Sensory Panel Training: Developing Hospitality Students Analytical and Research Skills

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Abstract: Having been conducted for many years, sensory and flavour analysis have been instrumental in not only developing and assessing the quality of products, but also understanding their nature and unique characteristics. Relying on a variety of methods, this analysis can take on different forms, ranging from mostly descriptive to more instrumental approaches, which can include sensory panels, whose training is often time-consuming and demanding. Valued by winemakers, descriptive analysis procedures carried out with the help of sensory panels has been extensively used in the food and beverage industry and can be perceived as key within the scope of sommelier training and hospitality programs. However, despite this importance, given its subjective and intensive nature, sensory analysis can be affected by bias and fatigue, requiring regular calibration exercises, combined with structured tasting procedures and protocols. As a result, training sensory panels requires knowledgeable and experienced instructors, dedicated facilities and continuous support, in addition to a comprehensive view that includes other research approaches and tools that can be combined as to produce more valuable and accurate assessment. Focused on wine production and drawing from the authors' experience, this paper aims to reflect on exploratory research methods involving sensory evaluation, putting forward strategies that can be used to support sensory training. Consistent with a work in progress, it addresses the topics of research methods, action research and reflective practice, contributing towards the development of novel approaches within the scope of teaching research methodology in business and management. Despite the focus on wine production, the strategies described aim at enhancing tourism and hospitality students' research and analytical skills, ultimately being able to benefit other practitioners in the field.

Keywords: Descriptive analysis, Sensory analysis, Sommelier training, Wine, Wine education

1. Introduction

Recent market and behavioural changes, brought about by changes in consumption patterns and the amount of readily available information on food products, having resulted in a significant growth regarding sensory information and research (Stone and Sidel 2021). In addition to an impact on consumers, these changes have also affected businesses, with more companies acknowledging the importance of sensory analysis, particularly when it comes to expert recruitment and/or consultancy and the building sensory infrastructure. As a result, given the "growing demand for newly trained sensory scientists and more course offerings at universities" (Stone and Sidel 2021, p.2), there is currently an increased awareness on the importance of sensory training, not only in areas associated with food production, but also in areas pertaining to business, particularly marketing and sales.

In the case of wine and winemaking, sensory analysis is crucial, with various methods and best practices available for both large and small wineries (Lesschaeve and Noble, 2022). For that reason, and much like in other sectors, as wine becomes increasingly more relevant within the scope of the hospitality and tourism industries, there is an increased necessity for specialized staff, that value wine sensory experiences (Carmer, Kleypas, and Orlowski 2024). Having made its way into tourism and hospitality education and training, sensory analysis and training is considered to influence students' product perceptions, not only from a consumers' perspective, but also in their marketing and sales ability, opening up a wide range of possibilities for their future (Carmer, Kleypas, and Orlowski 2024; Thomas et al 2014).

Based on this premise, this paper focus on exploratory research methods involving sensory evaluation, putting forward strategies that can be used to support sensory training within the scope of tourism and hospitality higher education. In addition to describing research methods which are aligned with action research and reflexive practices, they the authors share insights on the development of novel approaches within the scope of teaching research methodology in business and management. Despite the focus on wine production, the strategies described aim at enhancing tourism and hospitality students' research and analytical skills, ultimately being able to benefit other practitioners in the field.

2. Context and Methodology

Considering the growing interest surrounding wine, particularly within the scope of tourism and hospitality education, and the lack of studies in "wine sensory experience as a pedagogy" as well as the "little to no standardization in wine sensory experience pedagogy within the academy" (Carmer, Kleypas, and Orlowski 2024), the training strategies described in this paper build on the work of previous, non-academic, instruction methods in order to describe a panel training initiative implemented at a post-graduate course.

