



Swedish Primary School Teachers' Experiences of Subject-Integrated Food Education

Louise Hård
University of Gothenburg, Sweden

Päivi Palojoki
University of Helsinki, Finland / University of Gothenburg, Sweden

Christel Larsson
University of Gothenburg, Sweden

Abstract

Food education has the potential to increase early primary school students' knowledge and skills regarding sustainable food choices. However, teaching and learning about food-related knowledge and skills is scarce in early primary school lessons. This study aims to explore Swedish primary school teachers' experiences of subject-integrated food education and their perceptions of the opportunities and challenges associated with subject-integrated food education. Conducted within the framework of a case study, teacher interviews, influenced by results from a pre-questionnaire, were analyzed using thematic analysis. The results show that subject-integrated food education, using food and school meals as pedagogical tools, can facilitate the teacher's role as a food educator, if they are consciously and systematically used. The preconditions for successful subject-integrated food education in primary schools include a school organization that promotes subject integration, an understanding in common of what food-related knowledge entails, and professional teacher competence in food pedagogy. This research highlights the need for a more systematic and integrated approach to food education in early primary school settings.

KEYWORDS: FOOD EDUCATION, PEDAGOGICAL TOOLS, SUBJECT INTEGRATION, SUSTAINABLE FOOD CHOICES

Introduction

Food education is defined here as the teaching and learning of food-related knowledge and skills that support sustainable food choices. The food-related teaching and learning may further comprise home economics education or other food-related learning activities within the school. Benn (2014), Bjørkkjaer et al. (2023), Kimura (2011), and Smith et al. (2022) emphasize that food education aims to promote sustainability in health, the environment, and the economy, as well as a social and cultural understanding of food choices. Additionally, Kimura (2011) points out that food education can improve public health through its impact on both the individual and societal levels.

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Louise Hård ✉ louise.olsson.hard@gu.se

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Food education reflects sustainability and public health goals in striving to achieve equity in health and a sustainable environmental impact related to food consumption (Public Health Agency of Sweden, 2020; United Nations, 2015). In relation to this, food education in Swedish primary schools is formulated in the national compulsory school curriculum as "knowledge of and understanding of the importance of one's lifestyle for health, the environment and society" (National Agency for Education, 2022, p. 14). Food education is also visible in the curriculum through words such as diet, health, and sustainable development, although it is more visible in the curriculum for preschool, leisure-time centers, and later primary school than early primary school (National Agency for Education, 2022).

Besides supporting food-related learning, food education has the potential to facilitate learning processes in various school subjects and to serve as an "excellent tool for learning" (Haapaniemi et al., 2022, p. 81). Additionally, food, with its tangible, familiar, close-to-everyday life character (Höijer, 2013), is seen as a 'learning tool' for home economics teachers (Höijer et al., 2011). Additionally, by activating students' senses, food education can lead to more meaningful learning processes (Christensen, 2019; Gelinder et al., 2020; Gisslevik et al., 2017). Nevertheless, this discussion is not new; Palojoki (1997) had already emphasized in the 1990s the potential of food as a tool to concretize abstract nutrition-related concepts in home economics education. Moreover, the view of food as a learning tool follows a socio-cultural learning tradition of tools that mediate the learning process (Säljö, 2014; Vygotsky, 1978).

The school subject that currently presents food-related knowledge and skills in Swedish compulsory schools (preschool class to grade 9, students aged 6-16 years) is Home and Consumer Studies (HCS). The subject is by far the smallest in the Swedish compulsory school curriculum, with an allocated teaching time of 130 hours over nine years of compulsory school, of which 40 hours are allocated to primary school (preschool class to grade 6, students aged 6-12 years) and 90 hours to secondary school (grade 7-9, student ages 13-16 years) (National Agency of Education, 2024).

Due to the limited number of hours allocated to HCS, the subject has to be taught late in primary school, often from grade six. Since children's eating habits are established early in life (De Cosmi et al., 2017) and schools are an important arena for the prevention of healthy eating habits (Sepp et al., 2016), the late introduction of food education in primary schools is a lost opportunity. Moreover, the limited number of hours allocated for HCS correlated poorly with the complexity of the curriculum, which includes an increasingly complex syllabus, not least according to sustainability education (Gisslevik et al., 2017; Oljans et al., 2018). The complexity of the HCS curriculum in relation to the number of lesson hours presents HCS teachers with a potentially impossible task (Bohm, 2022). Within research on home economics education, it is also noted that teachers and students prioritize practical food work at the expense of food discussions (Beinert et al., 2021; Bohm, 2022; Gisslevik et al., 2018).

