

<https://helda.helsinki.fi>

Sensory expert assessor's learning practices at workplace : Competencies and contexts in sensory evaluation

Savela-Huovinen, Ulriikka

2018-04

Savela-Huovinen , U , Muukkonen , H & Toom , A 2018 , ' Sensory expert assessor's learning practices at workplace : Competencies and contexts in sensory evaluation ' , Journal of Sensory Studies , vol. 33 , no. 2 , 12315 . <https://doi.org/10.1111/joss.12315>

<http://hdl.handle.net/10138/328180>

<https://doi.org/10.1111/joss.12315>

unspecified

acceptedVersion

Downloaded from Helda, University of Helsinki institutional repository.

This is an electronic reprint of the original article.

This reprint may differ from the original in pagination and typographic detail.

Please cite the original version.

Competencies and contexts in sensory evaluation

1 TITLE:

2 Sensory expert assessor's learning practices at workplace: competencies and contexts in
3 sensory evaluation

4 AUTHORS:

5 1. Ulriikka Savela-Huovinen

6 2. Hanni Muukkonen

7 3. Auli Toom

8 CORRESPONDING AUTHOR:

9 Ulriikka Savela-Huovinen

10 CONTACT INFORMATION:

11 Ulriikka Savela-Huovinen, ulriikka.savela-huovinen@helsinki.fi, +358 41 435 56 02

12 AUTHORS' AFFILIATIONS:

13 1. Department of Economics and Management, Faculty of Agriculture and Forestry,
14 University of Helsinki, Finland;

15 2. Faculty of Education, University of Oulu, Finland;

16 3. Centre for University Teaching and Learning, Faculty of Educational Sciences,
17 University of Helsinki, Finland.

18 SPONSORS:

19 The Jenny and Antti Wihuri Foundation

20 ABSTRACT

21 The aim of this study was to identify competencies and learning contexts that are central
22 when a standardized sensory expert assessor conducts food sensory evaluations in an
23 authentic professional context. The aim was to answer the following questions: first,
24 according to assessors, what competencies does sensory evaluation require? Second,
25 what contexts of sensory evaluation do assessors report on?

26 Thirteen assessors from three Finnish food companies were interviewed using semi-
27 structured thematic interviews to map competencies and development intentions and
28 explain established practices. In the study, 42% of analysis units described individual
29 evaluation contexts, 53% described collaborative interactional contexts, and 5% described
30 collaborative knowledge creation contexts. The findings contribute to the explanation of
31 how assessors learn extensively from each other in collaborative interactional and
32 knowledge creation contexts. Assessors' learning practices and abilities to work
33 collaboratively in interactional and knowledge creation contexts need to be ensured for the
34 development of expertise.

35 **KEYWORDS:** Contexts, competencies, collaboration, learning, sensory evaluation and
36 knowledge creating.

37

38 PRACTICAL APPLICATIONS

39 Our findings suggest that an important aspect of enhancing learning and achieving
40 consistent results in assessors' work is to increase collaborative and knowledge creating
41 practices in sensory training, in addition to training individual skills. Such practices are
42 embedded in daily practices, especially the cases when product defects were sought and
43 discussed. Advanced practices included: learning, sharing and reviewing both external and

Competencies and contexts in sensory evaluation

44 in-house consumer panel feedback, developing methods to moderate small-panel
45 evaluations and developing a product vocabulary collectively between the assessors.
46 These practices supported sensory expert assessors in developing their personal and
47 collective expertise in the workplace.

48

49 1 INTRODUCTION

50 In order to do their work effectively and to develop in the profession, assessors need to
51 maintain their expertise and acquire new competencies related to their work both
52 individually and in collaboration with their colleagues. It was reported in an earlier study
53 that increased training, including group work attributes defining and discussing differences
54 between the evaluations, improved sensory panelist performance by reducing variability
55 (Chambers et al., 2004). Also, using reference samples as an unknown sample and
56 utilizing multivariate data analytical techniques in training sessions helps in identifying
57 assessor differences and inconsistencies as a panelist (Nielsen et al., 2005).

58 The assessor's work involves the physiological skills required for perception and ability to
59 sense, separate and describe samples, and cognitive skills such as long-term memory
60 skills and mastering the vocabulary. Gibson (1969) defined the term "perceptual learning"
61 as "an increased ability to extract information from the environment as a result of
62 experience and practice with simulation coming from it" (p.3). Goldstone (1998) specified
63 the definition that "it is a result from explicit instruction and deliberate practice in
64 discriminating between samples in some perceptual domain or from relatively passive but
65 extensive experience of various samples from such a domain "(p.585). Further, Hughson
66 and Boakes (2002) have suggested that knowledge may play a decisive role in a range of
67 unexplored domains that require sensory abilities. Lelièvre-Desmas et al. (2015) showed
68 that specific domains are represented in memory as prototypes abstracted from repeated
69 exposures but are not generalizable to other domains. Also, when using memory, we need
70 to focus on detecting change rather than identification and precise recognition of stimuli
71 (Köster, 2006).

Competencies and contexts in sensory evaluation

72 According to a study by Croijmans and Majid (2016) on coffee and wine, perceptual
73 experience alone does not explain assessor performance because they have only a limited
74 domain-specific advantage over novices when describing odors and flavors. Ballester et al.
75 (2008) suggest that wine expertise is cognitive expertise rather than perceptual expertise,
76 when evaluated by the sense of smell. Similarly, González et al. (2001) showed that
77 sensory evaluation of characteristics that presume a cognitive description are better
78 performed by assessors. Further, it has been shown that wine assessors are not better
79 than controls on detection, but they were superior on discrimination and identification when
80 evaluated by odors (Bende & Nordin, 1997). Prior research therefore has pointed out that
81 the learning evolves from verbal learning and learning to direct the focus of attention
82 (Bitnes et al., 2007), and training in both perceptual and cognitive skills are needed.