Attended by 23 students, this course aimed to train specialised professionals, who can grasp the strategic importance of experience tourism and human resources when promoting wine and wine-growing territories/wine tourism destinations, offering unique facilities to support sensory training. Overall, students enrolled in the programme had no previous specialized sensory training, even though they had previous interest and/or experience with wine and wine-tasting activities.

The activities described focussed on the sensory panel training and aimed to develop students' skills in performing descriptive sensory analysis. This type of analysis involves the "the detection (discrimination) and description of both the qualitative and quantitative sensory components of a consumer product … [including] aroma, appearance, flavour, texture, aftertaste and sound properties" (Murray, 2001) with panelists being required to quantify aspects in order to factually describe the product attributes. In addition to the facilities and protocol used, the authors will outline the different stages of training, drawing preliminary insights based on their experience and defining future work.

2.1 Sensory Analysis Facilities

Sensory analysis training usually takes place in a dedicated laboratory equipped with individual booths for each panellist, ensuring controlled environmental conditions of 20 ± 2°C temperature and 60 ± 20% relative humidity. The most important criterion for a tasting room is that it provides a quiet, odor-free, temperature-controlled environment where judges can evaluate wines under controlled lighting, free from distractions. The booth area is separate from the preparation area to prevent judges from inadvertently receiving clues about the experiment.

In the booths, controlled lighting allows for the evaluation of wine color under a constant light source. Each booth has a light switch, for the judge to signal the experimenter. A small hatch door in each booth allows communicate with the judge and change samples without distracting others. Spittoons are provided for expectorating samples.

As mentioned previously, this course was taken by 23 students, who were introduced to the lab and the tasting protocol prior to their first experimental session.

2.2 Protocol

According to the established research protocol, samples should be presented coded with random numbers in identical containers. By randomizing the order for all judges, bias is eliminated. For evaluations involving aroma and taste, standard wine-tasting glasses with 35ml of each solution/wine sample must be provided. To enhance aroma evaluation, watch glasses should be available as lids for the wine glasses. Before the tests, the panel leader must smell each glass to ensure that no defect odor is present. The samples are coded and presented in random order (ISO 6658, 2017).

2.3 Panellists and Training

The panellist selection process usually consists of two stages: selection and preliminary training. In this case, considering the nature of the course, there was no initial selection, with all students taking part in the session. Nevertheless, in order to understand their profiles and appetence, a questionnaire was applied as to evaluate personal attributes such as interest in wines, health status, smoking habits, availability and other general factors. Theoretical insights on wine sensory evaluation were provided during this phase.

Following this introductory stage, students went through an established training programme consisting of 3 consecutive stages (Fig. 1):

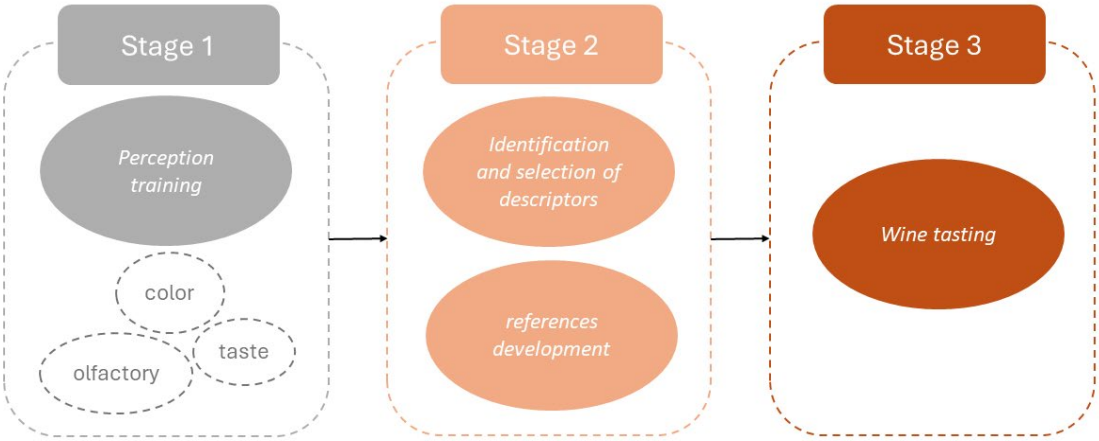

Figure 1: Panellist training stages

2.3.1 Stage 1 - Colour, olfactory and taste perception

Stage 1 consisted of perception training activities based on the senses.

