interest is found in Reggio philosophy on the role of food and eating, the scholarly literature is surprisingly scarce on this aspect of the Reggio Emilia Approach (REA). Thus the present work aims to fill a gap in the existing literature on approaches to food and taste education in this context. REA schools all have on-site kitchens and lunchtime has always been a significant moment, considered part of the school day (Carta dei Servizi dei nidi e delle scuole dell'infanzia comunali a gestione diretta, 2014). This interest in food is not only limited to mealtimes, but also promoted by sense-based education related to food (Coe et al., 2024). Paola Cavazzoni, *pedagogista* and director of Pause Atelier dei Sapori – a permanent food lab focused on topics linked to food and taste in a life-long learning perspective and part of Fondazione Reggio Children – maintains that 'eating involves the whole body, and does not just happen in the mouth'.[1] For young children, food is much more than nutrition: it is one way they explore, experience and discover the world around them, creating relationships with others and building their knowledge in the process. Thus, the values and ideas of REA are not only put into practice at schools, but its educational experience shapes and informs activities that take place in other contexts with people of all ages. The work described herein explored non-formal food ateliers with older children and adults, based on the Reggio educational philosophy.

Before proceeding, it is necessary to define some fundamental Reggio-specific terms. An *atelier* is a learning context/environment dedicated to the exploration of a specific topic (e.g. visual arts, nature, digital tools, single materials, etc. (Carta dei Servizi dei nidi e delle scuole dell'infanzia comunali a gestione diretta, 2014, p. 38; Giudici et al., 2001), or, in our case, food. It can be located in a dedicated physical space or set up temporarily. According to Vea Vecchi (2010, p. 2), an atelier 'is associated with things taking shape through action; places where brains, hands, sensibilities, rationality, emotion and imagination all work together in close cooperation' starting from the everyday, which then take on new value and meaning. The *atelierista*, often a person with an arts background, can be anyone with specific non-pedagogical training and works to develop projects and document learning processes. Cooks are referred to as 'cook-atelieristas' due to their culinary expertise. The atelier described in the study was developed and conducted by the Pause team, composed of two cook-atelieristas, three atelieristas (including one of the researchers) and a *pedagogista* with formal pedagogical qualifications.

In REA settings, inquiry and knowledge-building start from the learners: they *build their own knowledge* through the 100 languages, which recognises the plethora of ways learners 'are encouraged to explore … and express themselves through all of their available "expressive, communicative, and cognitive languages", whether they be words, movement, drawing, painting, building, sculpture, shadow play, collage, dramatic play, or music, to name a few' (Edwards et al., 1998, p. 4), as well as food. We hypothesise great richness in the simple act of putting food into one's mouth for both educators and learners, an act often considered mundane and accorded little importance in academic and learning contexts. In our case study, graphic mark-making and verbal descriptions of the participants' representations of taste informed their processes of communicating bodily experiences of flavour. The materials analysed – written/drawn accounts of taste experiences – can be considered an example of the 100 languages, another fundamental REA concept that posits that learning is 'multi-leveled and multimodal' (Edwards et al., 1998, p. 7). This may, in turn, invite educators, curriculum designers and researchers to reflect on relations between learners' bodily experiences and articulations of the 100 languages.

Sensibility to listen to and valorise children's ideas and perceptions refers to the pedagogy of listening (Rinaldi, 2021), a pillar of REA, which in our study means keeping participants at the centre of their learning processes resulting from sensory experiences and explorations with food. By engaging in such reflective taste pedagogy (Leer & Wistoft, 2018), the development of the participants' critical awareness and reflection may be promoted (Christensen & Wistoft, 2016). The work herein offers an example of what inquiry informed by the 100 languages can look like, showing how knowledge can be built in sense-based, learner-centred ways. The open-ended process of building knowledge is a fundamental characteristic of REA, and the 100 languages are the means.

Multisensory (food) experiences

Eating is a multisensory experience and describing experiences with and of food both requires languages and builds languages, broadly understood (and in the plural). Promoting bodily and sensuous learning experiences dialogues with the notion of the hierarchy of the senses (Korsmeyer, 2004, p. 87) that historically considers sight and

hearing as 'higher senses (worthy of attention) . . . intellectual senses . . . allied with the mind, leaving touch, taste, and smell in the realm of the body and its physical sensations', positioning these as 'lower senses'. This paper promotes awareness of taste, smell and touch and the democratisation of all aspects of the sensuous and sensory awareness within an educational framework.[2] Some other recent efforts in sense-based food education that valorise the perceptions of participants and promote the sharing and expression of their experiences of and with food include *Classes du goût*/Sapere Network (Institute du goût, n.d.) formal taste sessions, which originated in France and are currently active in Asia, Europe and Scandinavian countries, where the focus is on the sensory and sensuous pleasure of eating and of children of discovering themselves. In the Danish 'Taste for Life' project (Taste for Life, n.d.) food is considered a way to know and understand the world, giving value and meaning to 'mundane' aspects of everyday life, starting from mealtimes and eating, which is also in line with REA thinking (Vecchi, 2010).

By 'multisensory', we herein refer to how the five senses intersect and influence each other. The associations that people make between one sensory modality – for example, colour, shape, sound, texture and basic tastes – with a different sensory modality can be expressed visually, verbally (as described herein) or through sound (Fooladi, 2020, p. 372). This article attempts to bridge the gap between educational research in food and taste education, which has often traditionally focused on health-related topics (promoting a healthy diet, preventing eating disorders, etc.) and not necessarily valorising the sensory dimension in food and taste education. When it comes to sensory interactions and crossmodal correspondences related to food and taste, these have mostly been discussed in neuroscientific literature (Lee & Spence, 2022; Spence, 2019), with only a few exceptions discussing such in relation to education (e.g. Coe et al., 2024; Fooladi, 2020). Crossmodal correspondences are associative connections made between perceptions across senses, such as red being associated with sweetness, yellow with sourness, etc. Although the two terms are often confused, they are fundamentally different from synaesthesia, which is an idiosyncratic and involuntary condition where one sense stimulus activates a sense perception in another sense (e.g. literally perceiving a specific taste when seeing a certain colour, see Deroy & Spence, 2013). Previous studies have documented crossmodal correspondences between basic tastes and visual features where participants were asked to match pre-made colour patches or shapes with tastants (Spence et al., 2015; Velasco et al., 2015), or to choose from a list of descriptors (adjectives) to describe the taste of foods (Shields-Argelès, 2019). Since the aim of the atelier described herein is education rather than neuroscience, referring to Reggio thinking regarding learners' agency, the design of our study allowed learners the freedom of conceptualising *ab initio* their own associations between sensory perceptions and the graphic and/or verbal rendering of the experiences. This also allowed us to maintain the ecological validity of the atelier activities as an educational context.

Rationale of the study and research questions

Our study investigates learners' multisensory experiences of and with food and presents the food atelier setting as a context for learning based on the participants' lived experiences. Their articulations of sense experiences, as documented by their drawings and comments, constitute the object of the case study, connecting REA and the 100

languages, multisensory perception and food experiences. The present case study was guided by the research questions:

> How are learners' multisensory experiences with/of food represented visually and verbally in non-formal Reggio Emilia approach food ateliers?
>
> What insights about connections between learners' multisensory experiences with/of food related to language and visual expressions are generated from their explorations of it?