HCS has an interdisciplinary character with roots in both natural and social sciences, which makes it well-suited for subject integration (Haapaniemi et al., 2019; International Federation for Home Economics, 2008; Lavonen et al., 2022; Renwick & Bauer Edstrom, 2022). Subject integration in this study means bringing different school subjects together around a concept, theme, or area of knowledge (e.g. sustainable food choices) to facilitate students' overall understanding. For example, a study of the integration between Mathematics and HCS showed that mathematical fractions proved to be easier to understand through the practical application

of cutting an apple into eighths (Brante & Brunosson, 2014). By integrating various school subjects, student learning processes can be facilitated, and understanding can be increased (Haapaniemi et al., 2022; Lindblom et al., 2020; National Agency for Education, 2022).

Although learning opportunities may be increased through subject integration, it is time-consuming to implement (Lindblom et al., 2020; Haapaniemi et al., 2022; National Agency for Education, 2022; Pöntinen, 2019). New learning tasks must be created, and teacher collaborations need to be organized (Haapaniemi et al., 2022). Additionally, teachers need to be interested in other perspectives and school subjects, as well as in creating new teaching and learning opportunities (Fooladi et al., 2023; Haapaniemi et al., 2022). Furthermore, to make subject-integrated education possible in practice, the weekly school schedule and teacher planning time must be organized to encourage subject integration (Lindblom et al., 2020; Haapaniemi et al., 2022; Pöntinen, 2019). It is also important to synchronize the long-term planning of the subject content in various school subjects (Bohm, 2022). On the one hand, crossing subject borders can require educators to work outside their comfort zone (Fooladi et al., 2023). On the other hand, subject integration can lead to new ways of teaching and promote professional development (Haapaniemi et al., 2021, 2022).

To address the need for increased food education among students in early primary school, the present study focuses on primary school teachers' perspectives on subject-integrated food education. The aim of the present study is to explore Swedish primary school teachers' experiences of subject-integrated food education and their perceptions of the opportunities and challenges associated with subject-integrated food education.

Methods

Research Context

An exploratory case study approach is well suited to explore the experiences of practicing teachers in relation to subject-integrated food education because of the real-life context (Yin, 2018). The case selected in the study is an independent school (not municipally owned but free of charge, available for every student by queue system) located in an urban area in southwest Sweden. The number of students attending the school is approximately 500, spanning from preschool class to grade nine. The school was selected through contact with the school principal, who showed interest in food and nutrition and was willing to cooperate in a research project about co-designing subject-integrated food education. Regarding food education, all students in Sweden from preschool class to grade 6 (students aged 6-12 years), receive a warm, nutritious school meal each day at no additional cost (SFS 2010:800).

Research Participants

Participants of the study were selected in two rounds at the case school. First, a pre-study was conducted with an open-ended questionnaire focusing on food education and sustainability. The participants who completed the questionnaire ($n = 11$) were teachers at the case school, including one student teacher, who was teaching preschool classes up to grade five.

In the second round of recruitment, teachers who had completed the questionnaire were asked to indicate if they were interested in participating in a subsequent interview linked to subject-integrated food education, the focus of the study. The inclusion criterion for the interviews was: working as a subject teacher at the specific school in either preschool class or any grade up to grade five. A total of six teachers expressed an interest in participating in interviews by

indicating this in the questionnaire. Two additional teachers were recruited using the snowball method, one of whom had completed the previous questionnaire but did not declare an interest in participating in the interview and another who had not participated in the questionnaire round. In total, eight informants (seven women and one man) ($n = 8$) participated in the interviews. Participants worked in four different teacher teams, from preschool class to grade three (Table 1). It is important to note that participation in the interviews was not contingent on the teacher's experience or perception of subject-integrated food education.

After two rounds of recruitment, the participating teachers represented all grades of early primary school (preschool class to grade three). The teaching experience of the informants varied from less than one year to 20 years; all were qualified teachers but taught different subject combinations at the case school. Five teachers who completed the questionnaire did not participate in the interviews for the following reasons: different profession than the requested sample (specialized teacher, teacher-student) and/or lack of time or interest.