83

84 1.1 Sensory assessor learning contexts

85 Various working practices and collaboration contexts make learning at work possible
86 (Tynjälä, 2008). The three metaphors of learning are an emblem of expertise. The
87 acquisition metaphor and the participation metaphor were originally articulated by Sfard
88 (1998), and Hakkarainen et al. (2004) introduced the knowledge creation metaphor.
89 Paavola and Hakkarainen's (2005) definition of acquisition view is "knowledge is a
90 property of an individual mind; an individual is the basic unit of knowing and learning"
91 (p.537). It has also been described as a philosophically held understanding of expertise
92 that the mind is a continuously refilled container of knowledge, and learning is the filling
93 process (Bereiter, 2002). The participation metaphor highlights dialogue and development
94 of expertise through participation in workplace practices. The third metaphor of learning as
95 knowledge creation supplements the emblems of acquisitions and participation (Paavola &
96 Hakkarainen, 2008). This metaphor emphasizes collaborative creativity and production of

Competencies and contexts in sensory evaluation

97 new shared objects, knowledge artifacts, practices, ideas, models, and representations
98 etc. for some relevant purpose (Hakkarainen et al., 2004; Paavola et al., 2012). The
99 objects are continuously developed and modified iteratively, and are intended for some
100 subsequent use. Also, the cross-fertilization of practices of diverse communities and
101 settings (e.g., authentic connection with consumers) is a factor that facilitates engagement
102 in knowledge creation (Paavola & Hakkarainen, 2005). Knowledge creation is not based
103 on creative individuals; it requires fundamental readjustment of the practices of a whole
104 community (Paavola et al., 2004). As an entire learning community, there is an opportunity
105 to equip it to make dynamic change, evaluate and reflect on the best practices and
106 learning outcomes (Muukkonen et al., 2013).

107

108 1.2 Aim and research questions

109 This study focuses on assessors' learning practices in their everyday work. To be precise,
110 we carried out the study with assessors who are equivalent to standardized sensory expert
111 assessors (ISO 5492, 2008), shortened here to "assessors". We focused on learning
112 in workplace environments, and the study brought together the metaphors of learning with
113 studies in learning sensory evaluation. This study explores the assessors' competencies
114 and practices as well as the individual and interactional learning contexts of food sensory
115 evaluation. The following research questions were addressed:

116 1 According to assessors, what competencies does food sensory evaluation require?

117 2 What learning contexts for food sensory evaluation do the assessors report on?

118

119 2 METHODS

120 2.1 Participants

121 Thirteen assessors from three Finnish food companies were selected as the participants in
122 the study. Companies were invited to participate in the study if their product category count
123 exceeded ten, and if they had a product development department and sensory laboratory.
124 Companies have departments for undertaking market research and developing and
125 sensory testing. Typically, a new idea for a product comes from the marketing department.
126 Sensory testing is routine for a new product, for estimating shelf- life and deciding about
127 quality control procedures. Participants mentioned the use of in-house panels for new
128 product evaluation.

129 Company representatives were contacted, and they decided on which expert would
130 participate in the study. The selection criterion was that the participant had to work in a
131 laboratory or product development department as an assessor. All participants were
132 equivalent to standardized sensory expert assessors (ISO 5492, 2008), were female, and
133 they worked in six different food product sectors. According to the companies' instructions
134 for their employees, assessors' sense of taste must be tested for qualifications at the
135 beginning of the employment relationship and regularly every few years thereafter. The
136 participants had between two and 34 years of experience at the company or in the field.
137 Three of the assessors had doctoral degrees, five had master's degrees, and one was
138 close to university graduation, all in the field of food sciences. Four assessors had been
139 educated in a laboratory or process technology training field.

140

Competencies and contexts in sensory evaluation

141 2.2 Data collection

142 The qualitative method was selected because of the characteristics of the phenomenon
143 being investigated in the study. The data were collected using semi-structured thematic
144 interviews. The thematic interviews were conducted by the first author either individually or
145 in a group of two persons during 2015. Three group interviews and seven single interviews
146 were conducted. The interviews lasted approximately 60 minutes each, and were audio
147 recorded and transcribed verbatim.

148 We investigated how assessors described sensory evaluation practices in the laboratory,
149 in other departments and on the production line, to gain an understanding of the actual
150 sensory evaluation practices taking place. The interviews focused on sensory work
151 practices, methods and the use of sensory skills. Two main themes were emphasized in
152 the interview: (I) the practices and learning outcomes of sensory evaluation and quality
153 control, and (II) the personal characteristics of an assessor.

154 Questions related to Theme (I) focused on mapping the skills, sensory methods and daily
155 evaluation practices. The aim of the specific questions was to gather detailed information
156 about the routines and to find out about the competencies that were required. Theme (I)
157 questions were based on knowledge about the principle of good practices (Lawless &
158 Heymann, 2010; Parkkinen et al., 2008).

159 Theme (II) focused on personal characteristics, self-knowledge, and the use of sensory
160 skills and consumer understanding. The themes and the questions were chosen because
161 they related to studies of collaboration work, studies of learning and because personal
162 characteristics and the use of sensory skills vary between individuals. The theme
163 questions incorporated questions about the assessor and her use of sensory skills (e.g.
164 discrimination) and social effects within sensory evaluation (Tuorila & Appelbye, 2008).