The colour perception training took place in one session. Students were presented with 12 random colour samples of wines (white, rose and red) and were then asked to put the samples in ascending order in terms of the degree of colour intensity.

The olfactory perception training consisted of five sessions. To enhance comprehension of the aroma profile of wines, sensory tasting containing (aroma kit box - Le Nez Du Vin©), the Wine Aroma Wheel (Noble et al, 1987) (Figure 2) and natural products linked to wine aroma were provided.

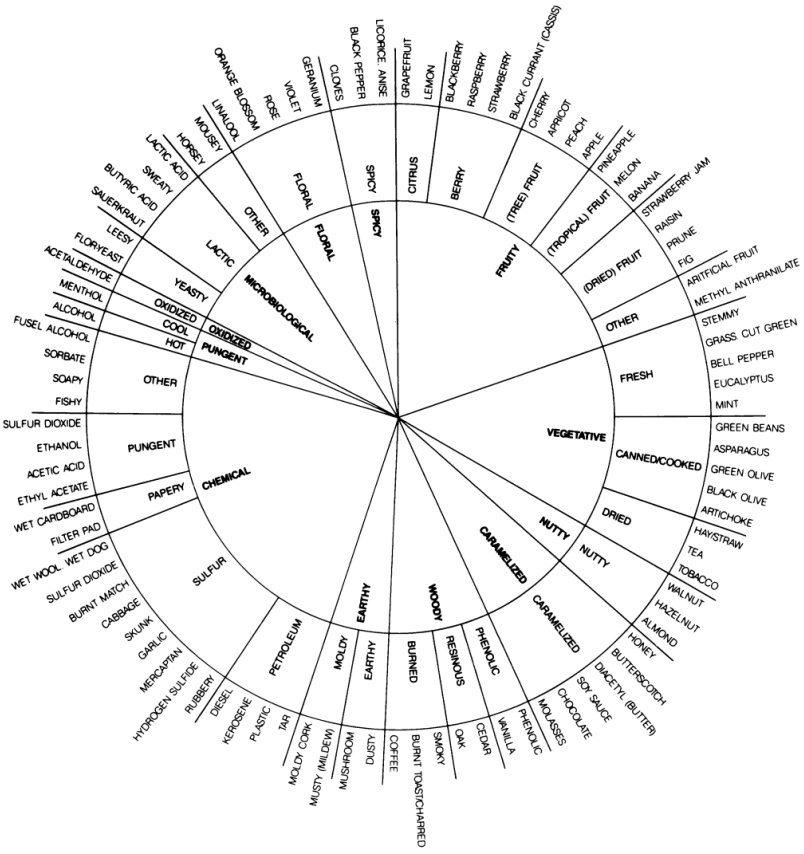

Figure 2: Wine aroma wheel (Noble et al., 1987)

These olfactory assessments were conducted in the initial sessions of training to introduce students to different aromas, oak barrel aromas and wine defects (see Table 1). Participants were instructed to smell fragrances presented in series of ten and mentally categorize the sensory perceptions detected, recording the corresponding descriptors. Finally, in the fifth session, panellists were asked to detect which sample was different by using triangle tests method. To evaluate the discriminatory capacity of the tasters, three samples were presented simultaneously, two being equal and only one different. Testers were asked to detect which sample was different.

