Interest, identity and perceptions. What makes a food technologist?

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Abstract

Purpose Previous research shows that identity formation is a crucial bridge between higher education and future employment. The objective of this study was to improve our understanding and knowledge of food technology students' prior interests, their perceived identity formation, perceptions of food technology and the profession of food technologist.

Approach A qualitative study was conducted, and the data consisted of audio recordings of 10 semistructured group interviews of first-, second- and third-year students, as well as alumni employed in relevant positions in the food sector. The interviews were transcribed and analysed by conventional content analysis following an inductive approach.

Findings Most students had previous general culinary interest, an interest in the science behind or an interest in contemporary food-related issues. Regardless of the year group and prior interest, most felt that graduation was the stage at which they could identify themselves as food technologists. They evolved from having a diffuse understanding of food technology and the profession, food technologist, to an increased awareness in their second and third years.

Originality The research findings inform higher education food technology programmes aiming to promote the development of food technology students' professional identity. The study suggests that a holistic approach to teaching, as well as context-based and professional activities at an early stage, might help students in their identity formation.

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Introduction

The production-to-consumption food industry is complex, and the right competence by graduates will be vital to secure economic growth and welfare, innovation and change in this sector (Povey *et al*., 2020; OECD, 2021). The required change in the food industry seeks highly motivated professional employees with high competence that are multidisciplinary problem solvers. Compared with other disciplines, for example, chemistry and microbiology, food technology first became a subject on its own in the 1960s (Hefft and Higgins, 2021). Food technology is hard to define because the industry encompasses layers of disciplines. Nevertheless, here we define food technology as the application of food science to the selection, preservation, processing, packaging, distribution and use of safe food (IFT, 2019). A range of skills other than technical competence is needed in today's work environment, including the food industry, and graduates need to be comfortable and effective when collaborating in different teams at work (Miller, 2016). A student's educational success can therefore be predicted by this student's interests, attitudes, knowledge and values (Harackiewicz *et al*., 2016; Donald *et al.*, 2018) where personal interest is one of the main motivational factors for conceptual change (Pintrich *et al*., 1993). Moreover, developing a robust professional identity during education has additionally been associated with a more successful transition to the workplace (Islam, 2008).

Nevertheless, there is a lack of research that examines the process of successful transformation of students into the preferable food technology graduate that the future food industry needs. The current study has given valuable insights into the students' process of becoming professionals. The objective of this study was to find parameters that influence the transition of students' view of themselves as food technologists. We have studied three aspects, interest, identity and perception, which consequently leads to the following research questions, (1) What prior interests are important for starting food technology studies? (2) When do food technology students and alumni identify themselves as food technologists? and (3) How do food technology students and alumni perceive food technology and the profession of food technologist? These questions are addressed using the framework of conventional content analysis to identify patterns of students' perceptions. Results from the study are discussed using different theoretical perspectives and research on interest, identity formation and conceptual understanding.

Literature review

Students' interest

The importance of promoting interest in education is highlighted in the literature (Harackiewicz et al., 2016). Studies indicate that the complex constellation of attitudes, behaviours and motivations often has a more significant impact on long-term success in life than academic achievement (Miller, 2016). Thus, higher education needs to shape the mindset of graduates in addition to providing knowledge and skills (Miller, 2016). The transition and adaptation to a new learning environment at the university is challenging and may, if unsuccessful, result in significant distress, poor academic performance, and increased drop-out rates (Yorke and Longden, 2004). The large body of literature on students' first-year experience shows that existing individual interests and goals interact with the teaching environment, enhance cognitive engagement and lead to better learning, motivation and educational success (Kahu *et al.,* 2017). Harackiewicz *et al*. (2016) and Donald *et al*. (2018) found that educational success can be predicted by a student's interests, attitudes, knowledge and values. These are valuable attributes in future candidates entering the working life in the food sector (Flynn *et al*., 2017). This has important implications for career development and will contribute to increased motivation and higher self-confidence (Hernandez *et al.,* 2013; Tomlinson and Jackson, 2021).

Students' identity formation

Students are continuously engaged in constructing a narrative to better understand what and who they are. This narrative tends to be tested and validated in the social environment, however, students are not well supported in this process, highlighting the importance of the social and learning environment for identity development (Holmegaard *et al*., 2014). The significance of identity formation was also shown by Tomlinson and Jackson (2021, p. 898): 'Identity formation is a crucial bridge between higher education and future employment and works as an enabling and empowering force'. Chickering and Reisser (1993) defined college student development as moving along seven vectors: developing competence, managing emotions, moving through autonomy towards interdependence, developing mature interpersonal relationships, establishing identity, developing purpose and developing integrity. They also pointed out the key institutional influences that can impact students' learning and growth: institutional objectives, institutional size, student–faculty relationships,

curriculum, teaching, friendships and student communities and student development programmes and services (Chickering and Reisser, 1993). When asking students, the process of identity formation is highly individual and includes mentors, peers and family, along with personal and professional experience (Sharpless *et al*., 2015). Professional identity is viewed as the main criterion and result of a student's successful adaption to the learning environment and professional and creative activities, as well as to changing social and cultural conditions (Gertsog *et al*., 2017). Developing a strong professional identity during education has also been associated with a successful transition to the workplace, higher motivation of the beginner practitioner and higher confidence in their role (Islam, 2008; Burleson *et al.*, 2021). Enhancing students' professional identity development affects their learning (Bjerregaard *et al*., 2016; Jensen and Jetten, 2015), decreases dropout and academic failure and may create more productive, motivated, creative, satisfied and better-prepared professionals (Canrinus *et al*., 2012).

Increased knowledge of student identity formation may enhance our understanding of the problems involved in motivating students, for example, in the science, technology, engineering and mathematics fields (McDonald *et al.,* 2019). One approach to support students in developing their identity can be achieved by giving them close contact with their future working tasks. Here, work-integrated learning (WIL) enhances familiarity with and nearness to their future profession (Jackson, 2017). Examples of WIL can be internships, placements, industry-based projects and governance (Coorey and Firth, 2013; Tomlinson and Jackson, 2021). Some students are practitioners and need to see practice before contextualising their learning (Mann *et al*., 2009; Nadelson *et al*., 2015). Alternatively, the use of real-life cases during learning and assessment and student projects in collaboration with the industry make the students face a reality (Simons *et al.,* 2012; Jakobsen *et al.,* 2020; Karlsen *et al*., 2015).