Table 1 Characteristics of the teachers participating in the interviews

Name*	Teaching grade	Teaching subjects/areas	Qualified teacher	Years of teaching experience
Jonathan	Preschool	Mathematics, Physical education, and health	Yes	>1
Linda*	Preschool	Art, Swedish	Yes	10
Malin	Preschool	Creative activity	Yes	7
Amanda	Grade 1	English, Swedish	Yes	8
Emma	Grade 1	Learning to read, Interdisciplinary work	Yes	1
Eva	Grade 1	Mathematics, Music, Physical education and health	Yes	20
Karolina	Grade 2	English, Science studies, Social study subjects	Yes	10
Britt*	Grade 3	Mathematics, Art, and Social study subjects	Yes	20

Note: *Pseudonyms were used to de-identify participants. Linda and Britt were interviewed together.

In line with ethical considerations, all research participants received both oral and written information about the pre-study and main study. The participants were also informed that participation was voluntary and that they could withdraw at any time without needing to provide any explanation. Ethical guidelines from the Swedish Ethical Review Authority on the protection of research participant integrity were followed throughout the research process. The protection of participants' privacy included informed consent, confidentiality in data storage, and protection of participants' identities when sharing results and publications. However, no sensitive personal information was collected (Swedish Research Council, 2007).

Data Collection Methods

First, data for the pre-study were collected through an open-ended questionnaire, which was distributed to primary school teachers during a staff meeting at the participating school in June 2022. The purpose of the questionnaire was to gather information about the teachers' initial understanding and experiences of food education and to serve as a recruitment tool to identify participants for interviews.

Secondly, data for the main study were collected through semi-structured teacher interviews held in a meeting room at the case school in September 2022. These interviews were conducted to complement the pre-study by confirming, broadening, and deepening the responses to the questionnaire. The interviews included questions about teachers' experiences of both subject integration and food education. They were less structured than the questionnaire, allowing

informants to share their experiences. The interviewer (the first author) was also able to ask follow-up questions. In total, seven interviews were conducted: six individual interviews and one pair interview (initially an individual interview that turned into a pair interview when an extra teacher joined). The interview duration ranged from 22 to 29 minutes, totaling 176 minutes. All interviews were audio-recorded, and the interviewer made additional notes during the interviews.

Data Analysis

A reflexive thematic analysis (Braun & Clarke, 2019) was employed to explore primary school teachers' experiences of subject-integrated food education and their perception of the related opportunities and challenges. In general, thematic analysis involves striving to reveal latent patterns and meanings in the collected data and searching for a structure that represents central concepts or thoughts (Terry & Hayfield, 2021). Further, the analysis method is a qualitative and interpretative approach that underscores the researcher's contribution during data interpretation (Terry & Hayfield, 2021). The analysis process of the study was guided by the research aim and related theoretical concepts, such as food education, subject integration, and socio-cultural learning processes.

The analysis process comprised six phases, as outlined by Braun and Clarke (2006). The initial phase involved **familiarization** with the data and making notes during the audio-recorded interviews. The interviews were subsequently transcribed into 30 A4 pages (font 12, single row spacing). The text linked to the research question was highlighted, as well as pedagogy issues or learning processes in general. The highlighted text was treated as data. These data items were then **coded**, often at a semantic and concrete level, to **generate initial themes** (Table 2). Codes that did not fit any theme were placed on a 'waiting list' for potential later use. The analysis was facilitated by using an extra column for temporary subthemes in clustering and by combining codes to themes, as well as through creative searching for patterns and central concepts. The researcher performing the analysis frequently revisited the data set to ensure a comprehensive analysis grounded in the data.

Table 2 Examples of the analysis process, moving from transcript to data item, code, and theme

Interview question	Response from the transcribed text	Code	Theme
What challenges do you have as a teacher in relation to subject-integrated food education?	I mainly feel that there are so many different inputs on what is healthy and what is sustainable, so I could say the wrong things. Then if it comes out in some research that this is great blah blah blah, it comes out from someone else from the other direction, no, but you wanted to say that it wasn't good because it's so complex.	Being aware of the complexity of health messages	The Role as a Food Educator
What options do you have as a teacher for subject-integrated food education?	It doesn't just have to be about eating right and doing it, like when we work with the senses, for example. With smell and taste and all this, food comes in as a great educational tool. You can try different things, put a blindfold on, and so on. What do you think you're eating now? Get to test your senses.	Promoting food experiences	Food as a Facilitator of Learning Processes
What are your experiences as a teacher in relation to subject-integrated food education?	We have an educational lunch, which I think is very luxurious. Now I can't sit with everyone, but those you sit with at the table have a conversation about the food. Glad you tried this. How do you think this tastes? If you try this together with this, I think it's very good. If you dare to try, I think people talk about those things.	Highlighting food conversation	School Meals as an Educational Resource