Table 1: Odour qualities evaluated during the training of the panel (reference compounds from aroma kit box – Le Nez Du Vin ©)

Aroma by Families	Sample number	Aroma
Fruity	1	Lemon
	2	Grapefruit
	3	Orange
	4	Pineapple
	5	Banana
	6	Lychee
	7	Melon
	8	Muscat
	9	Apple
	10	Pear
	11	Quince
	12	Strawberry
	13	Raspberry
	14	Redcurrant
	15	Blackcurrant
	16	Bilberry
	17	Blackberry
	18	Cherry
	19	Apricot
	20	Peach
	21	Marzipan
	22	Prune
	23	Walnut
Floral	24	Hawthorn
	25	Acacia
	26	Linden
	27	Honey
	28	Rose
	29	Violet
Vegetal	30	Bell pepper
	31	Mushroom
	32	Truffle
	33	Wine lees
	34	Cedar
	35	Pine

Aroma by Families	Sample number	Aroma
	36	Liquorice
	37	Boxwood
	38	Cut hay
	39	Thyme
Spicy	40	Vanilla
	41	Cinnamon
	42	Clove
	43	Pepper
	44	Saffron
Animal	45	Leather
	46	Musk
	47	Butter
Roasted	48	Toast
	49	Roasted almond
	50	Roasted hazelnut
	51	Caramel
	52	Coffee
	53	Chocolate
	54	Smoky notes
Oak	55	Oak
	56	Coconut
	57	Vanilla Pod
	58	Woody-Spicy
	59	Clove
	60	Smoky
	61	Medical
	62	New Leather
	63	Roast Coffee
	64	Burnt Sugar
	65	Candied Orange
Faults	66	Green Wood (Fault)
	67	Vegetal
	68	Rotten Apple
	69	Vinegar
	70	Glue
	71	Soap
	72	Sulphur
	73	Rotten Egg
	74	Onion
	75	Cauliflower
	76	Horse
	77	Mouldy-Earth
	78	Cork

Following the olfactory assessment, students carried out taste sessions, having been presented with samples (Table 2) representing each fundamental taste, allowing them to acquaint themselves with these basic flavors (sweet, acid, bitter, salty and umami) and mouthfeel (astringent and body)

Table 2: Compounds used in the initial taste session

Taste	Compound	Concentration/Quantity
Sweet	Sucrose (g/l)	30 g/l
Acid	Tartaric acid (g/l)	1 g/l
Acid	Malic acid (g/l)	1 g/l
Acid	Citric acid (g/l)	1 g/l
Bitter	Quinine sulfate (g/l)	0,5 g/l
Salty	Sodium chloride	1 g/l
Umami	Sodium monoglutamate	0,5 g
Astringent	Tannin	160 mg/l
Body	Milk (fat and light)	35 ml

Subsequently, to evaluate their detection thresholds, they were asked to assess solutions which were both below and above the expected detection threshold for wine. For sweetness, five sucrose solutions were prepared with concentrations of 0, 5, 10, 15 and 20 g/l; for acidity, five tartaric acid solutions with concentrations of 0, 0.05, 0.15, 0.40 and 0.75 g/l tartaric acid, respectively; and for bitterness, five tannin solutions with concentrations of 0, 20, 40, 80 and 160 mg/l.

In the subsequent sessions, students were tasked with ranking the samples in order of increasing intensity – a duplicate assessment conducted on different days. The presentation order remained consistent for all students across these sessions.

2.3.2 Stage 2 – Identification and selection of descriptors and references development

This stage focused on developing students' descriptive analysis skills and their ability to rate different aspects of wine based on standards.

Descriptive analysis (DA) is one of the most important techniques for evaluation of wine, making it possible to carry out an analytical evaluation of the differences between wines. For better results, the wines should have significant differences and the panel must be well trained (Linskeens et al., 1988).

Within the scope of this course, the attributes were defined verbally, presenting physical reference standards. Aroma, taste, sensation, flavor and persistence references were introduced as to make reference evaluation as close as possible to wine tasting conditions. Following this introduction, training sessions were carried out following existing standards and terminology (ISO 13299, Marques et al., 2016; Monteiro et al., 2012). Students were trained in the use of these terms in discussion sessions and in formal scoring tests, with references that clearly define each attribute.