Students' conceptual understanding of food technology

Exploring students' and alumni's perceptions of *food technology*, *interest in food* or *industrial food production*, and the profession *food technologist* gives us valuable information on how to improve the portfolio and learning environment in food technology education, thereby supporting the students in their conceptual understanding and identity formation. Understanding a concept is a prerequisite for creating complex interferences and conceptual knowledge (Hurrell, 2021). There has been a great amount of interest from

science educators on students' conceptual understanding and the process of conceptual change, as seen by the number of studies published (Mi *et al*., 2020). Pintrich *et al*. (1993) presented an overview of classroom contextual, motivational and cognitive factors related to the process of conceptual change, in which personal interest is one of the motivational factors.

As students' interest, identity formation and conceptual understanding has not been studied in the field of food technology, one objective of this study is to rectify this.

Methodology

Research participants and context of the study

The participants of the current research were food technology students and alumni at different stages in their careers. Data were collected in the first semester of 2019 from four groups (candidate categories): alumni (6), first-year (4), second-year (12), and third-year students (5), hence totalling 27 respondents. The six alumni had 1–24 years of work experience (1, 6, 12, 16, 20 and 24 years, respectively). The participants were recruited through volunteer sampling (Cohen *et al*., 2018) among current and former students at the Food Technology Bachelor Programme (FTBP) at NTNU. All current students and alumni with known contact information were invited to participate. All that responded joined the study.

The FTBP[1] at NTNU comprises five semesters of on-campus teaching and one internship semester in the food industry, at a research institute or at the National Food Safety Authority. From being a College, the study programme was included in NTNU in 2016. As a result, both the students and staff became part of a larger academic environment on a new campus. The process affected the food technology study programme curriculum; for example, the admission requirement changed, and a requirement for specialization in science was implemented in 2019. Furthermore, introductory courses in, for example, general chemistry, mathematics and microbiology, became more general and were taught in larger-sized classes with students from several study programmes. Examen philosophicum for Science and Technology was incorporated as a mandatory course. The course provides knowledge of the perspectives on science and contributes to a reflective relation and the application of scientific knowledge. The core content of food technology-related courses was retained in the

[1] https://www.ntnu.edu/studies/mtmat

process.

Active learning methods and real-life cases are a major part of the teaching activities in several food technology courses (Jakobsen and Waldenstrøm, 2017; Karlsen *et al*., 2015; Jakobsen *et al*., 2020). Training in laboratory skills is included in all relevant courses, which means that students learn how to set up and perform experiments, run analyses and tests and operate laboratory equipment. A group-based bachelor's thesis is performed through the department's R&D work or in cooperation with external partners in the last semester.

Data collection and analysis

We conducted a qualitative study to describe and interpret the participants' interests and their perspectives of identity, food technology and the profession of food technologist. The data consisted of audio recordings of 10 focus group interviews (Cohen *et al*., 2018), with two to four groups per candidate category. The unit of analysis was one interview, since each interview generated insights from one specific group of students representing one candidate category. Our results focus on the candidate categories rather than individual students. The students were interviewed in groups of two to four persons, and the interview was semi-structured (Cohen *et al*., 2018). In the semi-structured interview, the topics and questions were given, but the questions were open-ended and the wording and sequence of the questions were tailored to the responses given, with prompts and probes, as given in Cohen *et al*. (2018). Initially, we planned for four students per group, but due to illness and drop-outs, we ended up with different group sizes. The students were asked to express their interest in food or industrial food production and retrospectively explain (1) why they chose this course of study, (2) when they identified themselves as food technologists and (3) their perceptions of food technology and the profession of food technologist. The responses are a result of the interaction between participants. The reliance was on the interaction within the group who discussed the topics above supplied by the researcher, yielding a collective rather than an individual view.

The interviews were transcribed, anonymized and analyzed by conventional content analysis (Hsieh and Shannon, 2005), following the inductive approach described by Elo and Kyngäs (2008). Similar to Hsieh and Shannon (2005), we define qualitative content analysis as a research method for the subjective interpretation of the content in text data, obtained from interviews, through the systematic classification process of coding and identifying patterns. Content analysis is described

as a well-suited method for analyzing multifaceted and sensitive phenomena (Elo and Kyngäs, 2008). By using content analysis, it is possible to analyze data qualitatively and, at the same time, quantify the data by measuring the frequency of different categories (Vaismoradi *et al*., 2013). The category frequency may indicate the significance of a concept Cohen *et al*., 2018). An advantage of the conventional approach to content analysis is 'gaining direct information from study participants without imposing preconceived categories' (Hsieh and Shannon, 2005, p. 1279). On the other hand, there is no one meaning waiting to be discovered or described. Indeed, 'the meanings in texts may be personal and are located in specific contexts, discourses and purposes, and hence meanings have to be drawn in context' (Cohen *et al*., 2018, p. 675). Therefore, a challenge is that we might fail to develop a complete understanding of the context, thus not being able to identify the key categories (Hsieh and Shannon, 2005).

To ensure validity and interrater reliability, two of the researchers first worked thoroughly through the data set on their own. They coded the transcriptions independently using open coding and an inductive approach. Subsequently, they met and went through the data together. Where their analyses did not coincide, they negotiated a common interpretation. The codes were compared and discussed, and categories were jointly constructed based on the initial codes (Table I).

After agreement on the codes and categories, the data were analyzed independently once more and transferred to NVivo (QSR International Pty Ltd.) by the two researchers. The coding comparison query in NVivo compares coding by two users to measure interrater reliability and the degree of coding agreement between them. The coding comparison query gave reliability measures ranging from 92% to 100% for all the initial codes.

Findings and discussion

Content analysis revealed the students' interests, identities and perceptions of food technology and the profession food technologist. The following subsections present the results and discussion chronologically, which here refers to the research questions.

Emerging codes and categories

After analyzing the transcripts using an inductive approach, we ended up with a set of initial codes for the four different topics in focus, as well as overarching categories, which

are the suggested key features of the transcripts, showing links between initial codes (Table I).