In the analysis phase, where themes were developed and **reviewed** (subthemes and codes), themes were changed or removed to establish better correlations among them and to illustrate the overall data story. The process of critically reviewing the emerging themes is important for maintaining scientific quality (Terry & Hayfield, 2021). The thematic table (Table 3) facilitated this process by helping to cluster the codes into subthemes. Through the interpretation of these candidate themes, the analysis transitioned from the reduced data items to more abstract themes (Terry & Hayfield, 2021). After **defining and naming** the themes, the final phase of analysis involved **writing** the manuscript to assemble the last pieces of the data story. Throughout the analysis process, collaboration and feedback among the authors played a crucial role.

Results

Based on the results of the study, which explored Swedish primary school teachers' experiences and perceptions of the opportunities and challenges of subject-integrated food education, three key themes emerged: 'The Role as a Food Educator' (highlighting teaching challenges), 'Food as a Facilitator of Learning Processes' (emphasizing the potential in learning processes), and 'School Meals as an Educational Resource' (reflecting teachers' experiences) (Table 3).

Table 3 Thematic table of the themes, subthemes, and connected codes

Theme I The Role as a Food Educator	Theme II Food as a Facilitator of Learning Processes	Theme III School Meals as an Educational Resource
Challenges in teaching *	Opportunities in learning processes *	Experiences of teachers *
Limited Experience ‡ <ul style="list-style-type: none"> • Food education perceived as enforced • Teaching food education in the classroom is unusual • Being aware of the complexity of health messages • Seeking transition between food practice and theory • Searching for implementation of food education 	Something Familiar ‡ <ul style="list-style-type: none"> • Having strong opinions about taste • Starting with familiar content • Producing subjective texts about food • Seeing food as culture 	Challenging Student's Food Choices ‡ <ul style="list-style-type: none"> • Expanding and developing preferences and tastes by nudging • Highlighting food conversation • Encouraging vegetarian meals • Tasting several times
Finding the Context ‡ <ul style="list-style-type: none"> • Teaching about meals in preschool • Using young students' eagerness to learn • Teaching is common in primary school • Including HCS content • Influencing content related to food • Facilitating subject integration • Competing with other learning goals in later primary school 	Facilitating Understanding ‡ <ul style="list-style-type: none"> • Promoting food experiences • Concretizing content • Learning about and with the help of food • Intertwining food and Math • Tasting to learn about the senses • Seeking transition between sensory experiences and information 	Striving for Sustainable Meals ‡ <ul style="list-style-type: none"> • Showing standard portions • Avoiding food waste • Encouraging daily vegetable intake • Showing good food options • Teaching about different nutrition categories • Having energy for school activities • Seeing food in the short- and long-term perspective

Note. * Data category from Research AIM; ‡ Subtheme; ● Code

Theme I: The Role as a Food Educator

Limited Experience

Food education was mainly perceived as something new and challenging for teachers, often leading to pedagogical reflections in the pre-study and the main study. Even though the food education part seemed straightforward in its objectives and direction, the teaching and learning procedures could seem a bit ambiguous to the teachers. As Jonathan reported, the unfamiliarity of food education related to its content was as follows:

I don't know what it [food education] means. Maybe that means thinking about how I'm going to integrate it. I don't have those tools at the moment. [Jonathan]

It can be forced/.../grasping at straws ... /That's how it is with everything, that if you don't know, it's difficult, so then it might automatically become a bit negatively charged. [Jonathan]

Furthermore, Malin indicated concerns about the implementation of subject-integrated food education:

How should I implement [food education]? I think it's difficult because I've probably never done it before. [Malin]

Some of the teachers asked for practical examples of teaching and learning in food education during the interview, while others were more comfortable with food education and described their practice of teaching and learning related to food.

In order to integrate food education in the classroom, the school food service staff was used in the past to talk about food and health, while offering samples for tasting. Britt explained the relationship between food education during school meals and the teaching in the classroom. Collaboration between teachers and the school food service staff was also seen in the pre-study, as was the teachers' wish to learn more about food education.