165 The interview themes and questions are presented in Appendix 1.

166 2.3 Data-analysis

167 The data were analyzed by following the principles of inductive and abductive content
 168 analysis (Timmermans & Tavory, 2012). In the analysis, continuous dialogue between the
 169 data and the theoretical framework was maintained. ATLAS.ti software (ATLAS.ti Scientific
 170 Software Development GmbH, Berlin, Germany) was utilized in the data analysis. The
 171 data were divided into text segments including a description of an assessor's practice: 523
 172 text segments were extracted from the data. The coding process consisted of three
 173 phases that were linked to each other. In the first phase, the competencies were analyzed
 174 inductively from the data. The same text segments of analysis were used in the second
 175 phase, during which we used abductive content analysis to analyze the contexts.

176 The data were analyzed inductively through repeated examination and comparison
 177 focusing further on the characteristics of evaluation competencies. Five categories were
 178 formulated: *evaluation skills, tasks, product properties, evaluation experience &*
 179 *background and the development of evaluation*. Categories of competencies and their
 180 descriptions are presented in Table 1.

181 **TABLE 1**182 **TABLE 1** Analysis categories of competencies

Category	Description	Example quotes from the interviews (translated and transcript from Finnish)
Evaluation skills	<u>1) Personal skills</u> Self-knowledge, responsibility, motivation, patience, objectivity,	"Skills in describing the amount of product defect and difference are meaningful. If assessors can't find anything or they find the defect or difference to be very small, we

Competencies and contexts in sensory evaluation

numeracy, memory, description and naming, sensitivity, techniques for sensing and ability to sense (taste, odor, touch, sight).

Also, learning and practicing opportunities.

2) Community skills

Assessors support and guidance

Instructions and concepts.

suppose that the consumer can't find it either. Our assessors have to be good enough to measure and evaluate the differences."

<p>Evaluation tasks</p>	<p>Evaluation methods and tools; assessor, decision-maker.</p>	<p>"We go through the consumer feedback monthly, and then we take the three top reasons for feedback. These details also go to the factory and we have a group that improves these products even more. In other words, people in the factory know which products get the most feedback."</p>
<p>Evaluation of product properties</p>	<p>Assessor describes the evaluation of product properties in the specific points of view.</p>	<p>"The typical product defect is that the product is either too diluted or too strong. We have the product specification but sometimes the items are at the extreme ends of the specification ranges and</p>

therefore too diluted or too strong. Those won't go to the grocery either."

Development of evaluation	<p>1) Assessment to provide suggestions for improvement.</p> <p>2) Defines the limits of the number and the level of assessment, as well as drawbacks.</p> <p>3) Appointed by development targets, as well as who and how to develop and evolve.</p>	<p>"My opinion is that we should develop our problem solving methods. We should learn to make the right decisions in a larger group of people, and not only between quality and process departments. Everyone should join in the learning process. Also, the situations where decisions are made."</p>
Evaluation experience and background	<p>Assessors own or required experience or background.</p>	<p>"When I came to this place of work I had training experience from the laboratory and process technology field. But I've grown and learned for this from my childhood. In the beginning of this job, I didn't get a chance, or couldn't even think of getting a chance, to make decisions in three or four years. I followed with a subservient attitude and I learned tasting from wise and practiced co-workers."</p>

Competencies and contexts in sensory evaluation

184

185 The three broad categories utilized in the second analysis phase were drawn from the
 186 theory of three metaphors of learning: individual action (monologue), collaborative
 187 interaction (dialogue) and collaborative knowledge creating. The knowledge creation
 188 approach is relevant when specific tools are available to help individuals and their
 189 communities work together for the advancement of their knowledge (Paavola et al., 2004).
 190 Individual practices, skills, learning abilities, backgrounds and experiences were identified
 191 first and sorted into a category we called individual action (monologue). The criteria for the
 192 quotes included an individual's own knowledge searching and work (how participants have
 193 learned, practiced or evaluated). Data segments including elements of involvement,
 194 interactive practices, joint practices and collaboration were categorized into collaborative
 195 interaction (dialogue) categories. Data segments including knowledge creation elements,
 196 object bound collaboration, joint planning and creation were categorized into collaborative
 197 knowledge creation. Categories of contexts and their criteria are presented in Table 2.

198 **TABLE 2**

199 **TABLE 2** Analysis of contexts in individual action, collaborative interaction and
 200 collaborative knowledge creation.

Category	Definition	Example quotes from the interviews (translated from Finnish)
Individual action (monologue)	Assessors own knowledge, action, and experience or practice (e.g. background, sensing abilities, and a development proposal).	“Especially in describing the method, sense of odor is very important but also the ability to separate the different flavors in a product.”

Competencies and contexts in sensory evaluation

Collaborative interaction (dialogue)	Enabling, improving, and participating in collaborative work. Evaluating and communicating collaboratively.	“Yes they do estimate the significance and extent of the products defect on-line. But if they are uncertain about the product defects, e.g. the amount of the aroma, they will ask for confirmation from the laboratory or product development. Decisions are made together because no one certainly wants to reject 6,000 kg independently. Independently rejected quantities are smaller and rejection depends on the products and defects.”
Collaborative knowledge creation	Collaborative knowledge creation: shared plans, documents, recipes, vocabulary and forms.	“We estimate the self-life of the product and then we define the best before date. If we find some problems in the self-life period, we start to adjust the product recipes. After all, it is a good way for us to learn.”