Quotes that included two ideas were denoted into two initial codes and either one or two categories. For example, 'In large companies, we can work with sales, subject leaders. There is so much was assigned the initial codes 'Sales' and 'Leadership' and the category 'Company—management'. The quote 'I thought it was a product developer or a slightly advanced chef who was a bit into developing a kitchen and a bit in a lab' was assigned the initial code 'Product development' and category 'Company—product development', as well as the initial code 'Lab work' and category 'Company—quality and control'. Cohen *et al.* (2018) also stated that items can be assigned to more than one category, and they saw this as desirable because it maintains the richness of the data.

Table I. Overview of the topics, initial codes and categories and examples from the coding process.

On interest

From previous studies, we know that students who learn from interest tend to devote more attention and engagement to the topic than if they learn from effort (Deslauriers *et al.,* 2019). Additionally, students' prior interests significantly impact their undergraduate performance (Lynch *et al*., 2011). Most students at the FTBP had a prior general culinary interest (76%) and/or an interest in the science behind food technology (76%) (Figure 1). Some had experience as chefs, while others had family members who inspired them to choose food education. The interest in food and, more specifically, the science related to food production — was an important factor for all the student groups when they chose higher education. The following statements are representative of their interest in science, for example, the link to nutrition: 'Just to know what is behind all the food that is on the shelf in the store and what I eat' (Jacob) and 'I think food is fascinating and how it affects our body. A lot of that nutritionally. What makes some types of food good to eat and some less good to eat' (Theo).

Additionally, the food technology students (71%) explained that their interest was related to the relevance of the food technology study itself (Figure 1). As one first-year student described it (Muhammad), 'I also feel that the study is quite a niche, but, on the other hand, something most countries need and that will be useful for many research groups and the

future'. The students' prior interest in contemporary issues, for example, sustainability, is also reflected in their quotes: 'It is exciting, and I do want to make a difference within food production in general, make it easier for the consumer to choose sustainable products' (Eve) and 'My interest is how relevant the study will be in the future, with increased needs and challenges with fewer resources available. It is exciting to be part of that development and bring about sustainable development then' (Christine).

The alumni's interest was more related to the student environment and inspiration from family and friends. Compared with the students, they did not highlight relevance, food interest or science and technology interest to the same extent as the students. We must keep in mind that since the alumni started their studies, the bachelor's programme has changed its name, content and location (from a peripheral region to the city centre). In the previous location, the food technology students were situated in a tighter environment, and the alumni might have glamourized this situation. It is also noteworthy that families, friends and peers played an important role in the decision-making on higher education and as career advisors one to two decades ago (Brooks, 2003). Today, youth obtain more information via the internet and social media and among postgraduate students, which are the two most selected reasons for the use of social media, as shown by Galan *et al*. (2015). In addition, times change, and over the last decade, there has been an increased focus on sustainability, local food production and culinary developments within molecular gastronomy (Caporaso, 2021). This might be a contributing cause to the active students' focus on relevance, food and science.

Figure 1. The students (n = 21) and alumni (n = 6) expressed their prior interests retrospectively before entering their university studies. The category *scientific interest* is represented by the codes, prior interest in 'technology, innovation and/or processes', 'culinary aspects' and 'chemistry, nutrition and microbiology'. The categories *no specific interest* and *interest in contemporary issues* are represented by the codes 'unplanned' and 'relevance' respectively. The category *social and environmental interest* is represented by the codes 'family and friends' and 'study environment'.

On identity

Intervening in student identity formation may increase the motivation of students in STEM fields (McDonald *et al*., 2019). Additionally, knowledge of professional identity development

is central to understanding the learning and development of students (Bridges and BPharm, 2018). The second-year students, third-year students and alumni agreed that graduation was the stage at which they could identify themselves as food technologists: 73%, 67% and 60%, respectively. An alumni candidate said that '… when I graduated, but I also had a feeling during the long internship period … that yes, this is what I will be working with' (Paula). Only the alumni (30%) thought that the internship period was important for developing identity as a food technologist, for example, 'I have a bit of it … I'm not a food technologist, but when it comes to that feeling, I think I can only say that it was after the internship period this spring somehow. Then, I finally knew what to do. It's the same as in summer jobs when you get an insight into working life and get to try what it means to be a food technologist' (Paul). Students with previous professional experiences may develop a stronger professional identity than students without (Barbarà-i-Molinero *et al*., 2017; Burleson *et al*., 2021).

One-third of the third-year students wanted to be employed as food technologists before they could call themselves food technologists. Many students need to see practice to fully understand it and contextualize their learning. Rather than just being told about or simulating an industry placement and industrial experience during the students' studies, longer-term cooperation placements in particular can have had a major influence on the students, as shown in other studies (Mann *et al*., 2009). This was also confirmed by Nadelson *et al*. (2015), who found that students who were engaged in learning activities similar to the activities of STEM professionals communicated higher levels of professional identity development.

Regardless of their interest in advance (culinary, science or technology and processes), graduation was still the crucial stage of identity formation for our informants. We know that the unclear definition of some professions makes it challenging to find a particular image, which affects professional identity development (Hallier and Summers, 2011). Because food technology is a highly multidisciplinary field with different courses within different disciplines and multiple work possibilities, this might be one reason why the candidates did not identify themselves as food technologists until after graduation. It might have been difficult to define what the profession is about until they knew all the parts of it.

As shown, the food technology students and alumni identified themselves with their profession at a very late stage in their education. The results indicate that our informants did

not necessarily understand the concept of identity well. One student often mentioned not only graduation but also internship and first employment as being important. The results might not give a detailed picture of when they identified themselves as a food technologist, but the results do show which stages the informants considered important milestones in their education or career development.

Because our students showed a late or diffuse identity formation and previous studies have confirmed the importance of identity formation on students' success (e.g., Canrinus *et al*., 2012; Jensen and Jetten, 2015), educators should strive to give students the possibilities for professional identity formation at an earlier stage in the education. As suggested in Barbarà-i-Molinero *et al*. (2017), more professional and authentic practices should be included starting in the first academic year. When introducing a new concept, the sharing of student values and understandings is essential (Trevallion, 2020). This will contribute to the students' acquisition of an appropriate image of their future profession and develop a real professional identity (Barbarà-i-Molinero *et al*., 2017). In addition, the students should be informed about the reality of the profession from the very start and increase their knowledge of themselves to establish a connection between the chosen profession and their inner values and beliefs.