Research design and methods

This food atelier was specifically designed for a large international group of participants to be conducted online during the Covid pandemic. This transition from the usual in-person atelier to an online one presented both challenges and opportunities. Some of the challenges were ensuring that the participants remained active and engaged, that they felt part of a learning group in which they could work together to explore and articulate. Strategies to create this collaborative atmosphere are described below in the description of the atelier. Collecting the artefacts (drawings) was also difficult because of the physical distance and the quality of the images. There were also a few instances of technical problems with internet connections. Opportunities created by being online meant that people from all over the world could participate and they chose a wide variety of foods to explore during the atelier, based on the seasonality of their location. The selection of foods would have been more limited in an in-person setting (i.e. participants would have chosen among a range of foods in a physical atelier). Another benefit of being online is that all of the ateliers conducted were recorded, resulting in the possibility for this analysis. Thanks to the small number of participants in the groups (an average of eight participants per group) and the presence of atelieristas and cook-atelieristas conducting the atelier sessions and the interpreters who knew Italian, English and the mother tongue of the participants, interactions between group members were facilitated and supported both from educational and linguistic perspectives. There are multiple expressive modalities according to the theory of the 100 languages and this atelier included primarily verbal language and drawing. The intertwining of verbal and graphic languages was part of building knowledge through the '100 languages', similarly to physical, in-person atelier settings.

The online atelier, 'The Grammar of Taste'

In line with Reggio thinking, the non-formal online food atelier aimed to involve the participants as co-inquirers and contributors to the development of the experience. Initially, participants received an invitation to gather a series of foods in their homes based on various qualities – colour, size, taste, sound – and to offer their personal interpretations, thus prompting the participants to start thinking before the actual event:

> What comes to mind when you think of food and taste?
>
> How many colours, scents, flavours, sizes, shapes, sensations, textures?

Together we'll try to discover the qualities of some foods, experimenting and exploring them from new points of view.

To participate in the atelier, you'll need to look for ten ingredients in your kitchen:

(1) a green food
(2) the smallest fruit
(3) the crunchiest vegetable
(4) something that grows underground
(5) a juicy food
(6) a slippery food
(7) a sweet vegetable
(8) a salty fruit
(9) the funniest food
(10) a food that you really don't like the taste of

When you've gathered them, prepare the foods you chose on your table before the atelier begins. This will be your own personal, unique setting!

You'll also need some paper and something to write with (a pencil, a pen, a marker).

Together we'll discover how food, taste, words, sounds, the voice, the body and mark-making intertwine.

During the atelier, each participant presented their favourite ingredient and introduced themselves by talking about it, tasting it and describing its taste. In a second phase, the participants were asked to translate these taste experiences into non-figurative graphic marks subsequently describing their drawings. Questions posed by the teams leading the ateliers were aligned to the participants' individual sensations and descriptions of the flavours. During the last phase of the atelier, the drawings were collected to create a digital group manifesto about taste. Each group also gave a title to their collection of images. This final phase of the atelier, not discussed herein, is mentioned to give readers a sense of the entire design of the food atelier.

Data collection and analysis

The data, collected during an ongoing educational project rather than specifically with this research design in mind, focuses on 10 sessions of an online food atelier with an international group of children and adolescents, utilising a convenience sampling approach (Cohen et al., 2007). The 113 participants from 15 different countries[3] were divided into 10 groups, based on age and geography/time zone, and the *lingua franca* was English. There were 92 participants (78 students and 14 adults) in the food atelier sessions. For our analysis, 58 drawings were collected. Since participating in the atelier was not mandatory, fewer drawings were produced either because of absences or non-participation during the activity. In addition, since the drawings were not physically collected after the atelier, the images included in the paper are screenshots taken from the video recordings and some drawings were not able to be included as they were not sufficiently visually legible and could not be analysed.

Herein, we focus on the graphic/verbal representation of each participant's taste experience, thus neither gender nor age were used as a criterion. Each group was led by a team of a cook-atelierista and an atelierista together with an interpreter who knew the languages the children spoke, English and Italian. The ateliers took place during parallel sessions conducted by different teams. In some groups, additional atelieristas and/or the interpreters participated as co-inquirers and this data is included in the study, as both the children's and the adults' experiences were of interest. Each atelier lasted two hours and followed the same structure, alternating questions with reflections and actions, both individually (in their homes) and as a group. The ateliers were recorded and transcribed verbatim, and parts in Italian were translated into English by one of the researchers who is a bilingual Italian/native English speaker and also one of the atelieristas.

The 15 countries involved were defined by the project and not the research study, thus, most participants were not native English speakers. Thus, translation was important, keeping in mind that the participants might not have expressed the nuances of their thinking due to language difficulties. The age range was set by the scope of the development project.

The data was analysed using an analytical tool devised for the study, inspired in part by Deguara (2019) on drawing analysis methodology. For our analysis, the 58 drawings collected were numbered D1–D58, with the suffix 'CH' if by a child/adolescent and 'AD' if by an adult. Descriptive theme codes were inductively generated using the constant comparative approach (Cohen et al., 2007) by surveying the material for visual and verbal traits that could represent various renderings of the multisensory experiences, producing the following themes:

- **NA (narrative)**: A figurative image telling a story, depicting a place, a scene, a situation, with characters, actions or environments (mountains, seaside, etc.) This code is also characterised by memory, associations, metaphors or emotions found in the verbal data.
- **PR (process/**transformation/change/temporal aspect/literal description of perception): On a visual and/or verbal level, there is something actively going on and the 'end' is different from the 'starting point' – thus introducing a temporal dimension. For example, a single line that modifies over its course or a series of images that express different 'states' during the taste experience. It can also include a literal description of taste perceptions.
- **ST (static**/geometric/random pattern): The drawing can be very simple/gestural (like a random scribble) or more detailed and carefully drawn. The visual pattern created by the element(s) does not represent a change or a process.
- **LD (literal depiction)**: Drawings of the food in question rather than the taste experience of it.
- **OT (other)**: Drawings that do not fit any other code or are ambiguous.

Except for PR and ST, the theme codes are not mutually exclusive, thus drawings could be coded with more than one code. The material then underwent a deductive analysis to quantify the presence of theme codes, giving a (semi-)quantitative picture.

In a second step, the coded material was analysed deductively to map the mentioning of the five senses. The criterion for coding was the presence of a given sense perception and not its absence. For 'sight', the defining criterion was a visual *experience/perception* of the food (e.g. colour, shape). 'Touch' included mouthfeel, weight, bodily sensations, physical movement and texture. 'Taste' referred to basic tastes in the mouth (e.g. sweet, salty, sour, bitter and umami). We are aware of the ambiguity of the word 'taste', often taken as equivalent to 'flavour', which encapsulates a broader set of sensuous perceptions than 'taste'.[4] 'Sound' was coded when participants clearly mentioned an auditory perception of the food they tasted. Finally, 'smell' was coded only when it was specifically mentioned.