201

202 In the third analysis phase, the first two analysis phases were combined and their results
 203 were considered together. The first author undertook the data coding and analyses, which
 204 were then examined with the other authors. Disagreements were discussed and changes
 205 were made to the coding if needed. To analyze the inter-rater agreement of classification,
 206 an independent rater classified approximately 10% of the ideas produced; the Kappa
 207 coefficient for rater agreement was 0.628 (Cohen’s Kappa) for analysis of the
 208 competencies and 0.646 for analysis of the contexts, which was considered to represent

Competencies and contexts in sensory evaluation

209 good congruity between the raters (0.40-0.75 rated as fair to good, see Fleiss et al., 1969,
210 p. 281).

211

212 3 RESULTS: evaluation competencies and contexts

213 3.1 Evaluation competencies

214 According to the assessors, evaluation requires both individual and collaborative
215 competencies. Evaluation skills were mostly related to the assessors' independent work.
216 The assessor focused mainly on their perception of the products' taste. Also, the sense of
217 smell and tactile sense were described in practical work as necessary, and the sense of
218 hearing less often. They agreed that their personal individual evaluation experience was
219 important. The assessors emphasized that skillful evaluation requires gaining enough
220 individual experience from a specific domain. The assessors described their long-term
221 memory as "a flavor memory" that they utilized in their work. Knowledge of independent
222 and individual evaluation methods, vocabulary, and the capability to make self-reliant
223 decisions and express opinions aloud were mentioned as key competencies. The
224 assessors also mentioned that cognitive evaluation skills are necessary when developing
225 assessment lexicons, practicing memory or searching for defects. The following excerpt
226 (1) describes the evaluation skills when an assessor works independently.

227 *(1) There is no short way. The more you taste, the more you will learn. And you will*
228 *acquire more abnormalities; flavors which are meaningful to remember. It's like the*
229 *"learning road of tasting", which is a long road. For example, different countries*
230 *have different origins and harvesting seasons and they are completed only once a*
231 *year. You have to go through many harvest seasons to learn the differences*

Competencies and contexts in sensory evaluation

232 *between them. If this year is different from last year, what do we do? Is that a*
233 *problem? Do we need to change the recipe? It's like that. It's quite a long process.*

234 Collaborative skills, when assessors compare product samples and sensory evaluation
235 experiences in small panels in the laboratory or on the production line, were emphasized
236 strongly. The experience was viewed as extending one's courage to express individual
237 opinions or different thoughts in an assessment situation. The following excerpt (2)
238 explains the evaluation skills required when an assessor works collaboratively. They were
239 asked about the relevance of the assessor's personal abilities to sense or describe what
240 they sense.

241 *(2) I noticed that sometimes people evaluate very well but they do not dare express*
242 *their opinions aloud. They might think they could be mistaken or that others won't*
243 *agree. From my point of view, the ability to explain and justify one's own opinions is*
244 *important. The experience of evaluating will enhance one's courage. Opinions are*
245 *not always identical, human senses are different and that has to be accepted and*
246 *discussed.*

247 Evaluation required collaborative work competencies and collaborative knowledge creation
248 practices. The assessors mentioned that daily tasks included testing, creating methods of
249 analysis and general methods of tasting, estimating the shelf-life of food samples,
250 identifying defects, using and creating a vocabulary and moderating methods for a small
251 panel. They mentioned challenges like the low number of panelists, the necessity to ingest
252 the sample, and the frequency and methods of tasting on the production line. The
253 collaborative knowledge creation assessment policy describes how an entire product
254 evaluation process involved several departments and individuals.

Competencies and contexts in sensory evaluation

255 The assessors mentioned that competencies related to products properties were the
256 knowledge of defects, harvest change, exterior texture and taste. Collaborative interaction
257 is required when there are some differences (e.g. color) compared to the reference, but
258 product quality is still good enough for delivery to a grocery store. Excerpt (3) describes
259 the assessor's individual evaluation of product properties, and excerpt (4) demonstrates
260 the evaluation of the product properties when the expert collaborates with the consumer.

261 *(3) Do you need any additional equipment for sensory evaluation? Not really, because*
262 *the product appearance in the picture is different when compared to the reference.*
263 *You can't see exactly what the color of the product is. Once we tried color fans but*
264 *because there are too many sample units and shades of color it was too difficult to*
265 *compare them with product sample. Also, the product color is not the same every*
266 *day because the color shade of the ingredients varies. When the product ages, the*
267 *colors change too.*

268 *(4) When the harvest changes, the flavors are different compared with the last year*
269 *because natural raw materials are never identical. For example, one is not allowed*
270 *to use any substances [chemicals] in organic products, so it is always different.*
271 *Sometimes consumers complain that the product is not the same, but you can't do*
272 *anything about nature: it is what it is.*

273 The assessors mentioned that social cues (e.g. social pressure or premium category) were
274 influential. Sometimes individual opinions were difficult to elicit, if product quality was
275 analyzed by a small panel. For developing collaboration between the assessors, experts
276 and departments of the company, the assessors raised issues related to considering the
277 impact of social dimensions within evaluation practices and developing methods to
278 moderate small-panel evaluations. They mentioned competencies and contexts involved in
279 how to avoid social cueing, and how to moderate situations and give everyone the

Competencies and contexts in sensory evaluation

280 opportunity to formulate their opinion. Social cues can be particularly influential when
281 evaluating expensive ingredients or products.

282 Assessors' experience and background were described mostly in individual contexts, but
283 the development of the sensory evaluation was often based on collaborative work between
284 the assessors. Excerpts 5, 6 and 7 demonstrate the assessors' independent, collaborative
285 and knowledge creating developments.