On perception

In general, the students and alumni from the food industry linked the concept of *food technology* to industrial food production, that is, the processing and control in the food production plant, and technology (47%) (Table II, A); this was confirmed by the word count of all the participants' statements (Figure 2). The words production, cooking, industry and technology were the most prominent. A more holistic view of the concept could be seen among 16% of the students and alumni, for example, 'I would say that food technology probably involves more than food production' (Marcel). They related *food technology* to the food value chain, which includes raw material, transport, processing and production and consumers: 'Food production from A to Z. From the chemical part to the microbiological and everything. To the actual production and the final product' (Tor), 'You ensure the entire chain, from goods in, to goods out' (George) and 'Seeing all stages in the entire production line and challenges associated with different steps in the process' (Anne).

More specific descriptions of the concepts related to quality and control, for example, food safety, control and inspection, were only mentioned by experienced students in their second

and third years, as well as alumni (in total 19%, Table II, A). Sustainability was not mentioned explicitly by the alumni. The use of this concept is relatively new, and the alumni did not seem to associate food technology with this term. Nowadays, industries commonly engage in sustainability issues, but it might be that our alumni informants are engaged in more specific production departments in the industry. The second- and third-year students mentioned sustainability explicitly, while first-year students talked implicitly about sustainability. The age of the informants might explain these differences; for example, some of the alumni belonged to another generation with twenty and twenty-four years of work experience. The increased focus on sustainability at NTNU and in the FTBP implies that the concept is introduced to the students already in the first semester.

In general, the first-year students mostly emphasized the production processes and technology (63%), and second-year students focused on production, technology, quality and control (66%). Third-year students associated food technology mainly with production and technology (55%) but also emphasized sustainable development (25%). The alumni drew associations mainly with production (46%) and the food value chain (27%). This overall picture is also visible in the word clouds in Figure 2. The associations 'industrial food production' and 'entire value chain' appeared for all year groups, while 'technology' was not mentioned by the alumni. The second-year students' focus on quality and control (31%) might be explained by their recent internships, in which quality and control were the main features (Table II, A).

Table II. Students' and alumni's perceptions of the concept of *food technology* (A) and the profession *food technologist* (B). A: Distribution of quotes within each study year and total (%) among the four categories from content analysis. B: The students' and alumni's perceptions before they entered their study (a) and at their present grade/position (b). The numbers are the distribution of quotes (%) within each study year among the categories from content analysis.

Figure 2 illustrates which words the students used when explaining the concept of *food technology*. The word clouds show an increased awareness from the first year to the second- and third years, as confirmed by a more extensive repertoire of words. The first-year students were influenced by their present stages and activities. Their admission requirements for specialization in science did not seem to impact their vocabulary connected to food

technology. The students gained a more professional vocabulary during their second and third study years, which reflects an attitude change towards food technology during their studies. The alumni students seemed to be more focused on enterprises or industry partners and production than the other student groups. When the alumni had been employed for a while, it seemed that their perceptions became narrower, more similar to first-year students' perceptions. They were more focused on their present tasks. By looking at the word clouds, we see that the nouns describing technical processes are predominant. This is in line with Sonchaiya *et al*. (2011) who studied the frequency of words found in food technology (FT) journals aiming to identify FT academic and technical words in research articles. The results revealed that the proportion of academic vocabulary was only 4%, whereas that of technical vocabulary was 28%. Technical noun phrases accounted for 73% of running words. This focus on both students' vocabulary and journal words shows that industrial food production and technology is key features of students' perceptions and research reports.

Figure 2. Word clouds, illustrating the 50 most frequent words mentioned by students and alumni when explaining the term food technology, limited to words with a minimum of seven letters.

Word clouds are useful in investigating text data, and they immediately show what common themes and phrases appear in the text. It is an excellent starting point for analysis but does not provide details about the text or how the words were used in context (DePaolo and Wilkinson, 2014). In a study where single-word summarisation (word clouds) was used by medical students, enhanced reflection and clinical discussion were stimulated (Philip, 2020). Hyland and Tse (2007) have declared that academic vocabulary should be regarded as a set of 'technically loaded' words that range from specific terms that could be used in a particular discipline to those that share some features of meaning and usage with words in other fields. Several of the words in Figure 2 can be seen as 'technically loaded', with some specific to food technology and others being more general.

Before the students started at the university, they had a diffuse perception of *food technologists*. The majority, irrespective of the year group, referred to quality and control of food products as the main occupation, in addition to food inspection (National Food Safety Authority) (Table II, B), for example, 'I think it was a bit diffuse then, what you could actually do, but I connected it very much to the Norwegian Food Safety Authority' (Theo).

Several students expressed uncertainty: ‘Honestly, I was a little unsure’ (Paul) and ‘I did not really know much about it’ (Theo). Of course, there is uncertainty in what the informants remembered from the pre-college period, but the results indicate that several of the students did not have an idea of what their future tasks would be when choosing the food technology study. This uncertainty was absent from their present perceptions.

When we asked for students’ and alumni’s present perceptions, they showed a more sophisticated view. They associated the profession with a much more extensive repertoire of tasks, as summarised in Table II, B (columns b have a larger number of categories than columns a for each group), and many of the students and alumni saw multiple work opportunities, irrespective of grade: ‘It seems like there are almost endless possibilities as long as it has something to do with food. It also does not have to have anything directly to do with food either’ (Anne), ‘It is very wide then. There is a lot to work with’ (John) and ‘Now I think you can work with everything. With supervision and product development. Everything related to food production. Quality control—everything. It just depends on how you use the experience you have’ (Sean).

It is not surprising that the students obtained a more sophisticated view after starting their studies because they get more experience each year. The students’ and alumni’s focus on the multiple work opportunities in their present position (Table II, B) indicates that they already have gotten familiar with other aspects during their first year of studies. Support functions like health, environment and safety, consultancy services and certification appeared as new concepts in their vocabulary after the second year of study and were not in their retrospective explanations. The content of the studies helps students widen their perceptions of food technology, build their student/study identity and form their professional identity.

Limitations of the study

A volunteer sampling method was used because of the limited number of students in the study programme (about 50 new students each year). When discussing the data, we need to consider that the participants may be well-intentioned, and they do not necessarily represent the wider population.

The sample size is relatively small. The selection represented 8–24% of the total number of students for each year group. Even if the interview group is rather small, the results still give

us valuable information and are not expected to influence the general conclusions to a larger degree.