The coding was initially done individually by two researchers, then compared and negotiated to consensus. Finally, a qualitative survey of the material was carried out, followed by further discussion to identify traits in the material that might not have been captured in the inductive and deductive steps. (See supplementary material for overview).

Ethical considerations, generalisability and limitations

Participation was voluntary and the families of the children who participated in the study and the adults who took part were asked for their consent, in line with the ethical principles for qualitative research (Santiago-Delefosse et al., 2016). All participants (or parents in the case of minors) received a statement of informed consent and they signed release forms approved by the Fondazione Reggio Children ethics committee. All quotes are anonymised, only indicating whether the respondent was a child or an adult.

The specific results have limited generalisability, since the taste experiences analysed are individual and subjective, but may still add to our knowledge of multisensory perception and literacy. The educational approach, however, has broad transferability as a model for promoting sensuous teaching and learning and developing taste awareness and literacy in formal and non-formal learning environments, focused on learners' experiences and insights about foods seen and eaten every day. The list of food prompts sent to the participants to prepare for the atelier included visual, auditory, tactile (texture) and taste characteristics, but smell was not as strongly present. Still, as seen in the results, olfaction appeared in several descriptions. This is discussed further below.

Mother-tongue and second languages played roles on several levels. Firstly, most of the original data and material in the study were in English. While we cannot be certain that experiences and what the participants wished to convey was not lost from one language to another, care was taken in transcribing and/or translating the sessions verbatim. Extra attention was paid when working with content translated from Italian to seek highest possible equivalence between original description and translation (for example, regarding the words flavour/'sapore' and taste/'gusto', which are often used interchangeably in both languages).

Limitations regarding the fact that the atelier was conducted online have been discussed in the Methods section. These included keeping the participants active and engaged, collecting the artefacts (drawings) from the atelier sessions and occasional technical problems with internet connections.

Results and discussion

In this case study, the food atelier setting aimed to create conditions for thinking about and representing the taste of familiar foods in a presumably new, different way: the 100 languages were activated both by the participants, who chose their own foods to explore, and the teams leading the ateliers, who asked participants to represent their taste experience through mark-making and verbal description. The teams that designed and led the ateliers did not know what would come out of the atelier or how the participants would represent their experiences.

Before turning to the analysis, we will exemplify the coding criteria/process to provide the reader with notions about the drawings and descriptions and how they were subsequently coded. Two drawings that were coded only NA, linked to narration, memory, associations, metaphor and emotions, are shown in Figure 1.

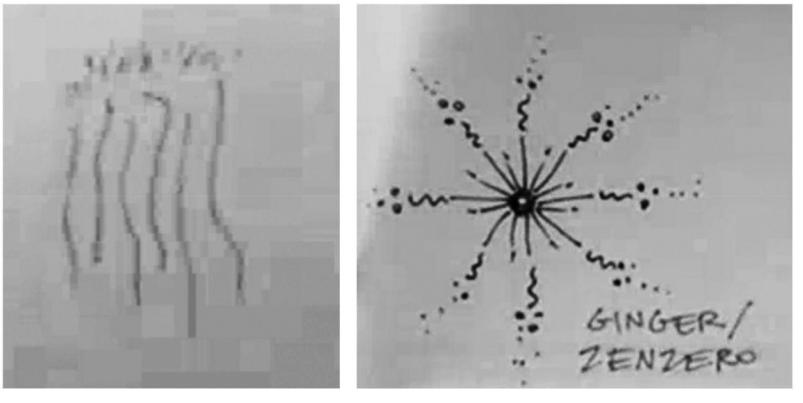

Figure 1. Drawings coded NA. Left, D7CH (broccoli): 'Broccoli has a spine that develops and I tried to do these little brushes on. This is how I feel in my mouth when I eat it. It looks like a firework that explodes in your mouth.' Right, D39AD (ginger): 'Ginger has a strong and spicy taste and it adds a lot and you can also drink it. I tasted a tiny piece – it's very spicy, then the flavour and smell arrive in my mouth – it's fresh and I feel clean, like I just brushed my teeth.'

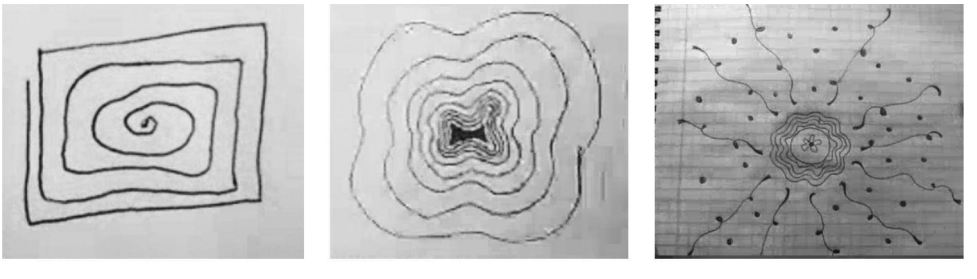

Figure 2. Drawings coded PR. Left, D28CH (chocolate): 'Chocolate, when I bite it is hard so it's more square, then it melts and becomes more circular, soft and tasty.' Centre, D35CH (sugar): 'White sugar is hard at first and then it disappears. You can't swallow it, it turns sweet, it's not very strong.' Right, D55CH (watermelon): 'The middle represents the first bite and the watery feeling when you bite watermelon and how the feeling expands when you keep biting.'

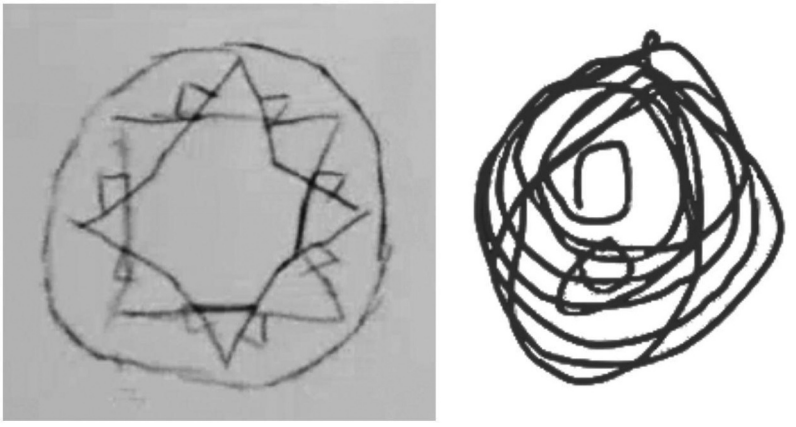

Figure 3. Drawings coded ST. Left, D33CH (tomato): 'The peel is tougher than the inside is softer, juicy, watery and sour. I don't like tomatoes!' Right, D22CH (sugar): 'I tried closing my eyes to do it- both scent and flavour. I imagined a cube of sugar.'