286 *(5) In optimal conditions, an external sensory panel could work the best. It is good that*
287 *there are assessors who work with certain products and learn to evaluate those. But*
288 *it has challenges, especially when the products are based on a personal idea or are*
289 *developed specially with someone. Even when these assessors get samples*
290 *blindfolded and even if they try to avoid favoring one over the others, unfortunately*
291 *their knowledge about the product affects the assessment.*

292 *(6) Recently we had a case in which the country of origin had a problem: the product*
293 *tasted like raw potato. We talked about it a lot, and when the product came in the*
294 *laboratory we told the new tasters: "Here is the raw potato flavor". And they tasted it*
295 *and said: "aha yeah, when you say it is a raw potato flavor, that's what it's like".*
296 *They found the right words for the flavor very easily because we used those words.*
297 *If we hadn't said anything, they wouldn't have any words to describe that flavor. And*
298 *next time they will remember the potato flavor.*

299 *(7) An example from the training field: we should speak using the same words*
300 *otherwise the flavors can't be described. For example, you can remember the flavor*
301 *from your grandmother's barn. Or something else, and you have to synchronize*
302 *your taste with others. Everyone should evaluate, and together we should search*
303 *for flavor defects, and name those too.*

304

Competencies and contexts in sensory evaluation

305 3.2 Contexts of sensory evaluation

306 Of the analysis units, 42% described individual evaluation contexts, 53% described
307 collaborative contexts, and 5% of them described collaborative knowledge creation
308 contexts. The cross-analysis between the contexts and the competencies is presented in
309 Table 3. Excerpts 1, 3 and 5 (above) demonstrated the context in which the assessor
310 works independently. The individual context was emphasized in the results of evaluation
311 skills (e.g. ability to sense and memory), and evaluation experience and background.

312 According to the evaluation of the product properties (e.g. finding specific defects), more
313 than 80% took place in collaborative interaction (Table 3). The collaborative context was
314 also emphasized in tasks and in the development of an evaluation. Related to
315 collaboration, important matters included learning, sharing and reviewing both external and
316 in-house consumer panel feedback, developing methods to moderate small-panel
317 evaluation and developing a product vocabulary collectively between the assessors.
318 Excerpts 2, 4 and 6 (above) demonstrated the contexts in which the assessors work
319 collaboratively.

320 Five per cent of the units analyzed in the evaluation categories included collaboratively
321 shared objects, e.g. product samples, and assessor learning as knowledge creation (Table
322 3). Knowledge creation contexts were found in daily practices especially in cases when
323 product defects were sought and discussed. These contexts were emphasized in
324 evaluation tasks and development. Excerpt 7 (above) demonstrated the knowledge
325 creating context in development work.

326 **TABLE 3**

327 **TABLE 3** The cross-analysis of competencies and contexts in sensory evaluation

Competencies and contexts in sensory evaluation

CONTEXT	Skills		Tasks		Product properties		Development		Experience and background		Total	
	f	%	f	%	f	%	f	%	f	%	f	%
Individual	61	64.2	83	32.7	5	19.2	38	33.3	33	97.1	220	42
Collaborative interaction	33	34.7	159	62.6	21	80.8	63	55.3	0	0	276	53
Collaborative Knowledge creation	1	1.1	12	4.7	0	0	13	11.4	1	2.9	27	5
Total	95	100	254	100	26	100	114	100	34	100	523	100

328

329

330 **4 DISCUSSION**

331 The expert's workplace has been identified as a key factor contributing to the continuous
 332 development of expertise (Tynjälä, 2008), and thus, the development of a workplace as a
 333 learning environment has been emphasized. Previous literature on sensory training has
 334 emphasized an individual's work in light of assessor training methods e.g., mental imagery
 335 (Tempere et al., 2014) and computerized panel training (Kuesten et al., 1994).

336 Collaborative interaction as a training method has been mentioned in a study by
 337 Marchisano et al. (2000) in which the results showed that there was no evidence that the
 338 feedback had positive effects on performance in triangle tests or scaling. The study
 339 suggested that the feedback did not lead to better performance because the information
 340 was provided without adequately teaching the assessors how to perform better. But in

Competencies and contexts in sensory evaluation

341 case of the familiar odor recognition test, feedback had a positive effect (Marchisano et al.
342 2000). Knowledge creation practices as a workplace learning method are not often
343 mentioned. Furthermore, there has been little research on what the actual daily learning
344 contexts in sensory evaluation are. Several studies have emphasized specific training or
345 approaches to food sensory evaluation (Bitnes et al., 2007, Hayakawa et al., 2010,
346 Croijmans & Majid, 2016) in order to promote assessor learning within this area.

347 This study contributes to the research on the perspectives of sensory assessors'
348 competencies and contexts of work, and we have therefore focused on authentic
349 professional contexts to determine the reported evaluation competencies. The findings
350 from this study are in agreement with the existing literature and support the assumption
351 that personal competencies play an important role in sensory assessment (Gonzalez et al.,
352 2000, Hughson & Boakes, 2002, Bitnes et al., 2007). The study findings demonstrate that
353 personal evaluation skills are significant when the assessors work individually. The
354 findings support the assumption that assessors also need problem-solving skills, skills to
355 evaluate their daily practices and the decisions they make, and conversation skills and
356 skills to work collaboratively in teams (Lawless and Klein 1989, Stone et al. 2012). Also,
357 the findings agree with the view that individual and group learning at the workplace can be
358 characterized as a highly social activity which requires interaction and dialogue,
359 challenges that make necessary learning and reflection on past experiences, and the
360 planning of future activities (Tynjälä, 2008).