Students will always be influenced by their studies, and their answers reflect their current positions, activities and interests. Hence, false memories might be a weakness of our data.

Conclusion and educational implications

The objective of this study was to improve our understanding and knowledge of food technology students' prior interests, their perceived identity formation, perceptions of food technology and the profession of food technologist. The latter can be hard to grasp because the study consists of various subjects and because the food industry encompasses layers of disciplines. The complexity of the food technology field may make comparisons with similar studies difficult, which is why it is important to investigate the identity formation directly in this field. As discussed earlier, early identity formation is central for college students and their professional lives (Barbarà-i-Molinero *et al*., 2017; Bjerregaard *et al*., 2016; Jensen and Jetten, 2015). Our introductory course 'Introduction to Food Science' is a start on this path; however, a continuous effort is necessary to enhance food technology students' professional identity development as our results show this is a gradual effect that need to be enhanced throughout the study. In general, their prior interests are a good starting point for identity formation. Regardless of the year group and their interests beforehand, the informants agreed that graduation was the stage where they could identify themselves as food technologists. A few students wanted to be employed as food technologists before they regarded themselves as food technologists. This is rather late in their education paths and shows that building a professional identity takes time. Our informants saw multiple work opportunities at their stage; these results show that working with students' perceptions from the very beginning of the study programme, as well as tutoring students to see the diversity of the discipline and professional life, is of the utmost importance. A core challenge remains in how to give the students a broad enough set of contextual and authentic experiences to support their formation as food technologists at an earlier stage. 'Context-based courses' are increasingly used to address this challenge currently facing science education: a lack of clear purpose, content overload, incoherent learning by students, lack of relevance to students and lack of transfer of learning to new contexts (Taconis *et al*., 2016; Slovinsky *et al*., 2021). More professional and context-based practices starting early on will help the students acquire an appropriate image of their future profession and develop a realistic professional identity.

The present study indicates that students' development into a professional identity depends on their experiences and perceptions of food technology before starting their studies, during their studies and, more importantly, during their internships. Because in some ways the students had a rather naive picture of food technology and food technologists, it is important to help them understand both the vastness of the subjects and possible careers to build their identity from the start of their studies. Finding both their identity and the relevance of their future careers can be an important factor in their success. The current study has given valuable insights into the students' process of becoming professionals.

Even if we studied a specific group of students, our findings may serve other study programs where the future professional role might be unclear or unknown for beginners. The ideas and expectations that students come to the university with, may be quite naive. This is expected to be the case in professions that are generally not the focus of public attention and even so in professions that get media attention (cf. forensic science). By addressing this in first-year courses and internships early in their education, students might be better informed on their future roles and be more motivated in their studies.

