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ABSTRACT

How can we create large-scale changes in our society that lead to more sustainable food consumption? One certain contributor to change is to ensure that the products and meals available in supermarkets, cafeterias, schools, hospitals and restaurants are sustainable while at the same time evoke pleasure, as pleasure is decisive for food choice. There is a need for culinary practitioners to prepare delicious meals based on sustainable ingredients, which require less resources to produce (such as vegetables, algae, legumes, grains, seeds and nuts), and also to use new ingredients (such as production side-streams or insects). However, these ingredients are not necessarily delicious due to, e.g., their bitterness. They may also evoke disgust or be socially unacceptable to eat. Thus, future culinary practitioners need knowledge of how to make these products acceptable and delicious in meals. Sensory science provides a valuable toolbox for evaluating foods, and thus contributes to finding ways to both change sensory properties of foods and improve their

KEYWORDS

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1. These authors contributed equally to this work.

deliciousness. Therefore, knowledge about this can contribute to important know-how in culinary arts educations. However, in the current culinary arts educations in Denmark, not much training and education in how to taste and how to carry out sensory evaluation of food is implemented. Taste for Life and the University of Copenhagen have worked with input from vocational teachers on developing teaching materials about sensory science for culinary arts educations. In this opinion article we present the ideas behind the programme and discuss the potential of the material. We hope and expect that it will contribute with knowledge about how to increase deliciousness through a course dedicated to sensory science as part of a culinary arts education.

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INTRODUCTION

Globally, there is a need for more sustainable eating habits and food consumption. The hospitality sector is responsible for the provision of an increasing share of the food eaten (Warde et al. 2007). In Denmark, the latest available statistics reveal that around 800,000 meals are served daily at schools, kindergartens, eldercare and hospitals, approximately 225,000 meals are eaten in restaurants, cafes or in fast food places, with many dinners consumed as take-away meals (Stamer, Thorsen and Jakobsen 2017) and 25 per cent of the Danes with access to cafeterias at work or in their place of education are eating their daily lunch in the cafeterias (Landbrug og Fødevarer [2016] 2017). Hence, it is obvious that a change in the way these meals are made can have tremendous effect on what foods are consumed. Ensuring that these daily meals are produced using sustainable ingredients certainly would be a contributor to a change towards more sustainable food consumption.

One way to ensure more sustainable food habits is by reducing the consumption of meat and increasing the consumption of ingredients that require less resources to produce, such as vegetables, algae, legumes, grains, seeds and nuts, or ingredients such as production side-streams or insects (Willett et al. 2019). Meat and meat-based products are generally considered to contribute to deliciousness of a meal due to the taste of umami and high energy content of meat (Mouritsen and Styrbæk 2014). The more sustainable ingredients mentioned are not necessarily delicious due to, e.g., bitterness, and some may even evoke disgust or be socially unacceptable to eat (Rozin and Fallon 1987). Meat is a main contributor to protein in many industrialized countries (Chai et al. 2019; Willett et al. 2019). Hence, in Denmark we have to adjust the way we eat if we want to eat more sustainably. Future culinary practitioners need knowledge about how to make the more sustainable foods more acceptable.

Pleasure is a major determinant of food choice (Mustonen et al. 2007), and acceptability and deliciousness of foods are crucial for the formation of new eating habits and acceptance of novel food products (Rozin 2006). Culinary practitioners (trained chefs, caterers, sandwich makers and healthcare cooks)

are the ones who prepare many of the meals consumed on a daily basis; thus, they have an important role in changing and forming new – more sustainable – food habits. The food prepared needs to be delicious, so that novel and sustainable food products become (more) acceptable and part of new more sustainable eating habits.

Sensory science provides a toolbox for evaluating the sensory properties of foods and meals and following from that, tools to understand the deliciousness of meals. With theories for sensory perception and adapted sensory methodologies for testing foods, it is possible to develop teaching material. The culinary practitioners of the future may, based on knowledge obtained through this teaching material, enhance, support and expand their understanding of how to develop delicious meals based on sustainable ingredients. Consequently, this would contribute to a change towards more sustainable food consumption.

Taste for Life and the University of Copenhagen have worked with vocational schools on developing teaching materials about sensory science for culinary arts educations. This article presents the considerations regarding development and the processes used to develop the material. The purpose of the teaching programme is to improve knowledge about how to obtain deliciousness through sensory education.