361 We observed that learning sensory evaluation, such as perceptual learning and
362 experience-based learning are linked to the metaphors of learning. We summarized how
363 the daily practices analyzed in the study were related to the theoretical background and
364 the three metaphors of learning (by Paavola & Hakkarainen, 2005). An overview of the
365 three metaphors of learning and the results of the study are reiterated in Figure 1.

366

367

FIG.1. SENSORY LEARNING METHODS AND THE THREE METAPHORS OF

368

LEARNING. BASED ON THE THREE METAPHORS OF LEARNING BY PAAVOLA AND

369

HAKKARAINEN (2005).

<p>Assessor learning as acquisition – Monologue, within mind approach Individual context was emphasized in the results as</p> <ul style="list-style-type: none"> • evaluation skills (e.g. ability to sense, memory) • evaluation experience and background. <p>In a field of the perceptual learning, experience-based learning, category learning, different kinds of individual skills, experience and background are essential (e.g. mental imagery).</p>	<p>Assessor learning as participation – Dialogue, interaction approach Collaborative context was emphasized in the results in</p> <ul style="list-style-type: none"> • evaluation tasks, • evaluation of product properties (e.g. finding specific defects), • development of evaluation practices. <p>The evaluation tasks, product properties and development are the situations where verbal or conceptual learning and linguistic abilities are essential (e.g. when describing defects).</p>
<p>Assessor learning as knowledge creation – Co-creation, developing collaborative shared objects and artefacts Only 5% of total analyzed units in evaluation categories appeared in collaborative knowledge creation context (e.g. developing and creating lexicons).</p>	

370

371

As shown, the daily practices involved collaborations around tasks, evaluation of product

372

properties and development work. Learning occurs in a context of practical experience and

373

critical reflective actions (Webster-Wright, 2009). However, there has been surprisingly

374

little empirical research on the practices of assessors in sensory evaluation and contexts

375

that would take into account both the individual and collective resources contributing to the

376

expertise in the evaluation work. We argue that this kind of approach would provide a

377

broader perspective from which to investigate sensory evaluation practices and

378

competencies.

Competencies and contexts in sensory evaluation

379 Competencies represent more than the levels of knowledge and skills needed to account
380 for the effective application of available knowledge and skills in a specific context
381 (Westera, 2002). Organizing a framework and explaining the important domain features
382 also requires expertise (Solomon, 1997). This puts to the fore the importance of the
383 professional community and the participation metaphor of expertise. Further, the
384 knowledge creation contexts in daily sensory evaluation practices need to be examined
385 more carefully, because they are essential learning environments for the assessors and
386 thus contribute to their expertise in multiple ways.

387 This research outlined an investigation of the practices assessors reported by asking them
388 to describe normal everyday practices in detail. The semi-structured thematic interview
389 allowed assessors to answer using their own words. The aim was to engage in research
390 striving for a deeper understanding of everyday practices. In determining the number of
391 interviews, we followed the guideline that twelve interviews of a homogenous group are
392 needed to reach saturation (Guest et al. 2006).

393 There are some shortcomings in the study design related to the questions prepared. The
394 theme questions were comprehensive, and some details may have been lost. The
395 researchers were unable to verify qualitative information mentioned by the assessors
396 about their everyday work e.g. how collaboratively assessors work when they are working
397 in groups. We also recognized that there are multiple valid methods for assessors and
398 experts of various kinds to evaluate products, and the competencies required in these
399 positions vary. Despite this, widely described everyday practices and contexts have now
400 been determined and collected.

401 This qualitative study was done with a non-representative set of industries in a single
402 country and all the companies were leading companies in the field. The study was unique
403 as such, and represents practices in three industries. We argue that the data collected

Competencies and contexts in sensory evaluation

404 were valid for studying the phenomenon and answering the study questions, as was the
405 method of utilizing the three broad categories from the theory of three metaphors of
406 learning. As a qualitative study, the most significant results were the development of
407 categorization and the distribution of competencies that were found and the contexts
408 based on them. The conceptualization of the results can be generalized and exploited in
409 other studies. According to Jervis and Drake (2014) qualitative research aims to lead to an
410 understanding of consumer behavior and motivation. Correspondingly, the qualitative
411 method applied in this study sought to understand an assessor's behavior.

412

413 5 CONCLUSION

414 Assessors' learning options and their ability to work collaboratively in the interactional and
415 knowledge creation contexts need to be ensured and facilitated. According to Meiselman
416 (2013), the work of assessors is changing, and consumers participate in product
417 development. Chambers et al. (2016) exemplify knowledge creation contexts in which
418 consumers can participate in sensory evaluation. They created the concept named the
419 "living" lexicon which grows, changes and adapts over time and can also be used for
420 consumer education. Based on these examples, we suggest that there should be research
421 in assessor learning practices and pedagogy to enhance their opportunities for utilizing
422 sensory data from consumer collaboration. The findings of this study will provide tools for
423 companies to promote learning and adapt new concepts in changing working life.

Competencies and contexts in sensory evaluation

424 APPENDIX The theme interview

425

426 Introduction

427 A theme interview for assessors of sensory evaluation in laboratory and development
428 departments. The study focus is on the sensory expert assessor's sensory evaluation of
429 everyday practices.

430 THE GENERAL QUESTIONS

431 1. Please tell us about your background and how long have you worked for the company?

432 2. How is sensory evaluation associated with your work?

433 3. How long have you been working in sensory evaluation?

434 4. In what ways were you trained in sensory evaluation?

435 5. What experience have you had in the manufacture of this factory's products?

436 6. What experience have you had in sensory assessment in this company?

437 7. What types of teams have you worked in?