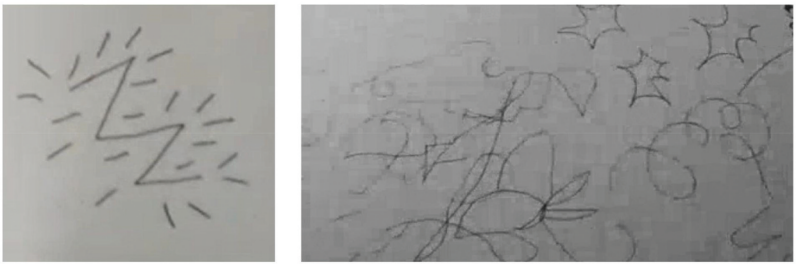

Figure 4. Drawings coded OT. Left, D12AD (candied ginger): 'I love candied ginger, there is so much going on in my mouth when I taste it – sweet, spicy, chewy, soft, crunchy.' Right, D54CH (orange): 'First I just closed my eyes, and tried to think what comes to mind when I think of an orange, I just drew some lines and then I thought of explosions and finally smiley faces which represents my face when I eat an orange.'

Examples of drawings coded only PR are shown in Figure 2, highlighting process, transformation, change, temporal aspect or literal descriptions of taste perception.

Drawings coded only ST are shown in Figure 3, interpreted as showing no temporal change, development or process (cf. methods section).

Drawings coded OT (Figure 4) did not fit any of the other categories as identified by the keyword descriptors for the other codes nor did the sensory data in the descriptions resolve this. (No drawing was coded OT plus another code).

Drawings only coded LD (Figure 5) were literal, figurative depictions of the foods tasted.

In some cases, the participants' comments shifted or clarified the choice of theme code(s): Figure 6 shows two drawings that might *look* similar but which take on different significance based on the participants' comments.

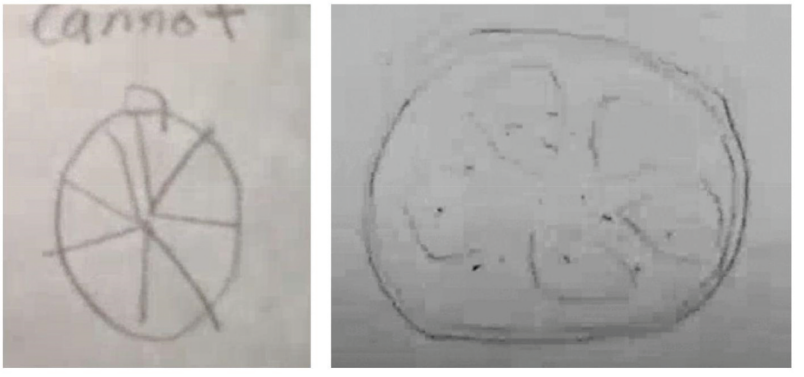

Figure 5. Drawings coded LD. Left, D45CH (carrot): 'I drew a carrot, it's sour.' Right, D8CH (tomato): 'The tomato is salty a little bit, it's red and round . . . the crunchiness of the seeds, the juiciness of the pulp. The peel is harder than the pulp . . . I like to eat tomatoes in different forms, I can eat it raw like it is, I can make a sauce.'

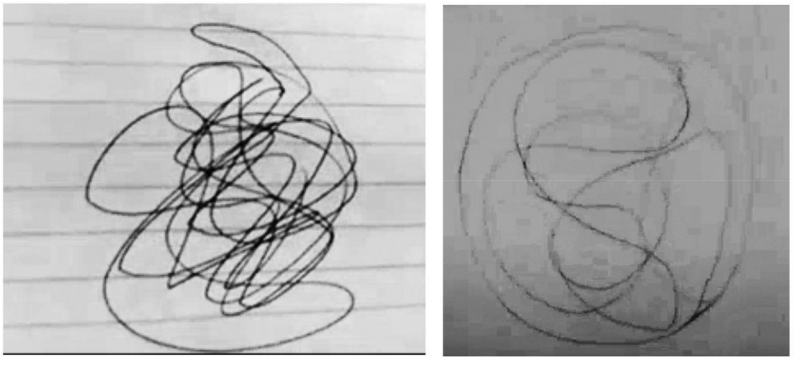

Figure 6. Example of theme coding interpretation. Left, D1CH (cauliflower): 'It's like a storm in my mouth', coded NA-ST. Right, D9CH (tomato): 'It's still a circle – Chaos – it has the same taste whenever I eat it – so when I bite into it, it's the same taste until I finish it', coded NA-PR.

Drawing D1CH refers to cauliflower being like 'a storm in my mouth', describing the taste in a metaphorical sense (thus the code NA) and the drawing itself is visually a sort of scribble, without beginning or end. It does not seem to relate to a change or a temporal dimension, so it was coded ST. Drawing D9CH might look similar at first glance, but here the participant wrote about chaos, which was interpreted as a metaphorical/associative reference to the act of eating a tomato (so again, NA). She also mentioned the tomato having the same taste *every time*, and in this case during *the time spent finishing eating it*, thus adding a temporal dimension and a change taking place, identifying the image as PR.

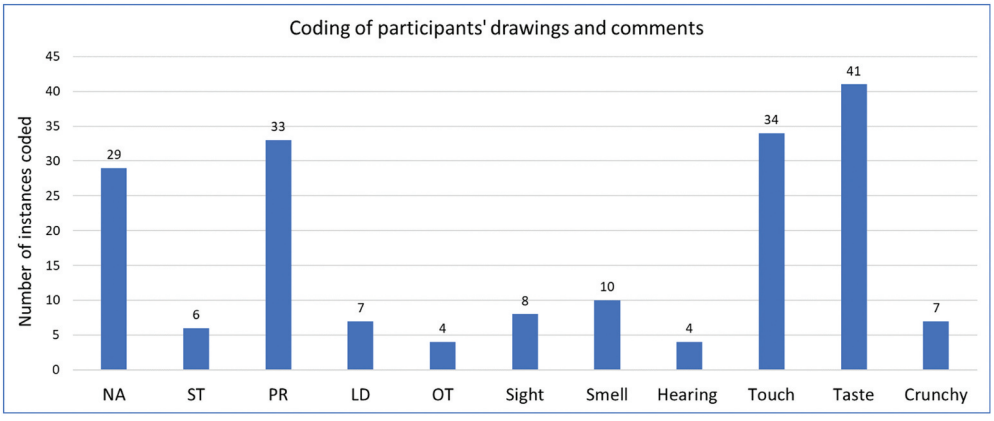

Figure 7. Counts of instances of coding of participants' drawings and comments.

(Semi-)quantitative findings

As seen in Figure 7, the most frequent codes are NA (narrative) and PR (process). With respect to the senses, touch and taste were much more frequent than smell, sight and hearing. Notably, both taste and touch occur in the mouth, while the other three are predominantly perceived by other body parts (Korsmeyer, 2004) supporting the (mis) conception that 'eating just happens in the mouth'.

Since the codes are not mutually exclusive, descriptions could be coded with more than one theme and/or sense.

Awareness that eating or putting something into one's mouth in general are highly multisensory experiences is not necessarily self-evident if one is not conscious of the experience of eating. Hence our interest in exploring the presence of the multisensory in the participants' drawings/descriptions by looking at number and co-occurrences of senses. Table 1 displays the number of sensory modalities coded for each drawing based on the comments, giving a picture of the participants' responses with respect to their multisensory perception. Interestingly, although the participants were asked to represent their taste experience, eight people did not offer any insight into the sensory experience of tasting their food. Nineteen participants reported one sense modality, while 31 reported two or more senses, meaning that over half described multisensory engagement during their taste experience. Only one person mentioned all five senses (D34CH, chocolate, Figure 8).