SENSORY AND CULINARY SCIENCE – IT’S ALL ABOUT THE EXPERIENCE

The methods of sensory science encompass measurements, evaluations and training in tasting skills. Sensory scientists specialize in methods for describing experienced flavours, measuring intensities of sensory descriptors, hedonic evaluations and discrimination between products. In product development, methods for sensory analysis are commonly applied to gain insight into how a product is perceived by consumers, which product is preferred and how much it is liked (Lawless and Heymann 2010). Gaining knowledge about this enables the development of products that are accepted by consumers. Hence, sensory science provides tools that can be used to improve food products and meals.

The focus of culinary practitioners is on cooking, culinary techniques, knowledge about raw materials and creativity (Rasmussen and Andreasen 2014). Culinary practitioners obtain mastery of their skills by practicing techniques in the kitchen, working with different ingredients, trying to perfect traditional recipes and challenging tradition. The main skill of culinary practitioners is craftsmanship. Mastering cooking skills means that culinary practitioners have knowledge about the transformation of food during cooking and how different elements contribute to the overall flavour of a dish. Colleagues and teachers in Taste for Life call this knowledge ‘implicit knowledge’ because it is something which is expressed in the craftsmanship without being verbalized. The implicit knowledge is learned through training and experience.

In both sensory science and culinary arts, focus is on the sensory experience. In both fields, the senses are key in discovering and evaluating food. Through dialogue with teachers in the culinary arts, we have realized that it would be advantageous to share sensory science and evaluation methods with practitioners outside of the sensory lab. Building sensory science expertise can help create a collective way of discussing the properties of food that is being prepared in the kitchen (Frøst 2019; Ulloa 2019). It can lead to awareness of

how to create acceptable and delicious meals and provide tools for creativity and development.

SENSORY SCIENCE IN CULINARY ARTS EDUCATIONS

There are several different culinary arts educations in Denmark. The duration of the programmes varies from seven months to four years and nine months. The requirement for enrolment in the programme is a graduation certificate from primary school. The educational programmes start with a course of twenty weeks duration, after which apprentices choose which education they wish to specialize in: healthcare cook, gourmet or assistant gourmet. In gourmet, it is possible to specialize as a chef, in open-faced sandwich and catering, as a sandwich maker, or in catering; the education for assistant gourmet is shorter and takes only two years.

Across all these specializations, most education and training takes place in an apprenticeship. Throughout the educations there are three school periods of seven to ten weeks during which both practical and theoretical teaching is integrated. For gourmets, the syllabus in sensory science includes eight pages in the standard culinary handbook (Smag for Livet 2019). Gourmets do not have a specific course dedicated to sensory science, but the curriculum must dedicate one week to teach sensory science, e.g., sensory analysis and preparation according to the Education Order. Furthermore, gourmets should have a sensory vocabulary to be able to express themselves and communicate with colleagues and guests (Ministry of Education 2018). In contrast, the education for healthcare cooks includes a course of approximately ten days of teaching called 'Sensory Science and Food Quality' (Academic Committee for the Nutrition Assistant Program 2020), as well as a course-related study and exercise book (Andersen 2013).

The teaching material about sensory science aimed at gourmets is limited. Consequently, if teachers want to teach the subject more thoroughly, they have to create their own materials or use materials which are developed for other educational specializations, e.g., the book on sensory science for healthcare cooks where the focus primarily is on the cooking for larger groups of people or in a healthcare setting.

Thus we – in Taste for Life – took the opportunity to create relevant materials on sensory science which can be used across the culinary arts. In our collaboration with culinary arts teachers and educational institutions, we asked for criteria for such materials. The culinary arts teachers requested that the materials consist of an equal amount of practical exercises and accessible theory, are aesthetic and approachable and that they should be adaptable across levels and culinary themes.

THE DEVELOPMENT OF TEACHING MATERIALS

Initially, the authors selected a list of topics among what is taught in sensory science at the university level to students in food science and related fields (Lawless and Heymann 2010; Meilgaard, Civille and Carr 2016). However, due to different purposes in the educational goals, some topics were omitted. Elements included all aspects of statistical analysis of data and planning of consumer evaluation, so the focus remained on what the culinary arts students can do in their everyday practice with the means they have in their workspace. Based on interviews and dialogue with culinary arts teachers over