438 THEME 1: Sensory evaluation methods and learning outcomes

439 I Evaluation process

440 1. What are the main tasks in your daily routines?

441 2. What is it meant in practice, when you talk about daily sensory assessment?

442 3. What methods do you use?

443 4. Describe the shelf-life practices in your department.

444 1. What are the outcomes of learning about product properties?

Competencies and contexts in sensory evaluation

445 5. Describe the collaborative work you use with the line workers? Related to quality
446 control.

447 II Evaluation environment

448 1. What environments do you have for the assessment?

449 2. How do you rate the practice related to the quality of the assessment?

- 450 • The social situation in the tranquility / appeasement.
- 451 • Packaging or presence of additional odors in the immediate vicinity of the product.
- 452 • Protected and defined evaluation time.
- 453 • Persons of influence (the most experienced, talkative, etc.).
- 454 • Use of water.

455 III Product knowledge and the definition of the product defects (quality experts/assessors)

456 1. How would you describe the process of measuring the meanings and amplitudes of
457 product defects? Is the meaning of error of assessment easy / difficult to evaluate?

458 2. How would you describe the use of the quality of tolerance (allowable limits) in a quality
459 expert's work?

460 3. Describe how do you use references in practical work? (Tasting / smelling etc.)

461 4. How is the magnitude of the difference described?

462 5. How important is the skill to describe the magnitude of the difference related to practical
463 evaluation work?

464 6. In what ways you would like to develop the observation of differences? Pictures?
465 Numeral values?

466 7. Describe the various types of product defects.

Competencies and contexts in sensory evaluation

467 8. Describe the common flavor defects?

468 9. How could atypical flavor defects (e.g. the taste of rancid fat) observation be
469 developed?

470 10. How do you use vocabularies in practical work?

471 IV Operations

472 1. Describe the different functions which can lead to errors in the findings?

473 2. Please describe the decision-making practices of quality assurance solutions for the
474 situation?

475 3. In what ways can there be a quality assurance solution for situations?

476 4. Describe in general the products and their meanings.

477 5. In what ways, if necessary, should 'backup practices' be involved?

478 6. What opinions and suggestions do you get from quality experts?

479 7. How would you describe your overall differing assessments which are present in the
480 product development, laboratory and the line?

481 THEME 2: Review the personal characteristics of evaluation work

482 I Assessor

483 1. Describe how assessors' personal characteristics (ability to sense and to describe it) are
484 practical in quality evaluation?

485 2. Describe what is meaning of assessors' self-knowledge (when they evaluate)?

Competencies and contexts in sensory evaluation

486 II Competencies

487 1. What is the importance of perception of quality evaluation techniques (e.g. how do you
488 check crunch)?

489 2. How would you describe assessors' discernment when the products are assessed only
490 on the basis of visual properties (e.g. gloss)

491 3. Describe the assessors' discernment, when the products are observed on the basis of
492 structure and sense (muscular sense, sensitivity to touch, hot and cold sensation).

493

494 III Understanding the consumer

495 1. Please describe the general way in which social cues (other opinions, an expensive
496 category, and a special product) affect sensory evaluation?

497 2. How does the importance of social cues reduce the quality of the evaluation?

498 3. Describe how consumer can be involved in product development (in the digital
499 environment etc.)?

500 Is there anything else you would like to add, or supplement? Do you have any further
501 questions on the subject?

502 Thank you very much for the interview!

503

504

505

REFERENCES

506

Ballester, J., Patris, B., Symoneaux, R., & Valentin, D. (2008). Conceptual vs. perceptual wine spaces: Does expertise matter? *Food Quality and Preference*, 19, 267-276.

507

508

Bende, M., & Nordin, S. (1997). Perceptual learning in olfaction: Professional wine tasters versus controls. *Physiology and Behavior*, 62, 1065-1070.

509

510

Bitnes, J., Martens, H., Ueland, Ø., & Martens, M. (2007). Longitudinal study of taste identification of sensory panelists: Effect of Ageing, Experience and Exposure. *Food Quality and Preference*, 18(2), 230-241.

511

512

513

Chambers, D. H., Allison, A., Marie, A., & Chambers, E. (2004). Training effects on performance of descriptive panelists. *Journal of Sensory Studies*, 19(6), 486-499.

514

515

Chambers, E., Sanchez, K., Phan, U.X., Miller, R., Civille, G. V. & Di Donfrancesco, B. (2016). Development of a "living" lexicon for descriptive sensory analysis of brewed coffee. *Journal of Sensory Studies*, 31(6), 465-480.

516

517

518

Croijmans, I., & Majid, A. (2016). Not all flavor expertise is equal: The language of wine and coffee experts. *PLoS One*, 11(6), DOI:<https://doi.org/10.1371/journal.pone.0155845>

519

520

Dehlholm, C. (2012). *Descriptive sensory evaluations: Comparison and applicability of novel rapid methodologies*. PhD Thesis. University of Copenhagen, Faculty of Science, Department of Food Science, Sensory Science Section.

521

522

Fleiss, J.L., Cohen, J., & Everitt, B.S. (1969). "Large sample standard errors of kappa and weighted kappa". *Psychological Bulletin*, 72 (5), 323–327.