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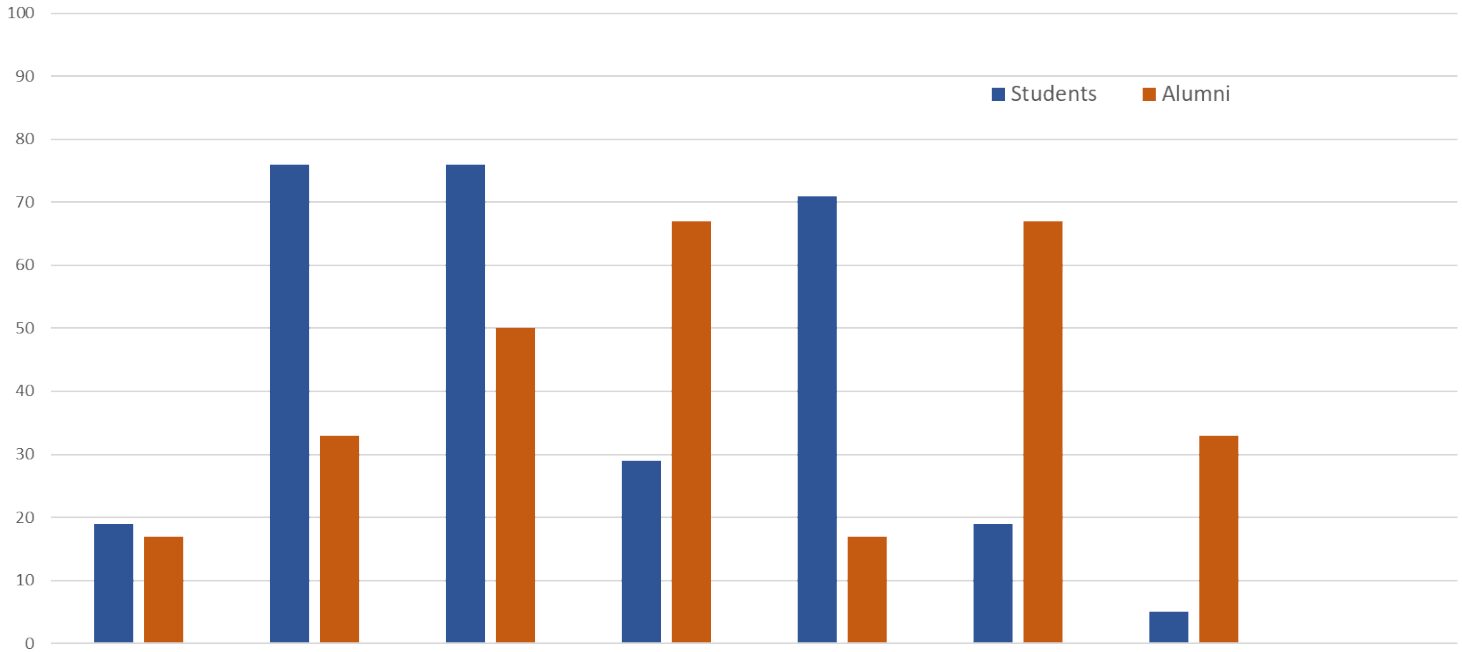
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Prior interest in culinary aspects
Prior interest in chemistry, nutrition, or microbiology
Unplanned
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Interest in contemporary issues
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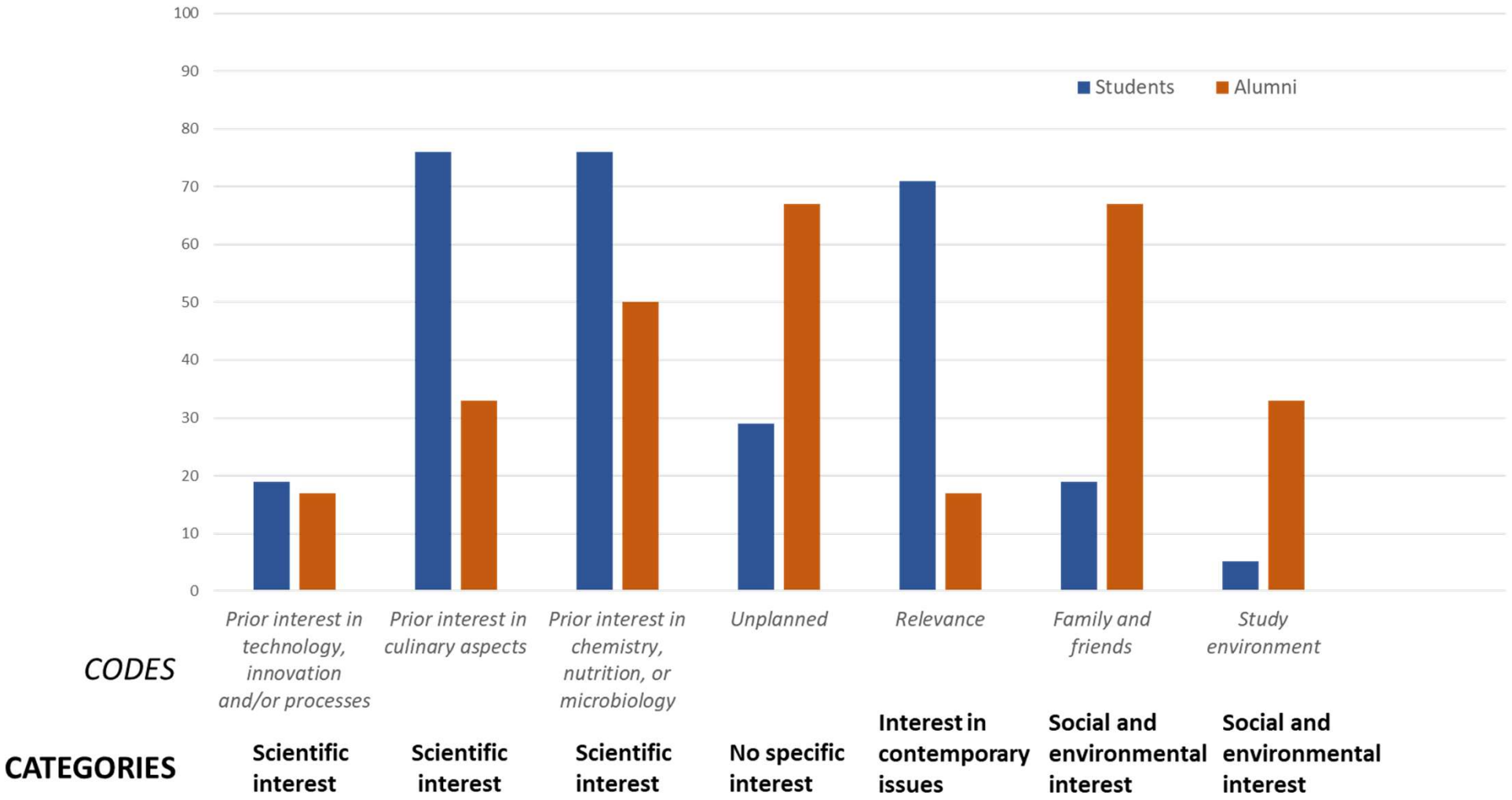
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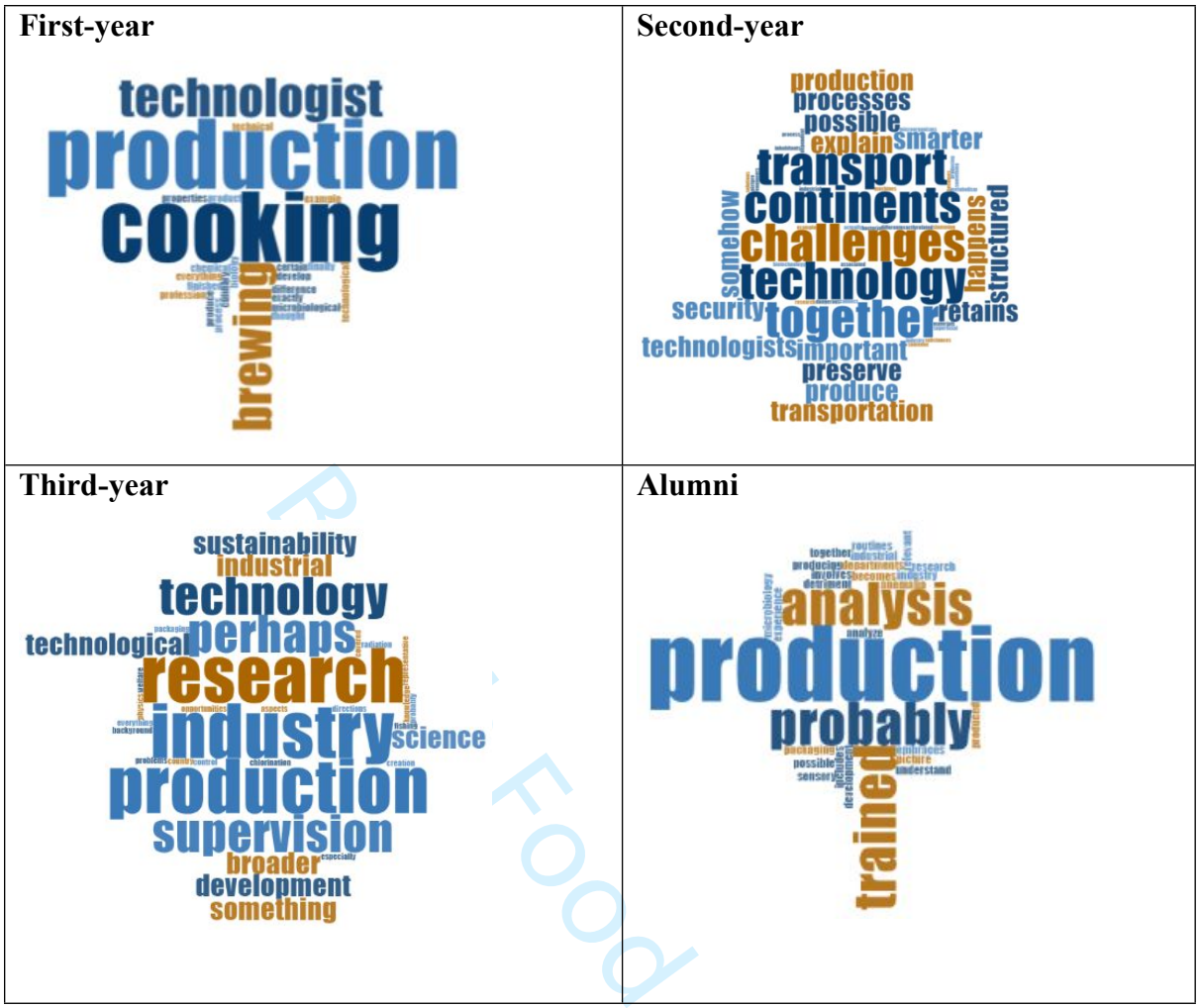