Table 1. Count drawings with number of sensory modalities coded.

0 senses	1 sense	2 senses	3 senses	4 senses	5 senses	Sum
8	19	19	9	2	1	58

Table 2. Count drawings with number of theme codes.

0 codes	1 code	2 codes	3 codes	4 codes	Sum
4	34	19	1	0	58

Table 2 shows that almost two-thirds (34) of the drawings were coded with just one theme. The theme codes did not specifically regard sensory modalities but were linked to other concepts which mainly regarded the visual characteristics of the drawings. The two coding steps were combined in contingency tables to show the co-presence of sensory modalities with the theme codings. Since the number of themes and sensory codes vary greatly (Figure 5), the absolute number counts do not necessarily give a balanced picture of correlation when comparing codes and themes. Tables 3 and 4 show coding results when theme codes were seen in light of the five senses (e.g. half of the drawings coded with sight are coded NA, and the co-occurrence with sensory modalities is generally higher for NA than for ST).

Tables 3 and 4 show a low number of codings for smell compared with taste and touch, perhaps due to the lack of words for 'basic smells', thus making it more difficult to put smell experiences into words (Drobnick, 2006). The tables also show the low number of codings for hearing. Perhaps this sense is not perceived as relevant for taste? Also, hearing is mostly connected to NA and PR, not with ST at all. Since hearing is a specifically temporal phenomenon, this correlates with these general notions. LD correlates more with sight than the other senses, which may be expected. In all four tables, NA and PR are the predominant theme codes overall, regardless of sense. Thus we see a pattern that taste experiences are perceived as processes, temporal and associative by nature, often linked to story-telling; they are seldom static.

Regarding co-occurrences between the sensory modalities (not shown), all drawings coded with smell also mentioned taste. Out of 10 coded for smell, eight were coded with three or more senses, and for sight, all were coded with three or more senses. Thus, when citing vision or olfaction, there appears to be a broader description of sensory modalities in general. The four coded with

Table 3. Theme codes vs. sense modalities – counts.

	Sight	Smell	Hearing	Touch	Taste
NA	4	6	2	15	19
ST	1	2	0	1	4
PR	4	6	3	23	27
LD	3	2	1	4	5
OT	0	1	1	2	2

Table 4. Theme codes vs. sense modalities – proportional.

	Sight	Smell	Hearing	Touch	Taste
NA (%)	50 %	60 %	50 %	44 %	46 %
ST (%)	13 %	20 %	0 %	3 %	10 %
PR (%)	50 %	60 %	75 %	68 %	66 %
LD (%)	38 %	20 %	25 %	12 %	12 %
OT (%)	0 %	10 %	25 %	6 %	5 %

hearing are too infrequent to imply any pattern. The by far greatest co-occurrence was between touch and taste, adding up to 26. Interestingly, 18 out of the 19 coded with only one sense were either touch or taste (8 touch, 10 taste, 1 sight). It is not surprising that taste is strongly present in general, since the atelier is literally 'about taste', but it is worth noting that the formal definition of taste (used in our coding) and the everyday use of the term are often different, depending on how it is contextually, culturally and experientially situated. While this distinction is used in our analysis, it was not made explicit in the atelier. We presume that the word 'taste' was used frequently in everyday language, although this does not signify the participants all intended the same meaning. The high prevalence of touch, however, is not as obvious. Lee and Spence (2022, p. 7) mention comments by Marks (1978) on the similarity between tasting and touching, since 'certain adjectives (e.g. "sharp") had shifted over time from first describing touch to later taste and now visual shapes'. This is an interesting angle from which to consider the taste–touch connection, given the focus in visual mark-making in our study. The fact that all participants mentioning smell also mentioned taste supports the fundamental role of olfaction in tasting, since aromas are the predominant sensory stimuli in our experience of flavour, in layperson's terms often referred to as 'taste' (Wilson 2015). Still, it is worth noting the low presence of smell, however not emphasised in the pre-atelier invitation the participants received.

We saw the most prevalent themes were PR and NA (Figure 7). The high frequency of NA should not come as a surprise, since the participants were actively encouraged to describe their sensory experience for which associations are important. Also, tasting is an action, meaning *to taste* is a verb as opposed to *the sense of taste* or *the tastants* of a food being nouns (Fooladi, 2020). Hence, the act of tasting is all about undergoing an active sensuous experiential process. This suggests that the food atelier described succeeded in its aims. The temporal dimension of taste experiences was also mentioned by participants ('here and now' perceptions during tasting, or memories linked to the foods). We find the link between NA codes to aspects like memory, time, temporality mentioned by participants particularly interesting. The stretching of time with regard to a taste experience is embedded in the design of the food atelier, since participants chose (and likely anticipated) the tastes of the foods before the atelier began, and then described their taste experience, often with reference to past experiences of eating that food. It is likely that depicting their taste perception through mark-making was an unusual experience that allowed learners to build new knowledge about familiar foods, thanks to intertwining sensuous experiences and two expressive languages (words and images) in a novel way, in line with the notion of 100 languages.

Qualitative findings from the perspective of sensory modalities

Regarding the senses, most – but not all – modalities have 'basic elements'. Generalising for each sense:

Taste – Widely accepted basic tastes: sweet, sour, salty, bitter and umami.

Vision – Basic 2D or 3D shapes: square/cube, triangular/pyramid, round/spherical, linear, flat, thick, thin, etc. – and colours: red, yellow, green, blue, etc.

Hearing – Basic words about volume: loud, soft, silent; pitch: high-pitched, low-pitched; rhythm: staccato, legato, fast, slow, etc.

Touch/Somatosensation – Basic textures/tactile qualities including: smooth, rough, juicy, dry, hard, soft, sticky, slippery, grainy, etc.; or dimension: big, small, etc.

Olfaction – There are no basic concepts, except perhaps regarding intensity (a strong/not strong smell). Talking about smell is often based on associations: 'smells like an apple', 'lemony', 'grassy', etc.

Thus, smell requires a qualitatively different language and concept-use, as basic descriptors are simply lacking. Yet smells (and tastes, which are in large part olfactory experiences) go beyond words and conjure up memories (cf. Marcel Proust's well-known madeline and tea reverie in his 'In Search of Lost Time'), narratives and emotions (Van Campen, 2014; Wilson, 2015). Turning to the data collected, a qualitative survey of drawings coded with olfaction revealed that the occurrence of NA is linked to comments related to memories, as in D14CH, and time, as in D34CH (Figure 8).

These findings are in line with research that has shown that smell is particularly closely linked to memory and time (Korsmeyer & Sutton, 2011; Low, 2013).

For drawings coded with touch and taste, describing taste experience in the 'here and now' and associations with nature were prominent features. The temporal ('here and now') characterised the majority of these drawings (25 coded taste and 19 coded touch), as the descriptions were linked to the moment of eating/tasting and not to recalling past experiences. Associations with nature included references to flowers, the sea, water, the breeze and fresh air, clouds, waves and sand.