In addition to the lack of experience in food education, some teachers expressed uncertainty in communicating food and health messages. Malin pointed out that communication and teaching related to student food choices had to be done with responsibility, finesse, and sensitivity, avoiding normativity. Linda also highlighted one of the challenges in conveying food and health messages, emphasizing that information about sustainable food can change over time, posing a risk of teaching outdated or incorrect information. Conversely, teachers recognized which general food and health messages were trustworthy: the risk of high sugar intake, the energy factor, and the importance of eating colorful foods according to educational nutrition models. Additionally, in the pre-study, the importance of "greener and less red and sweet" was mentioned.

Finding the Context

All teachers expressed the importance of incorporating food education into early primary school; however, they differed in their opinions on the context or school activity in which it should be integrated. On the one hand, as one teacher argued, it is important to teach and learn about food already in preschool by taking advantage of the youngest students' eagerness to learn. On the other hand, as another teacher expressed, food education can be seen as something that is allocated to the school subject HCS.

Furthermore, concerns were raised regarding the budget for teaching materials and the need for well-equipped classrooms for food education and HCS. Additionally, the lack of time and flexibility to implement food education in later primary school according to the curriculum, which includes 'more stuff and other stuff,' was identified as a challenge. The risk of adding too much learning content in primary school teaching was also mentioned as a challenge in the pre-study. Conversely, one interviewee, Amanda, saw the food educator role as flexible and believed that it was possible to adapt the teaching and learning content to the subject-integrated [food] theme:

Since you can control your [subject] area work as you know suits your group and control the content and according to our pedagogical interests and the children's interests, I don't see any pitfalls. [Amanda]

Unlike food education, the teaching strategy of subject integration was particularly familiar to the teachers. The case school organization included both separate and cooperative teaching planning time in promoting subject integration, as indicated by Malin:

So, we cross each other's paths all day long. We do it constantly/.../constantly plan together every day in the afternoon. [Malin]

Theme II: Food as a Facilitator of Learning Processes

Something Familiar

Emma and Linda recognized that food, being a part of daily life, was familiar to students, making it an engaging tool for learning. Further, the subject of food familiarity in learning processes was noted by Emma, who saw food as something familiar to the students:

No, food is nothing foreign to the children. It's different when we come to Chemistry and learn what atoms and molecules are. It's not as obvious. Food is still something they encounter every day and is familiar to them. [Emma]

Additionally, Linda saw food as a potential tool to learn about different cultures:

You can learn a lot through different types of food. Partly where you come from, [what is] typical for different cultures or within nations. Also what kind of food you eat. [Linda]

Food's potential to engage, motivate, and inspire students' learning was highlighted as beneficial. For instance, Linda believed that strong student preferences for certain foods could be a foundation for text production. Additionally, Jonathan mentioned that using physical food as teaching material provided added value compared to digital presentation programs for increased student motivation.

Facilitating Understanding

The use of food as a pedagogical tool was seen as meaning-making due to its familiarity and experience-generating character. Several teachers stated that food education that stimulates the senses is a positive aspect of the learning process. Learning opportunities were related both to knowledge of the function of the senses and the stimulation of the senses. In addition, Jonathan pointed out the potential and challenges of finding the transition between students' experience and information:

Find that transition between just experiencing food and using your senses around it, getting it over to this information part. Find a nice transition there, I think. [Jonathan]

Also, Karolina illuminated the learning potential in food from two angles: learning about food and learning with the help of food:

/.../food should not only be something we eat. It should be something we learn about and with the help of. [Karolina]

In addition to the potential of food to assist the learning process through its experience-generating character, the teachers appreciated food for its tangibility and ability to facilitate student understanding. For instance, the school subject that the teachers most often highlighted as applicable to subject-integrated food education was *Mathematics*. As Eva explained, for example, cucumbers can be transformed into teaching and learning materials:

After all, they can cut the cucumbers into half-centimeter, full-centimeter-thick slices, and cut them into sixths or eighths. [Linda]

Nevertheless, various other subjects were reported to be relevant to subject integration. For example, drawings, pictures, photos, or videos of food, which are related to aesthetics or communication, could be used in Art lessons (Britt & Linda). Amanda expressed thoughts about teaching fruit or meal names in English classes to support young students' learning of English words:

/.../for example, you learn fruits in English or dishes in English. It must be very simple when you work in grade one. [Amanda]

Similarly, in the pre-study, both Mathematics and language teaching were seen as prominent subjects for integrating food education.