Figure 2. Word clouds, illustrating the 50 most frequent words mentioned by students and alumni when explaining the term food technology, limited to words with a minimum of seven letters.

Table I. Overview of the topics, initial codes and categories and examples from the coding process.

Topic	Initial codes	Categories
Interest	Family and friends	Social and environmental interest
	Study environment	
	Unplanned	No specific interest
	Relevance	Interest in contemporary issues
	Prior interest in culinary aspects	Scientific interest
	Prior interest in technology, innovation and/or processes	
	Prior interest in chemistry, nutrition, or microbiology	
Identity formation	After first employment	Employment
	When graduated	Graduation
	Under internship	Internship
Conceptual understanding of food technology	Industrial Food Production	Food production processes and technology
	Technology	
	Food value chain	Holistic food value chain
	Food safety	Quality and control
	Control and inspection	
	Research	Sustainable development
	Sustainability	
Conceptual understanding of the profession food technologist	Leadership	Company – management
	Sales	
	Quality – product	Company – quality and control
	Food safety	
	Lab work	
	Industry	Company – production
	Production/Food production	
	Production responsibility	
	Product development	Company – product development
	Design	
	Research	
	National Food Safety Authority	National Food Safety Authority
	Health, Environment and Safety	Support functions
	Consultancy services	
	Certification	
	Multiple work opportunities	Multiple work opportunities
	Unsure	Unsure

Examples on coding; raw data	Initial code	Category
"That you work more with product development. Then you get to be a little creative too and actually create something new" (Theo)	Product development	Company – product development
"But I also think a lot of quality around everything then. Food that is to be eaten and produced, good quality must be ensured in one way or another, so the food technologist can contribute in many places" (Theo)	Quality - product	Company – quality and control
"What happens when the food actually rots, what substances are formed in the food and why it is dangerous" (Anne)	Food safety	Company – quality and control

Table II. Students' and alumni's perceptions of the concept of *food technology* (A) and of the profession *food technologist* (B). A: Distribution of quotes within each study year and total (%) among the four categories from content analysis. B: The students' and alumni's perceptions before they entered their study (a) and at their present grade/position (b). The numbers are the distribution of quotes (%) within each study year among the categories from content analysis.

A Categories	First-year	Second-year	Third-year	Alumni	In total
FPP[a] and technology	63	35	55	46	47
Holistic food value chain	25	17	5	27	16
Quality and control		31	15	18	19
Sustainable development	12	17	25	9	18

B Categories	First-year		Second-year		Third-year		Alumni	
	a	b	a	b	a	b	a	b
Company - management			17	7		12	8	4
Company - production	25	22	17	14	25	12	17	9
Company - product development		17	4	16		12	17	13
Company - quality and control	25	6	17	33		17	33	13
National Food Safety Authority	25	17	20	7	50	6	21	4
Support functions				2		17		13
Multiple work opportunities		38		21		24		44
Unsure	25		25		25		4	

[a]Food production processes

Dear Editor, British Food Journal

Thank you for giving us the opportunity to publish our article in your journal and for sending us suggestions for further improvements. Our manuscript ID BFJ-02-2022-0146.R1 entitled "Interest, identity and perceptions. What makes a food technologist?" which we submitted to the British Food Journal, has now been revised and our response to the reviewers' comments are given below. Changes in the revised manuscript and Table 1 are highlighted by using green coloured text. A new Figure 1 is uploaded. Changes in Figure 1 are not highlighted. In cases where we saw opportunities to improve the language, we did. Such small amendments in the text are not highlighted.

The authors appreciated the comments and suggestions from reviewer 3, which indeed contributed to improve this manuscript. We hope that you find the revised paper more clear. Once again, thank you for inviting us to resubmit our manuscript to the British Food Journal. We look forward to receiving your feedback.

Kind regards,
Corresponding author

Reviewer: 2	
Reviewer comment to Author	**Response from Author**
Recommendation: Accept	Thank you for considering our paper as valuable for publishing.
Dear Author(s), I believe that your revision efforts have profoundly improved the value of the paper and its contribution to the literature. Congratulations on addressing such an important topic for future generations. I wish you all the best.	Thank you for appreciating our revisions.
1. Originality: Does the paper contain new and significant information adequate to justify publication?: Yes. The revisions made by the authors have profoundly improved the article. The research objective is well explained and anchored in the literature. The entire structure of the paper is clear and has an excellent writing style.	Thank you for commenting the improvements, and for appreciating the objective, structure and writing style.
2. Relationship to Literature: Does the paper demonstrate an adequate understanding of the relevant literature in the field and cite an appropriate range of literature sources? Is any significant work ignored?: The literature is well organized; the authors have made efforts to improve the understanding of the phenomenon	Thank you for appreciating our efforts to improve the manuscript.