All four drawings coded with hearing – D34CH (chocolate, Figure 8), D10AD (coffee and biscuits, Figure 10), D32CH (coffee beans) and D47AD (potato chips) in Figure 12 – included temporal aspects. This could stem from the fact that audition is highly reliant on the temporal dimension of perception, aligning with the fact that none of the drawings coded with hearing were coded as static (ST).

Drawings coded with sight were more frequently found to co-occur with literal descriptions (LD) than other modalities. Colour as part of the experience was present in half of the descriptions (not shown). The low number of LD is most likely due to the fact that participants were asked not to draw the actual food they tasted, but explicitly to express their taste experience/perception. Interestingly, some participants drew a literal

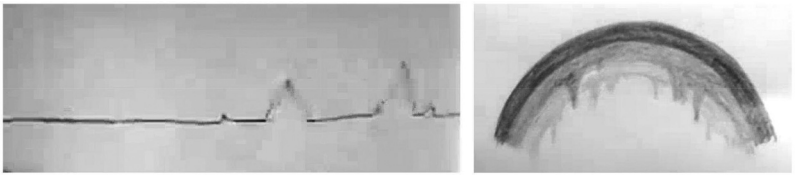

Figure 8. Motifs mentioned in relation to drawings coded olfaction. Left, D14CH (lemon): '(Lemons) make me think of my best friend because she had a lemon tree. I won't see her anymore because I'm going to middle school', coded NA+PR. Right, D34CH (chocolate): '(Chocolate) . . . smells really good, and when you have it in your mouth, it melts, it's sweet and at the beginning it is hard to chew but after a few seconds it starts to melt', Coded: NA+PR+LD.

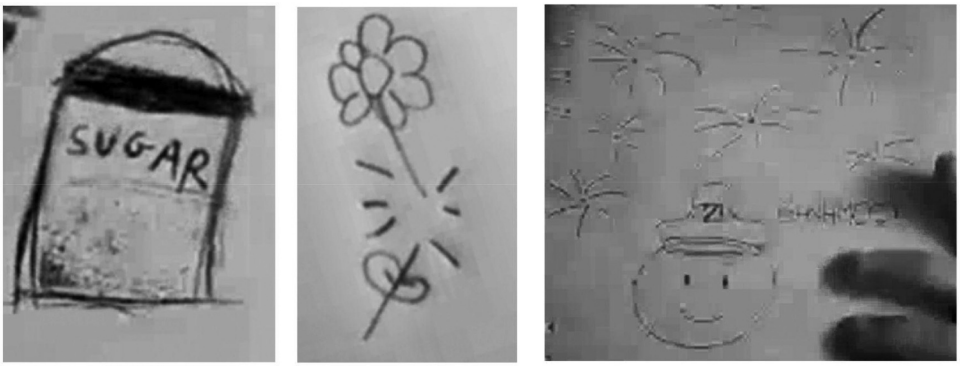

Figure 9. Figurative drawings not coded LD. Left, D17CH (apricot): 'Apricots have a particular taste, it is sort of grainy and you eat the peel which is fuzzy and it is very sweet. I drew sugar to show a grainy taste', coded NA (because of the association to sugar), PR (description of perception). Centre, D19CH (carrot): 'I tried a carrot – it was crunchy and hard. I drew a broken flower for a crunchy flavour', coded NS (obviously a metaphor). Right, D52CH (pomegranate): 'I have a simple drawing for a complex idea. I drew fireworks and a person who wants war because "granar" (pomegranate) reminds me of war – it's a feeling. I made a story with the taste of something. Pomegranate, my grandma used to bring me them and it is the most colourful', Coded: NA.

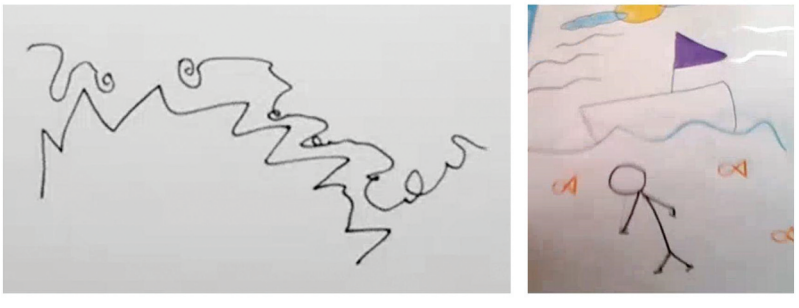

Figure 10. Drawings not mentioning olfaction where it would have been expected. Left, D10AD (coffee and biscuits): 'I drew coffee and biscuits. I felt a sort of conflict in my mouth between the strong coffee that was interrupted by the sweet taste of the biscuits – sort of like a sound in my mouth', coded: NA and PR. Right, D50CH (tangerine): 'When I eat a tangerine it melts in my mouth and I feel it is fresh, not too sweet and not sour and it's hard to swallow, it is like I am drinking juice. I drew the breeze, it's like fresh, when I feel the juice of the tangerine in my mouth and then I feel like I am swimming in the tangerine juice', Coded: NA.

depiction of a *different* food, object or scene to represent their taste experience (Figure 9) rather than using more abstract marks. These drawings, depicting concrete objects or situations rather than the foods tasted, were not coded as LD, despite the fact that they were figurative, as they represent a 'leap of association' rather than a literal representations of the foods tasted.

Absences and ambiguities

The coding method only included the presence of a type of description, theme or sensory modality, although sometimes the absence might be equally relevant and represented an opportunity for dialogue about bodily experiences and concepts/language. A qualitative survey of the data, while not as systematic as the previously mentioned coding, revealed that some sensory data stand out due to the absence or omission of a sense, either regarding the specific food or in the participant's comments. Examples are D54CH (orange) in Figures 4 and 10, which omitted mentioning smell when the coders might expect olfaction to play a prominent role.

Coffee and citrus fruits are particularly aromatic foods, and it is notable that the participants did not mention this explicitly. Perhaps in these cases, olfaction is not so clearly a conceptualised part of the food experience compared to taste and texture (cf. Methods section).

Three participants explicitly mentioned closing their eyes: the experience of orange (D54CH, Figure 4), watermelon (D16CH, Figure 11) and sugar (D22CH, Figure 4), thus forcing the absence of sight. Another mentioned colour in a metaphorical sense, incidentally also describing sugar (D21CH, Figure 11). These four were not coded for sight.

Also regarding D21CH (sugar), it was surprising that sweetness was not explicitly mentioned since the participant was describing sugar. Thus, the tool does not automatically capture the possibility that some things are considered so self-evident that they are perceived as redundant or 'too basic' to mention explicitly, and qualitative considerations are therefore of value for the researcher or educator.

Analysing the word 'crunch(y)' represented an interesting borderline case. Is this perception to be interpreted as hearing, touch or both? Nine participants used this word in their descriptions. In two cases, it was very clear that 'crunch' was related to sound (Figure 12).