Traditionally, in order to carry out descriptive analysis, one to six weeks of training are required, with the first sessions involving discussions regarding reference standards and their appropriateness for rating the flavor of selected wines. Moreover, panelists must agree on and work with specific terminology to describe the sensory qualities and attributes of different types of wines. Once these references have been established and final terms selected, training sessions resemble formal testing. Prior to each session, the students should smell and/or taste each of the references and then rate the intensity in coded wines.

Within the scope of their training, students were asked to score attributes' intensities on a five-point scale (ranging from 1 – not perceived at all, to 5 – the attribute is clearly perceived, and the intensity is higher than that of the reference), adapted from Monteiro et al. (2014) and Vilela et al. (2015). The scoring was carried out in the perceived order they perceived, with students having to rinse with water between wines.

Throughout the session, students received feedback. Every time someone student did not rate a term properly, he/she was presented with wines or reference standards that illustrate "low" and "high" intensity of the term. After familiarizing themselves with these, they rated coded samples, with results being systematically reviewed.

After all references were developed, two training sessions were carried out according to the methodology that would be used to evaluate the wines.

2.3.3 Stage 3 – Wine tasting

The last stage is wine tasting. In line with the defined protocol, sessions were carried out in the tasting booths of a sensory lab. Wine bottles were opened immediately before tasting, and 35ml sample of each wine were served in standardization wine-tasting glasses.

Attribute intensities were scored on a five-point scale (1 – lowest intensity to 5 – highest intensity). The students were instructed to give scores to the attributes in the order they perceived them, in the tasting sheet.

Samples were expectorated, and the students rinsed their mouths with water between wines, eating unsalted crackers to decrease astringency carry-over. If necessary, the students could have a rest and leave the tasting room.

3. Insights and Final Remarks

Reflecting on the course's outcomes, students' experience and research methodology teaching, it was possible to establish that students showed interest in participating in this study and like to consume wine (100%, n=23). However, everyone recognized the importance of improving the quality of wines and their marketing and promotion.

Most participants had never taken part in a sensory test (78.2%, n=18), being that all of them were fit to attend the training, as they there were no health restrictions, intolerances and food allergies that prevented the performance of the said tests. Overall, students were able to complete all the assigned tasks with the training having been successful in developing their sensory and descriptive analysis skills.

Following the training sessions, sensory analysis, which is a crucial component of wine tasting, particularly for professionals who aim to assess and evaluate wines accurately, was perceived as a way of acquiring valuable information about the characteristics, quality, and potential of a wine. Despite the subjective nature of tasting, training was instrumental in equipping students with instruments and information to assist them with unbiased assessment of wine.

Following up on the first sessions, in which the samples used differed significantly in the test variable to assist in training and reinforce differences, students' assessment became more consistent, sensitive, and reproducible. In addition to regular attendance and concentration, feedback on their performance proved to be effective in motivating and improving engagement levels. This progress supports the use of these methods within the scope of postgraduate courses, making a case for sensory training in tourism and hospitality.

As a method, despite its potential shortcomings (mostly related to bias and the fact that it relies on human perception) descriptive analysis has proven to be comprehensive and useful, being that individuals can be trained to carry out this type of analysis. This signal potential benefits in integrating sensory evaluation into tourism and hospitality curricula, as it can help provide a better understanding of wine both as a product and as an experience, thus having an impact on company's management and promotional strategies.

These findings are in line with the literature, in that this approach can contribute to the success of product development in the wine and wine-making industries, with company's management playing a pivotal role in integrating sensory analysis into their organizations.

On the other hand, considering "even minimal sensory analysis training may change consumer product perceptions in wine", the strategy described can contribute to the ongoing discussion on wine pedagogy, having an impact that extends further than academia.

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