under study.	
3. Methodology: Is the paper's argument built on an appropriate base of theory, concepts, or other ideas? Has the research or equivalent intellectual work on which the paper is based been well designed? Are the methods employed appropriate?: Yes. The methodology is rigorous.	Thank you for finding the methodology rigorous.
4. Results: Are results presented clearly and analysed appropriately? Do the conclusions adequately tie together the other elements of the paper?: Yes.	Thank you for the positive comment.
5. Implications for research, practice and/or society: Does the paper identify clearly any implications for research, practice and/or society? Does the paper bridge the gap between theory and practice? How can the research be used in practice (economic and commercial impact), in teaching, to influence public policy, in research (contributing to the body of knowledge)? What is the impact upon society (influencing public attitudes, affecting quality of life)? Are these implications consistent with the findings and conclusions of the paper?: Yes, the authors further improved the part on educational implications by suggesting interesting insights that could open up new research scenarios in the future.	Thank you for appreciating our suggested amendments.
6. Quality of Communication: Does the paper clearly express its case, measured against the technical language of the field and the expected knowledge of the journal's readership? Has attention been paid to the clarity of expression and readability, such as sentence structure, jargon use, acronyms, etc.: Yes. The paper is well written.	Thanks for this positive comment.
Reviewer: 3	
Reviewer comment to Author	**Response from Author**
Recommendation: Minor Revision	Thank you for your comments and suggestions. We agree that the new amendments improved the manuscript.
Comments: This is an interesting paper, but there are still some weaknesses in the paper.	Thank you for appreciating the topic of the paper, and for suggesting further improvements.

The key words are limited - consider the keywords that people will use when searching for the paper.	We have specified some of the key words, and added four new: Keywords: food technology, food technology education, identity formation, internship, practical experience, student identity, student perception
page 3 - graduates to the preferable food technology candidate - do you mean students or graduates- because the students transform into a graduate i.e. it is the end of the process not the beginning	Thank you for discovering this mismatch. We changed the sentence into: "Nevertheless, there is a lack of research that examines the process of successful transformation of students to the preferable food technology graduate that the future food industry needs."
Please use UK spelling throughout.	We used Scribendi.com for proofreading the manuscript before the first submission, and we asked for British English. Now, two colleagues did the proofreading, and we found only one sentence and one word which we amended from US to UK spelling: 1. "Some students are practitioners and need to see practice before they can contextualize their learning" (literature review, section Students' identity formation) was changed into "Some students are practitioners and need to see practice before contextualising their learning" 2. "behaviors" (p.3) is replaced by "behaviours"
How does the coding in table 1 relate to the key words in figure 1?	We agree that the previous key words in figure 1 should be improved. We amended the key words in figure 1 so that they fully correspond with the name of codes in table 1. We also added the words "Codes" and "Categories" in figure 1 to make a better connection between the table and the figure. We also amended the figure caption to make the connections clear. Please see new submitted files for figure 1 and table 1.
1. Originality: Does the paper contain new and significant information adequate to justify publication?: Not in its current form	The revised version is now hopefully more clear, especially in the conclusion where we added a sentence to specify the new information of this manuscript: "The complexity of the food technology field may make comparisons with similar studies difficult, which is why it is important to investigate the identity

	formation directly in this field."
2. Relationship to Literature: Does the paper demonstrate an adequate understanding of the relevant literature in the field and cite an appropriate range of literature sources? Is any significant work ignored?: The research gap nor the conceptual model that is being tested is positioned at the end of the literature review. The needs to be positioned to support the reader.	We added a sentence at the end of the literature review to guide the reader: "As students' interest, identity formation and conceptual understanding has not been studied in the field of food technology, one objective of this study is to rectify this."
3. Methodology: Is the paper's argument built on an appropriate base of theory, concepts, or other ideas? Has the research or equivalent intellectual work on which the paper is based been well designed? Are the methods employed appropriate?: How was the focus group planned - what was the format of the focus group - were there any biases arising from the methods employed? Were all questions the same for all focus groups or was the interview schedule different for different groups?	Thank you for the questions. We initially planned for equally sized groups and identical questions. Since we did a semi-structured interview, the topics and questions were the same for all focus groups (we had a pre-determined interview guide), but promps to the answers might have been slightly different. Bias will always exist due to student variability. We added this sentence to clarify: "In the semi-structured interview, the topics and questions were given, but the questions were open-ended and the wording and sequence of the questions were tailored to the responses given, with prompts and probes, as given in Cohen et al. (2018)."
The abstract states The aim of this study was to improve our understanding and knowledge of food technology students' prior interests, their perceived identity formation, perceptions of food technology and the profession of food technologist. The aim is not included in the main paper which is a weakness and is not reconsidered explicitly in the conclusion.	We found that we used the word "aim" in the abstract, and the word "objective" in the introduction. To make it more consistent, we replaced "aim" in abstract with "objective". We included the objective in the conclusion.
4. Results: Are results presented clearly and analysed appropriately? Do the conclusions adequately tie together the other elements of the paper?: Table 1 - difficult to see how the codes relate to the categories and which codes are in which categories - consider how this can be better expressed.	We amended the table by inserting horizontal lines to separate the topics. Hopefully this makes it easier to see which initial codes belong to which category. Since the journal prefers tables without lines/grids, we didn't insert lines between each category, but this can easily be changed if the journal wants these kind of tables.
The findings and discussion section is	Thank you for pointing at this

descriptive and does not clearly show how the coding in Table 1 relates to the three aspects that have been considered from the literature. This section is disconnected from the literature	disconnection. We changed the last title in the literature review into: "Students' conceptual understanding of food technology" (added food technology). We also changed the title of the three last topics in table 1 into: "Identity formation", "Conceptual understanding of food technology", and "Conceptual understanding of the profession food technologist". In the previous version they were named "identity", "food technology" and "food technologist". As we see it, the three aspects in the literature section (interest, identity formation and conceptual understanding) is now better connected to the topics in table 1.
5. Implications for research, practice and/or society: Does the paper identify clearly any implications for research, practice and/or society? Does the paper bridge the gap between theory and practice? How can the research be used in practice (economic and commercial impact), in teaching, to influence public policy, in research (contributing to the body of knowledge)? What is the impact upon society (influencing public attitudes, affecting quality of life)? Are these implications consistent with the findings and conclusions of the paper?: Implications are considered.	Thank you for appreciating our educational implications section.
6. Quality of Communication: Does the paper clearly express its case, measured against the technical language of the field and the expected knowledge of the journal's readership? Has attention been paid to the clarity of expression and readability, such as sentence structure, jargon use, acronyms, etc.: generally good	Thank you for this positive comment.