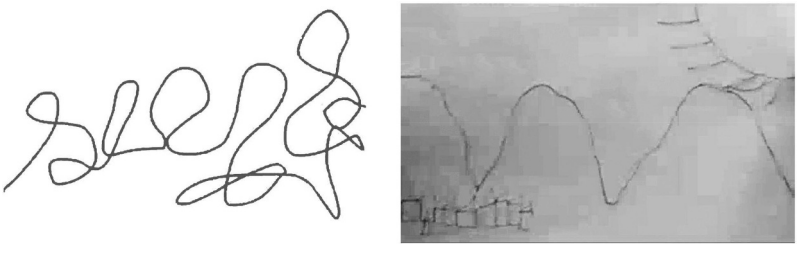

Figure 11. Drawings/comments including visual aspects but not coded for sight. Left, D16CH (watermelon): 'Watermelon tastes sweet, juicy and fresh and the smell makes me think of fresh air. I closed my eyes while tasting the watermelon. In my opinion because it is sweet juicy fresh and then sweet when I sent it down, there is always sweet water left in my mouth', coded PR. Right, D21CH (sugar): 'The taste of sugar makes me think of happiness, to a happy thing – like going to the mountains, tasting sugar brings you back to happiness, the opposite of lemon which is sour, although they go well together – they're two opposite things. I drew the happiness – the mountain with the little village, I wanted to colour everything yellow. It took a lot of thinking, drawing takes little but thinking takes time,' coded: NA.

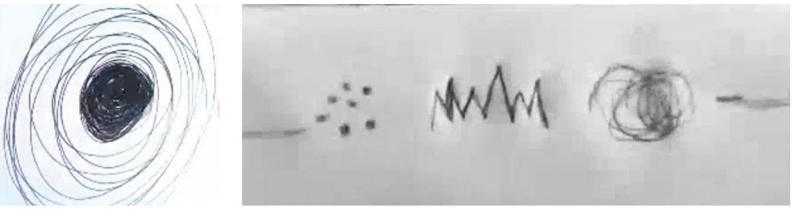

Figure 12. Drawings mentioning 'crunch(y)' coded for hearing. Left, D32CH (coffee beans): 'Coffee beans: strong and intense and it smells nice. I hear it crunch when I chew it', coded OT. Right, D47CH (potato chips): 'I had a potato chip, and when I put it on my tongue, it was flat and smooth but then immediately I began to taste the salt on my tongue. Then I started to chew and it was crunchy and noisy in my mouth, then it became all mixed, like a paste and then when I finished chewing it became a smooth paste, a line', coded: PR.

In the other seven cases, the coding was ambiguous. Some examples are D19CH (carrot, Figure 9) and D12AD (candied ginger, Figure 5). Since the coders did not reach a consensus for these drawings and the participants could not give clarification, 'crunch-(y)' was not coded related to a specific sense but given a separate code. The composite perception of 'crunch(y)' could be an interesting concept to discuss for educators. Spence (2015b) found that not only is sound an under-considered aspect of the multisensory experience of eating, but audition is the most underestimated sense regarding taste perceptions and experiences, both by researchers and the general public. This finding has been mirrored in our results, where sound was the least reported sense.

Shape and taste

Prior neuroscience-oriented studies have investigated crossmodal correspondences between shape and taste (e.g. Spence & Deroy, 2014), finding that sweet tastes are often associated with rounded shapes, while salty, sour and bitter flavours are linked to more angular, spiky shapes. In our study it was interesting to consider how shape came into play when foods and drawings were chosen freely rather than predefined by the researchers as is the rule in many neuroscience studies. Figures 13 and 14 show drawings where basic tastes were mentioned, and thus contribute to bridging the gap between neuroscientific and educational approaches regarding multimodal expressions of experiences of and with food.

Figure 13 shows the drawings where 'sweet' was explicitly mentioned in the comments:

Most of these drawings – 16 of the 19 – are indeed characterised by curvilinear, rounded shapes. A peculiar case is D43CH which describes lemon together with the apparently paradoxical comment 'It's a lemon with drops that are sweet.' Here, one might speculate whether the shape is more closely related to the word description than the usual taste of lemons.

Figure 14 gives a visual overview of drawings with comments mentioning sour, salty and bitter.

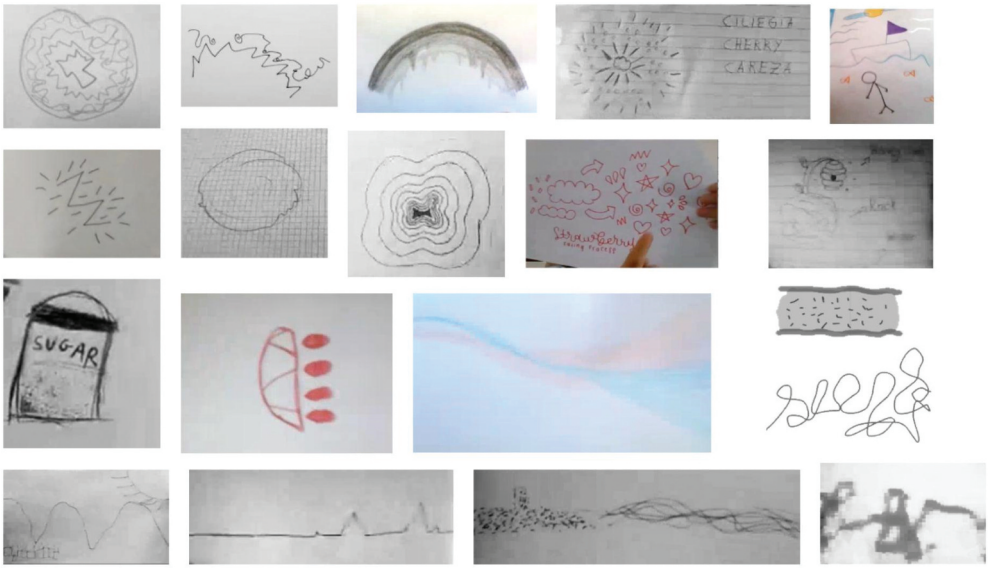

Figure 13. Drawings whose comments mention sweet taste. Top row: D4CH (carrot), D10AD (coffee and biscuits), D36CH (chocolate), D37CH (cherry), D50CH (tangerine). Second row: D12AD (ginger), D27CH (plum), D35CH (sugar), D48CH (strawberry), D56CH (carrot). Third row: D17CH (apricot), D43CH (lemon), D49CH (banana), D51CH (grape), D16CH (watermelon). Bottom row: D21CH (sugar), D14CH (lemon), D18CH (apricot), D15CH (unspecified food).