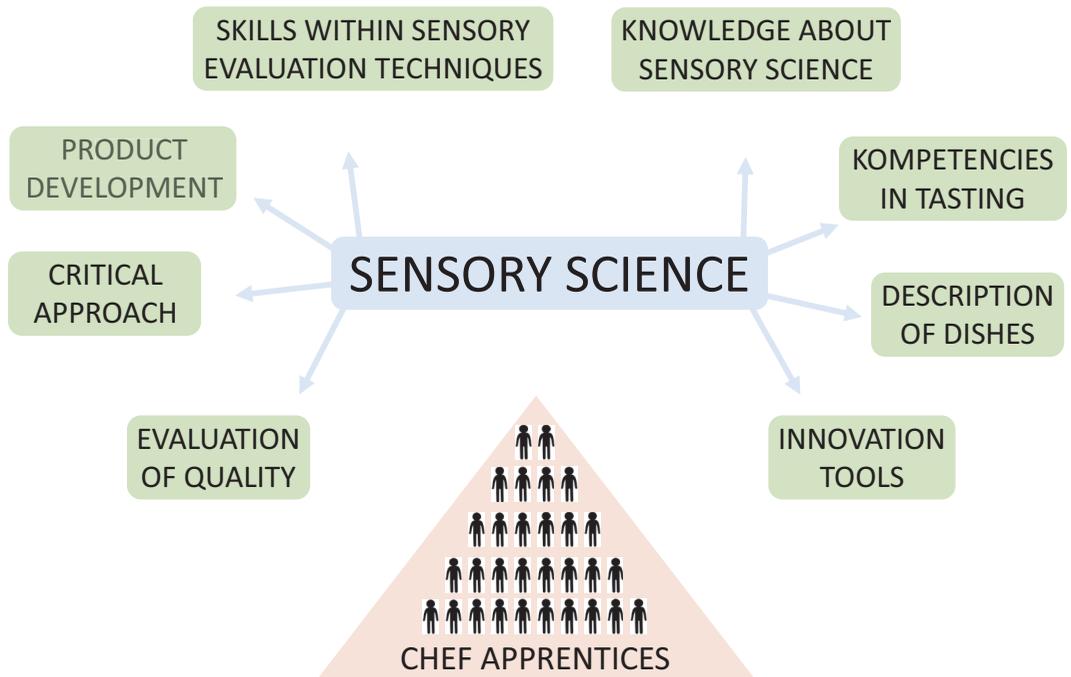


Figure 1: Overview of the learning outcome as a result of teaching in sensory science for vocational apprentices.

a series of individual meetings in the fall of 2018, we revised the list of topics that would be relevant to include. In the spring of 2019, the teaching materials on sensory science were initially tested at three vocational schools over individual courses of three days. Feedback from apprentices and teachers indicated that the optimal structure of the teaching materials was five modules with different sensory themes. In the winter of 2020 we, the authors, taught ten classes of gourmets and healthcare cook apprentices sensory science using our own teaching materials. This resulted in a final compendium of teaching materials, which is available on Taste for Life's website. The aim was to make the teaching materials available and easy to use for stakeholders without an ongoing physical presence from sensory specialists.

The teaching materials consist of a combination of theory taught through videos and slideshow presentations, and practice taught through tastings and exercises. It includes an introduction to the biology and function of the senses: taste, sight, smell, hearing and touch, and practical sensory methods with associated exercises, which can be carried out in a kitchen or classroom. It contains teacher guides with questions for in-class discussions and questions for the apprentices to discuss and reflect upon during the kitchen exercises.

Each module centres around a topic within the framework of the senses and their function, verbalization and assessment, and most importantly, deliciousness. It is designed so that it is possible to select the content that fits to a particular level in the education. Module one to four takes between two to four hours to complete, depending on the time spent on discussions in class, and module five takes four to seven hours to complete.

The teaching materials may be adapted with relevant food products in the exercises and used for all culinary arts educations. The teachers involved in the project suggested that the teaching materials could also be applied to the educational programme for bakers, confectionaries, butchers and waiters. The intended learning outcome of the teaching programme is illustrated in Figure 1.

EXPERIENCES FROM THE TEST OF TEACHING MATERIALS

Generally, we received positive feedback from teachers and apprentices about the teaching programme and the learning outcome was high. However, we saw large differences between the skills of the apprentices – both with regards to the comprehension of theory and to cooking skills. This was a challenge with respect to including and involving all apprentices in all parts of the teaching. Some apprentices were very attentive during the theoretical parts of the teaching, whereas others were more active during the practical parts of the teaching. Our impression was that many apprentices are driven by the craftsmanship and the practical parts of the education and training. Teachers explained that they had the same experience, and that it constituted a challenge when teaching. Apprentices and teachers especially praised the parts of the teaching programme that connected theory with practical work.