Theme III: School Meals as an Educational Resource

Challenging Student's Food Choices

The case school provided free school meals for all teachers and students, and some teachers saw the meal situation as an opportunity for food education. Eva described a specific teaching approach during school meals, where she encouraged students to try new vegetables and engage in discussions about sustainable food choices. She emphasized the importance of broadening the students' taste preferences:

You eat with the class. We stand with them and try to inspire them to eat more vegetables, 'try more', but also to encourage them to always eat at least one vegetable. Encourage them who take several. If you hear that it's good to eat more, you'll understand that it's good [sustainable]. [Eva]

Broadening students' taste preferences was considered important and was highlighted in dialogues on sustainable food choices during school meals. As Eva also stated:

I can't sit with everyone, but those you sit with at the table have a conversation about the food. 'Glad you tried this'. 'How do you think these tastes?' 'If you try this together with this, I think it's very good.' 'If you dare to try'. I think people talk about those things. [Eva]

All students were generally encouraged to try new vegetables during school meals in order to help them get used to new flavors. Furthermore, Emma mentioned that a popular "veggie challenge" has been held in the preschool class, where students counted each new vegetable, they tried for one week. However, teachers also highlighted a challenge associated with dealing with students who were hesitant to try new foods and flavors. As Linda pointed out:

.../it sounds so unfortunate to say, but I find that children often [say] 'I don't like it, I don't love it'. They can't eat rice; they can't eat potatoes. Then they are so picky about it.../ Everything doesn't have to taste fantastic. It can be ok because you need the energy. You have to be able to tolerate it. [Linda]

Teachers also highlighted the importance of raising student awareness of vegetarian meals in terms of sustainability, making the students aware that the content of the meal is more than just the flavor. Moreover, the focus on developing students' taste preferences was also seen in the results of the pre-study.

Striving for Sustainable Meals

School meals were viewed as an opportunity for teaching about sustainable food choices, including balancing the proportions of various foods on students' plates based on health, economic, and environmental factors. The teachers aimed to encourage students to make healthy and sustainable food choices. For example, both jam and margarine were mentioned as foods that were easy for the students to "overdo". The teachers tried to find a balance by showing a 'normal portion', having a 'how to spread a sandwich task', and discussing food and health with the students:

It's good that you eat jam with food, so that it's not just jam with some food or no food at all. It's good to combine it so that you have a chat about it and point out what's good, and what's positive. Maybe they will still choose jam, but then we have talked about it. [Eva]

It's about fat. You have to go into that range. .../ I might think that they are too small to understand what I'm talking about, but at the same time, some have realized that you shouldn't have too much margarine on your sandwich. [Malin]

In addition to challenging students' food choices, the teachers' focus was on getting the students to eat enough to get through the day, concentrate on schoolwork, and be able to be physically active during school breaks. Besides meeting students' immediate energy needs, there were thoughts about health from a larger perspective. As Karolina expressed:

What it does do to you if you eat good, and the right food, what effect it has and health effects, also in the long term.../to get it in a larger perspective. [Karolina]

The teachers also underscored the interconnection of nutrition, sleep, and physical activity in promoting overall well-being, as articulated by Karolina:

.../we have had a teaching area before and then we had woven in how important diet, sleep, .../ exercise, and eating the right food are to cope. [Karolina]

In addition to the food and health perspective, Jonathan emphasized the significance of environmental aspects in student school meals by pinpointing the importance of small portions to minimize food waste. Generally, the sustainable perspective on food was highlighted in both the pre-study and the main study.

In summary, the three identified themes in the results—'The Role as a Food Educator,' 'Food as a Facilitator of Learning Processes,' and 'School Meals as an Educational Resource'—are interconnected, sharing a common focus on student's sustainable food choices (Figure 1). The Subject in the figure represents the food educator, the teacher, who may employ food as a tool for learning or school meals as an educational resource (Mediating artifacts). The Object of the teacher's activities is learning processes within the framework of subject-integrated food education. The Outcome is to promote sustainable food choices among the students. The triangle model is grounded in Vygotsky's theory of cultural mediation (Vygotsky, 1978).