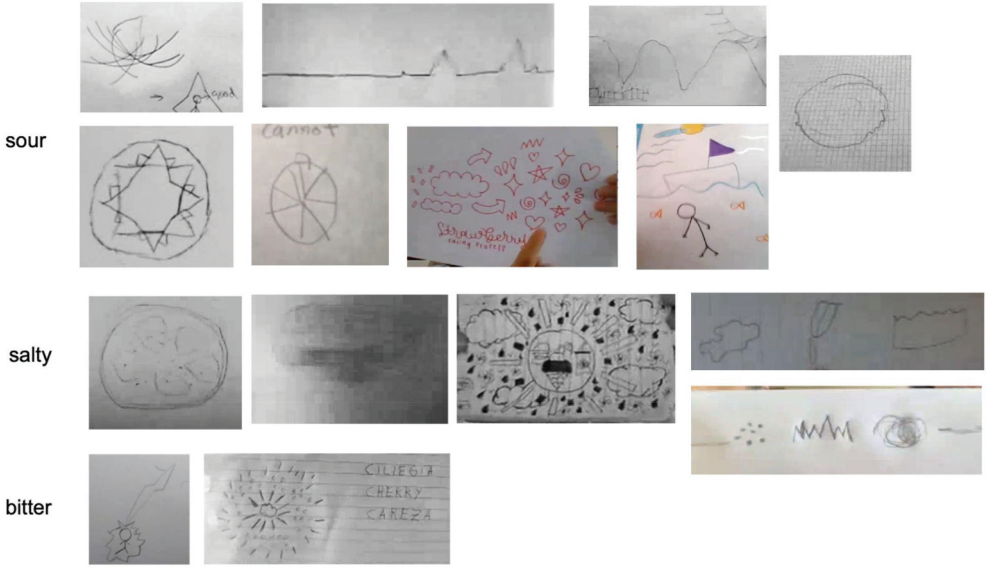

Figure 14. Drawings whose comments mention sour, salty and bitter taste. Sour: 1st row – D2CH (unspecified food), D14CH (lemon), D21CH (sugar), D27CH (plum); 2nd row – D33CH (tomato), D45CH (carrot), D48CH (strawberry), D50CH (tangerine). Salty: D8CH (tomato), D38CH (scrambled eggs), D58CH (salty mango), D44CH (tomato), D47AD (potato chip). Bitter: D3CH (unspecified food), D37CH (cherry).

Since a few of the drawings mentioning sour, salty and bitter tastes also mentioned sweet taste, some of the same drawings, as in Figure 13, also appear here. Ten of the 15 drawings feature spiky, angular or linear elements. Our findings are thus broadly in line with already established shape–taste correspondences (Spence, 2015a), although verifying this was not the focus of our study.

Summary and conclusion

In the material studied, we see a broad, rich use of languages (plural), which supports our notion that taste experiences, when placed centre stage, are contexts for and may promote rich conceptual and language use and development. Eating is an act of 'here and now', and food, after being consumed, 'disappears' or becomes part of the body. Thus, it represents a transient experience that cannot be brought back and experienced later, relegated to memory, when compared to some other aesthetic experiences (music being a case of its own).

We see that when coding for themes visual descriptions (drawings) are more prominent, while sense coding was informed more by the verbal accounts. Our research indicates that educational design may be able to capture and render – on paper – the multisensory nature of food experiences. We do not claim that such experiences are encapsulated in their wholeness, but the five sensory modalities and complex experiences (described by the theme codes) can be identified, even in an online atelier context. We show one way of addressing and exploring senses that are not commonly activated in teaching in general. In this way the atelier may contribute to democratising the senses (cf. Korsmeyer, 2004) through an innovative learning context. In analysing graphic mark-making and comments, we investigated the role of the senses when taste experiences are translated into drawings, focused on learners' lived experiences and the consequent learning processes activated during the food ateliers that exemplify what implementing the 100 languages can look like.

The educational context of REA – and in particular the food atelier – created a playful setting to explore food and taste, despite the physical and linguistic distances between the participants in our study. Each participant's individual taste experience is at the centre of their explorations, in line with the pedagogy of listening (Rinaldi, 2021) and reflective taste pedagogy (Leer & Wistoft, 2018), which give importance to learners' direct experiences with/of food and thus their knowledge-building process. Investigating learners' individual taste experiences and visual/verbal interpretations might also generate new awareness and insights, as well as build bridges between (abstract) concepts and language on the one side, and sensuous bodily experiences on the other.

Our findings show that other themes – like memory, time, temporality – can be approached via multisensory experiences of taste (Coe et al., 2024; Coe, 2024). According to Spence (2015b, p. 11) 'our enjoyment of eating and drinking often extends over a much longer time period', including anticipation and subsequent memories of food (Figure 15). While current neuroscientific studies on taste perception focus on the moment of tasting, by investigating learners' experiences of/with food from a (taste) education perspective, the timeframe of a tasting experience is extended, including both before the tasting takes place and afterwards, through memories or associations the experience brings up. This broad timeframe is embedded in the design of the REA food atelier described herein.

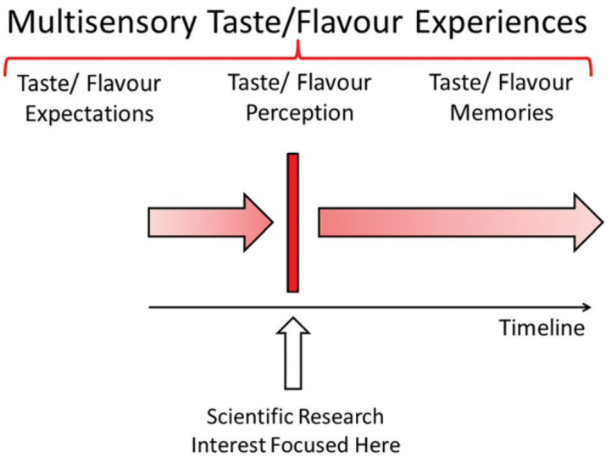

Figure 15. Multisensory taste/flavour experiences in relation to time (from Spence 2015b), with permission from the publisher, BMC).

Our study thus offers an educational model and context for promoting a more holistic experience in food and taste education. Gaining insight into learners' representations of their taste experiences by considering both visual characteristics of their drawings and their verbal descriptions fosters sensory consciousness and awareness about foods seen and eaten every day. The choice of foods, guided by the invitation sent before the atelier, appeared to have an impact on the research findings. This invitation could be revised in a future iteration to support various foci of the atelier as a pedagogical context, but also to align the atelier to other research questions. The REA food atelier allowed learners to explore food by juxtaposing two expressive languages, words and images in a novel way, activating knowledge-building processes in line with REA philosophy and in particular the 100 languages, thus filling the latter concept, often broadly and vaguely conceptualised, with concrete content.

Notes

1. 'La cucina come luogo che crea saperi e cultura: per una nuova educazione', presentation delivered on 26 May 2021 at a conference at Centro Internazionale Loris Malaguzzi (Reggio Emilia).
2. The mind/body split- which has characterised education to the detriment of the body- is a rift that REA has always aimed to bridge. See the famous poem by Loris Malaguzzi, a sort of REA manifesto: https://www.reggiochildren.it/en/reggio-emilia-approach/100-linguaggi-en/.
3. Romania, Russia, Italy, Chile, USA, Canada, India, Brazil, Colombia, Spain, Argentina, Mexico, Perú, Guatemala, Panama.
4. For instance, vanilla is not a taste *per se* since it is perceived by the nose and not in the mouth. Thus, vanilla can be described as a flavour but not a taste. In everyday language these are often conflated, and some languages (e.g. Scandinavian) do not have a separate word for 'flavour' and use 'taste' for both. Further discussion below.

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No potential conflict of interest was reported by the author(s).

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