In a forthcoming publication, we will look at the measured learning outcome of the teaching. The focus will be on results from a baseline and follow-up test of the apprentices' knowledge on sensory science and taste skills. We will also assess apprentices' expectations, engagement and evaluation of their experience.

The teaching curriculum for sensory science contains interactive and relevant up-to-date teaching materials in a ready-to-use format. This could help teachers overcome the time constraints for preparation which they experience, and provide the opportunity of attaining further education without increasing costs.

SENSORY SCIENCE ON THE SCHEDULE

The feedback from the apprentices and teachers demonstrated a pronounced interest in learning more about sensory science. Our impression was that the apprentices gained valuable evaluation tools from the sensory teaching programme.

Some vocational teachers already teach sensory science and have a considerable amount of knowledge in the field. However, other teachers have very limited knowledge about sensory science. Therefore, the teaching materials include a section with theory for each module to provide additional comprehensive information on the topics. Additionally, we developed a course in sensory science for teachers at each of the collaborating vocational schools to ensure that teachers feel empowered to teach the subject. Our aim is that in time vocational teachers will use the teaching materials in a self-guided fashion. We hope that the materials will be adapted to different vocational educations at different levels, and we invite vocational teachers from other countries to adapt it to their teaching conditions.

HOW CAN KNOWLEDGE ABOUT SENSORY SCIENCE LEAD TO A MORE SUSTAINABLE FUTURE?

The goal of teaching sensory science to culinary practitioners is that they more deeply understand how to obtain deliciousness and how the sensory system works. Teaching sensory science is a way of supplementing the knowledge of culinary practitioners with a toolbox. They get the opportunity to experiment with sensory evaluation methods and techniques. Subsequently, culinary practitioners improve their skills by systematically testing the sensory components and adjusting them when developing meals.

Culinary practitioners are the ones who create the meals that a large number of people eat every single day. The environmental impact of food production, may it be food waste, agriculture or the way foods are processed, is imperative to take into account when producing meals. Thus, chefs need to know how to prepare acceptable and delicious meals from sustainable ingredients that require less resources to produce or develop processing methods that can be applied in kitchens that prolong the shelf life of foods.

Teaching sensory science can increase knowledge and understanding of what makes a meal delicious. This may help culinary practitioners overcome the challenge of using sustainable ingredients in meals. Future culinary practitioners may help increase the acceptability of unfamiliar, disliked or less accepted foods that have an unpleasant taste by developing, systematically evaluating and improving the foods to become delicious.

We firmly believe that by teaching sensory science to culinary practitioners, we provide them with tools that can support the creative process and disseminate knowledge about how to make sustainable foods that are also delicious. The current programme has been developed with the aim of increasing the speed at which sensory evaluation is carried out and adapting it to the conditions of the professional kitchen. We acknowledge that the suggested practices are unconventional and violate a number of basic rules of sensory analysis. However, we believe that it is a more fruitful approach for the practitioners to use our suggested methods because our methods create a systematic approach for the practitioners to use their senses. By learning this in their training, they can increase their innovation success and quality of the food after they enter the professional culinary production of sustainable foods and meals.

LINK TO THE TEACHING PROGRAMME ON TASTE FOR LIFE'S WEBSITE

The material can be found on the website of Taste for Life:
<https://www.smagforlivet.dk/undervisning/erhvervsskoler>.

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DECLARATIONS OF CONFLICT OF INTERESTS

The authors have nothing to declare.