523

524

Competencies and contexts in sensory evaluation

- 525 Gibson, E.J. (1969). *Principles of perceptual learning and development*. E. Norwalk, CT,
526 US: Appleton-Century-Crofts.
- 527 Goldstone, R.L. (1998). Perceptual learning. *Annual Review of Psychology*, 49, 585-612.
- 528 González, R., B., J., Càrcel, J. A., & Mulet, A. (2001). Cheese hardness assessment by
529 experts and untrained judges. *Journal of Sensory Studies*, 16, 277-285.
- 530 Guest, G., Bunce, A., & Johnson, L. 2006. "How Many Interviews Are Enough?" An
531 Experiment with Data Saturation and Variability. *Field Methods*, 18(1), 59–82.
- 532 Hakkarainen, K., Lonka, K., & Lipponen, L. (2004). *Tutkiva oppiminen: Järki, tunteet ja*
533 *kulttuuri oppimisen sytyttäjinä [Progressive inquiry: How reason, emotion, and culture fire*
534 *up learning]*. Porvoo, Finland: WSOY
- 535 Hughson, A.L., & Boakes, R.A. (2002). The knowing nose: The role of knowledge in wine
536 expertise. *Food Quality and Preference*, 13, 463–472.
- 537 ISO 5492 (2008). International Standard 5492. Sensory analysis – Vocabulary. Ref. No.
538 ISO 5492:2008 (E). International Organization for Standardization. Genève.
- 539 Jervis, M. G., & Drake, M. A. (2014). The use of qualitative research methods in
540 quantitative science: A review. *Journal of Sensory Studies*, 29(4), 234-247.
- 541 Kuesten, C. L., McLellan, M. R., & Altman, N. (1994). Computerized panel training: effects
542 of using graphic feedback on scale usage. *Journal of sensory studies*, 9(4), 413-444.
- 543 Lawless, H.T., & Klein, B.P. (1989). Academic vs industrial perspective on sensory
544 evaluation. *Journal of Sensory Studies*, 3, 205-216.
- 545 Lawless, H.T., & Heymann, H. (2010). *Sensory evaluation of food: principles and*
546 *practices*. New York, NY, USA: Springer Science & Business Media, LLC.

Competencies and contexts in sensory evaluation

- 547 Lelièvre-Desmas, M., Chollet, S., Abdi, H., & Valentin, D. (2015). Becoming a beer expert:
548 Is simple exposure with feedback sufficient to learn beer categories? *Acta psychologica*,
549 161, 95-103.
- 550 Marchisano, C., Vallis, L., & Macfie, H. J. (2000). Effect of feedback on sensory training: A
551 preliminary study. *Journal of Sensory Studies*, 15(2), 119-135.
- 552 Meiselman, H.L. (2013). The future in sensory/consumer research: evolving to a better
553 science. *Food Quality and Preference*, 27, 208 - 214.
- 554 Muukkonen, H., Kosonen, K., Marttiin, P., Vesikivi, P., Kaistinen, J., & Nyman, G. (2013).
555 Pedagogical design for knowledge creating inquiry in customer projects. Knowledge
556 Management & E-Learning: *An International Journal (KM&EL)*, 5, 278-297.
- 557 Nielsen, D., Hyldig, G., & Sørensen, R. (2005). An effective way to minimize drifting and
558 monitor the performance of a sensory panel during long-term projects - a case study from
559 a project on herring quality. *Journal of sensory studies*, 20(1), 35-47.
- 560 Paavola, S., Lipponen, L., & Hakkarainen, K. (2004). Models of innovative knowledge
561 communities and three metaphors of learning. *Review of Educational Research*, 74(4),
562 557-576.
- 563 Paavola, S., & Hakkarainen, K. (2005). The knowledge creation metaphor—An emergent
564 epistemological approach to learning. *Science & Education*, 14, 535-557.
- 565 Parkkinen, K., Tolonen, K., & Tuorila, H. 2008. Aistit ammattikäyttöön [Senses in
566 professional use]. Helsinki, Finland: WSOY.
- 567 Paavola, S., Engeström, R., & Hakkarainen, K. (2012). *The dialogical approach as a new*
568 *form of mediation*. In A. Moen, A. I. Mørch, & S. Paavola (Eds.), Collaborative Knowledge

- Competencies and contexts in sensory evaluation
- 569 Creation: Practices, Tools, Concepts (pp. 1-14). (Technology enhanced learning; Vol. 7).
570 Rotterdam: Sense Publishers.
- 571 Sfard, A. (1998). On two metaphors for learning and the dangers of choosing just one.
572 *Educational Researcher*, 27, 4-13.
- 573 Solomon, G. E. (1997). Conceptual change and wine expertise. *The Journal of the*
574 *Learning Sciences*, 6(1), 41-60.
- 575 Stone, H., Bleibaum, R., & Thomas, H.A. (2012). *Sensory evaluation practices*. Oxford,
576 UK: Academic press.
- 577 Tempere, S., Hamtat, M. L., Bougeant, J. C., Revel, G., & Sicard, G. (2014). Learning
578 odors: The impact of visual and olfactory mental imagery training on odor perception.
579 *Journal of Sensory Studies*, 29(6), 435-449.
- 580 Timmermans, S., & Tavory, I. (2012). Theory construction in qualitative research from
581 grounded theory to abductive analysis. *Sociological Theory*, 30,167-186.
- 582 Tuorila, H., & Appelbye, U. (2008). *Elintarvikkeiden aistinvaraiset tutkimusmenetelmät*
583 [Research Methods for Food Sensory Evaluation]. Helsinki, Finland: Oy
584 Yliopistokustannus.
- 585 Tynjälä, P. (2008). Perspectives into learning at the workplace. *Educational Research*
586 *Review*, 3,130-154.
- 587 Webster-Wright, A. (2009). Reframing professional development through understanding
588 authentic professional learning. *Review of Educational Research*, 79(2), 702-739.
- 589 Westera, W. (2001). Competences in education: a confusion of tongues. *Journal of*
590 *Curriculum Studies*, 33(1), 75-88.