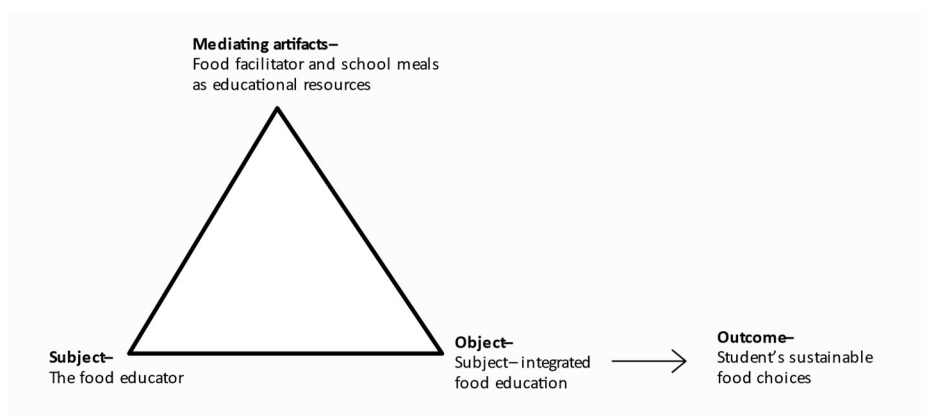


Figure 1 The relation between the food educator, food tools, subject-integrated food education, and student's sustainable food choices

Discussion

This study explored Swedish early primary school teachers' experiences of subject-integrated food education and highlighted opportunities and challenges connected to the phenomenon. Data were collected through qualitative interviews. The interview guide was developed based on experiences from a pre-study questionnaire.

The results showed that the teachers had significant experience with subject integration in general, but limited experience with subject-integrated food education. The school had a strong tradition of subject integration and an organizational structure that facilitated collaborative teaching. Obstacles to subject integration, such as a lack of planning time or limitations in the school organization, which have been identified in previous studies (Bohm, 2022; Haapaniemi et al., 2022; Lindblom et al., 2016; Pöntinen, 2019), were not expressed in the present study. The teachers were also comfortable with subject integration and open to new perspectives, which facilitates integration, as observed by Fooladi et al. (2023).

On the other hand, despite the teachers' extensive experience with subject integration, they often considered classroom subject-integrated food education to be something new, ambiguous, and challenging. Several of the teachers associated food education with school meals rather than classroom lessons. In order to feel confident and competent as food educators and to enable effective communication about food and health messages, teachers be adequately educated and pedagogically supported. The role of the teacher in home economics education can be a valuable collegial support, but additional continuing education may be necessary.

Based on the teachers' extensive experience in subject integration, the teachers saw several opportunities to integrate food education into various school subjects. Several examples were given of elements that could support learning processes. For example, food was seen as something that can inspire, engage, and motivate due to its familiarity, which is in line with Haapaniemi, et al. (2022), Höijer (2013), and Palojoki (1997). Food was also seen as a prominent tool for generating experiences through the senses. Finally, the teachers noted that food can be a tool to facilitate the understanding of lesson content, for instance, in mathematics or language teaching. The concretizing character of food is consistent with Höijer (2013) and Brante and Brunosson (2014). The view of food as a pedagogical tool further confirms the research of Haapaniemi et al. (2022), Höijer et al. (2011), and Palojoki (1997).

All interviewed teachers were convinced of the importance of teaching and learning about sustainable food choices in early primary school. This aligns with research showing that food habits are established early in life (De Cosmi et al., 2017). The results demonstrated that teachers had spontaneous experiences of food education, predominantly during school meals. Conversations and dialogues during mealtimes were identified as valuable elements in food-related teaching and learning. The use of learning dialogues is in line with socio-cultural learning elements of human interaction and mediating artifacts (Vygotsky, 1978; Säljö, 2014) (Figure 1). Moreover, challenging and developing students' taste preferences is beneficial in meaningful learning processes related to knowledge about sustainable food choices (Christensen, 2019; Gelinder et al., 2020; Gisslevik et al., 2017). However, while food education was present, it was often temporary rather than systematic and therefore did not reach all students.

In today's Swedish early primary schools, the presence of subject-integrated food education is determined by each school and individual teacher's interest. The outcome is influenced by the teacher's competence, and priorities, resulting in inequalities in food education outside of the dedicated school subject, Home and Consumer Studies. The present study therefore highlights the teacher's role and responsibility as food educators in primary school, as well as the importance of teachers taking responsibility for and initiating food education to achieve individual and societal sustainability goals related to equity health and the environment (Public Health Agency of Sweden, 2020; United Nations, 2015).