REFERENCES

- Andersen, K. K. (2013), *Kulinarisk sensorik (Culinary Sensory Analysis)*, 2nd ed., Odense: Praxis-Erhvervsskolernes Forlag.
- Chai, B. C., van der Voort, J. R., Grofelnik, K., Eliasdottir, H. G., Klöss, I. and Perez-Cueto, F. J. A. (2019), 'Which diet has the least environmental impact on our planet? A systematic review of vegan, vegetarian and omnivorous diets', *Sustainability*, 11:15, p. 4110.
- Frøst, M. B. (2019), 'How to create a frame for collaboration between chefs and scientists – business as unusual at Nordic Food Lab', *International Journal of Gastronomy and Food Science*, 16:100132, pp. 100–32.
- Landbrug og Fødevarer (2016), *Kantinegæstens Stemme (The Voice of the Canteen Guest)*, <https://ernaeringsfokus.dk/analyser/maaltider/kantinegaestens-stemme>. Accessed 12 November 2020.
- Landbrug og Fødevarer (2017), *Færre Madpakker - Men Fortsat Populært (Fewer Lunch Packs, But Still Popular)*, <https://ernaeringsfokus.dk/analyser/maaltider/faerre-madpakker-men-fortsat-populaert>. Accessed 12 November 2020.
- Lawless, H. T. and Heymann, H. (2010), *Sensory Evaluation of Food – Principles and Practices*, 2nd ed., New York: Springer.
- Meilgaard, M. C., Civille, G. V. and Carr, B. T. (2016), *Sensory Evaluation Techniques*, 5th ed., Boca Raton, FL: CRC Press.
- Ministry of Education (2018), *Bekendtgørelse om erhvervsuddannelsen til gastronom* ('Executive order about the vocational gastronomy education'), <https://www.retsinformation.dk/eli/lta/2018/401>. Accessed 12 November 2020.
- Academic Committee for the Nutrition Assistant Program (2020), *Uddannelsesordning for ernæringsassistentuddannelsen* – inkl. Beskrivelse af fagrækken og praktikmål – jf. BEK nr 426 af 07/04/2020 ('Education scheme for the nutrition assistant education – incl. the description of subjects and intership goals cl. Order no. 426 from 07/04/2020'), <https://www.ernaerings-assistent.dk/praktiksteder/uddannelsesregler/uddannelsesordning>. Accessed 12 November 2020.
- Mouritsen, O. G. and Styrbæk, K. (2014), *Umami: Unlocking the Secrets Behind the Fifth Taste*, New York: Columbia University Press.
- Mustonen, S., Hissa, I., Huutilainen, A., Miettinen, S. M. and Tuorila, H. (2007), 'Hedonic responses as predictors of food choice: Flexibility and self-prediction', *Appetite*, 49:1, pp. 159–68.
- Rasmussen, P. and Andreasen, U. (2014), *Kokkebogen (The Chef's Manual of Danish Culinary Art)*, 7th ed., Odense: Praxis-Erhvervsskolernes forlag.
- Roizin, P. (2006), 'The integration of biological, social, cultural and psychological influences on food choice', in R. Shepherd and M. M. Raats (eds),

- Psychology of Food Choice – Volume 3 Frontiers in Nutritional Sciences' Series*, Wallingford: CABI, pp. 19–39.
- Rozin, P. and Fallon, A. E. (1987), 'A perspective on disgust', *Psychological Review*, 94:1, pp. 23–41.
- Smag for Livet (2019), *Gastronom : Lærebog for Kok, Smørrebrød og Catering*, (Textbook for Gourmet, Sandwich and Catering), 5th ed., Odense: Praxis-Erhvervsskolernes Forlag.
- Stamer, N. B., Thorsen, G. N. and Jakobsen, G. S. (2017), *Tal om Mad Madindeks 2017, Befolkningens Måltidsvaner (Numbers of Food, Food Index 2017 Meal Habits of the Danish Population)*, Roskilde: Madkulturen.
- Ulloa, A. M. (2019), 'The chef and the flavorist: Reflections on the value of sensory expertise', *Food, Culture and Society*, 22:2, pp. 186–202.
- Warde, A., Cheng, S-L, Olsen, W. and Southerton, D. (2007), 'Changes in the practice of eating: A comparative analysis of time-use', *Acta Sociologica*, 50:4, pp. 363–85.
- Willett, W., Rockström, J., Loken, B., Springmann, M., Lang, T., Vermeulen, S., Garnett, T., Tilman, D., DeClerck, F., Wood, A., Jonell, M., Clark, M., Gordon, L. J., Fanzo, J., Hawkes, C., Zurayk, R., Rivera, J. A., De Vries, W., Majele Sibanda, L., Afshin, A., Chaudhary, A., Herrero, M., Agustina, R., Branca, F., Lartey, A., Fan, S., Crona, B., Fox, E., Bignet, V., Troell, M., Lindahl, T., Singh, S., Cornell, S. E., Srinath Reddy, K., Narain, S., Nishtar, S. and Murray, C. J. L. (2019), 'Food in the anthropocene: The EAT–Lancet Commission on healthy diets from sustainable food systems', *Lancet*, 393:10170, pp. 447–492.

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