The importance of empowering sustainable food choices among students emphasizes the significance of highlighting food education in policy or governing documents (Sepp et al., 2016). However, the concept of 'food education' is not clearly expressed in the national curriculum of primary school. In line with findings from the study, revealing that teachers have limited experience with subject-integrated food education in classrooms, it is essential to clarify what food-related knowledge entails in the curriculum on education. Having an understanding in common with clear concepts facilitates communication with students and assists with subject integration. Moreover, including food education in the curriculum would create a greater focus on the teaching and learning of food-related knowledge and skills that support sustainable food choices.

Prerequisites for conscious and systematic subject-integrated food education in early primary school include a subject-integration-friendly organization at the school level, and clearly and explicitly formulated policy or governing documents at the national level. Moreover, teachers should be provided with professional development opportunities and support to better understand what subject-integrated food education entails. This support can be facilitated by a teacher in home economics education or others with corresponding pedagogical knowledge, as well as those with knowledge in food and nutrition.

Strengths and Limitations of the Study

The general strengths of a case study approach are that several sources of information are used and that it strives to capture various viewpoints (Yin, 2018). In this case study, data was collected in two steps: a pre-study questionnaire followed by teacher interviews. Different data collection methods also increase the trustworthiness of the analysis and facilitate a deeper understanding of the data. In the analysis process of the study, the interpretation of the data was supported by the first author's extensive experience as a teacher in HCS, as well as the

authors' discussions. Correspondingly, in reflexive thematic analysis, well-executed reflexive work is considered a strength (Terry & Hayfield, 2021). To ensure that the data interpretation is as transparent as possible, it is presented in the method section in tables.

The use of a single case has limitations compared to multiple case studies. These limitations are related to the generalization of the results, but the use of a single case can still be justified depending on the uniqueness of the case (Yin, 2018). In this study, the use of a single case was motivated by the emphasis on subject integration of the selected case. However, the purpose of the qualitative case study was not to generalize, but to explore, describe, and learn from the teachers' view of subject-integrated food education.


Conclusions

This case study shows how Swedish primary school teachers experience and describe subject-integrated food education in three ways. Firstly, the results imply that the teachers saw challenges in bringing food education into the classroom, which can be supported by educators with experience in food pedagogy and competence (i.e. teachers in home economics education or other professionals with pedagogical knowledge of food and nutrition). Secondly, the opportunities of food as a familiar, experience-generating, and tangible pedagogical tool demonstrate that subject-integrated food education has the potential to support teaching and learning in sustainable food choices, as well as in various subject-specific knowledge (Figure 1). Thirdly, the results show that the existing food education during school meals challenges student food preferences but could be better organized by stimulating teachers' pedagogical awareness in an attempt to reach all students.


In conclusion, the implementation of subject-integrated food education can strengthen the teacher's role as a food educator by utilizing pedagogical tools such as food and school meals. Nevertheless, successful subject-integrated teaching requires clear policy documents related to food education, reformed teacher education, and improved supportive structures for teachers in practice. This will enable teachers to systematically work with the integration of food education, both consciously and consistently. Most importantly, the approach of subject-integrated food education in primary school may empower sustainable food choices of the next generation.

Biographies


Louise Hård is a doctoral student of the Department of Food and Nutrition, and Sport Science at the University of Gothenburg. Her research field is teaching and learning in food and nutrition within the area of home economic education. Her doctoral thesis focuses on enabling, creating, implementing, and evaluating subject-integrated food education in primary school, by using co-design. **Email:** louise.olsson.hard@gu.se

 <https://orcid.org/0009-0004-2719-4826>

Päivi Palojoiki is a professor in Home Economics Pedagogy at the University of Helsinki, Finland, and an affiliated professor at the University of Gothenburg, Sweden. Her research focuses on subject-didactic questions related to the teaching and learning of home economics in basic education and teacher education. **Email:** paivi.palojoki@gu.se

 <https://orcid.org/0000-0001-7323-7015>

Christel Larsson is a professor in Food and Nutrition at the Department of Food and Nutrition, and Sport Science at the University of Gothenburg. One of her research focuses is on how to promote healthy dietary habits among children and adolescents, and food-related learning. **Email:** christel.larsson@gu.se

 <https://orcid.org/0000-0002-5785-0271>

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