



Embedding food system education into Swedish public schools

– teachers' perspectives

Hanna Weiss

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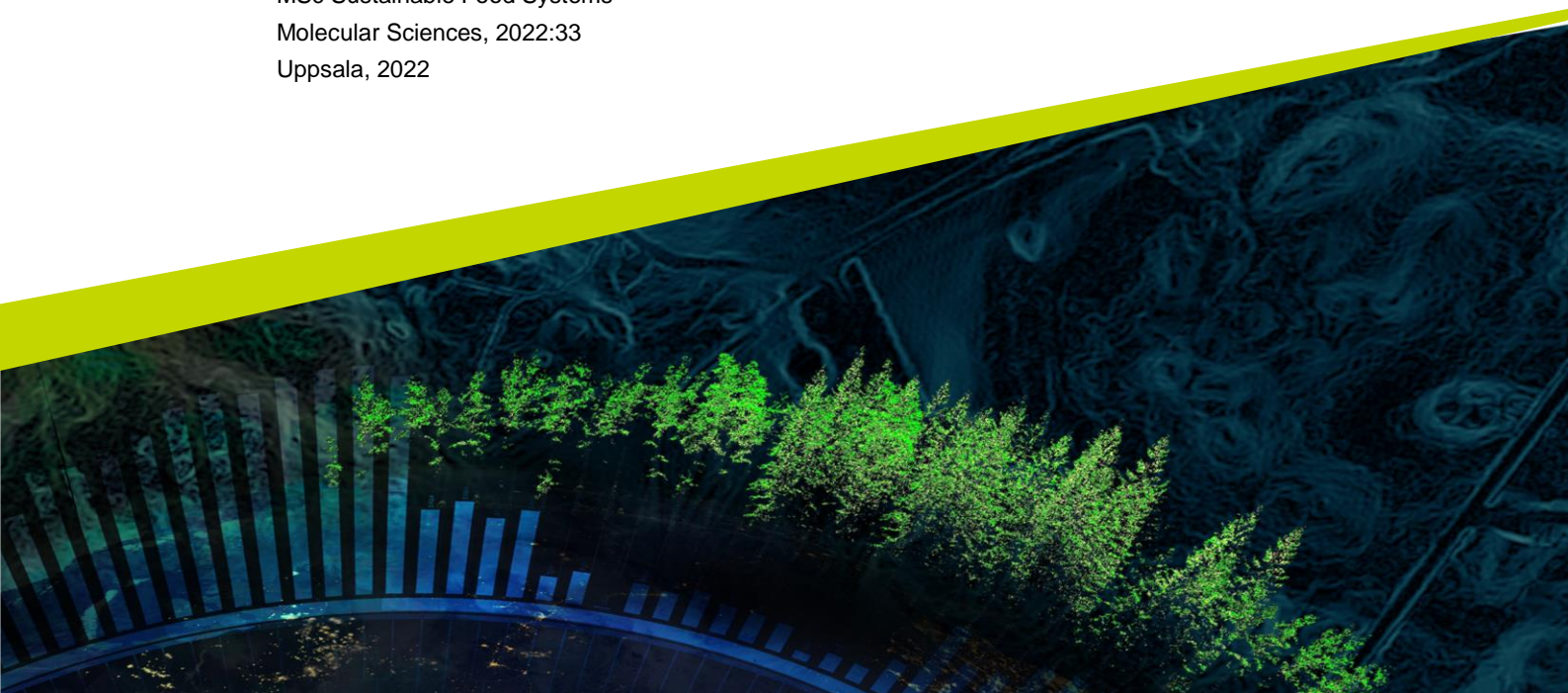
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Abstract

Modern, human driven food systems are putting pressure on the earth's resources, exploiting societies and degrading land. Food security is at risk, while a progressing anthropogenic climate change will presumably reinforce these incidents. Children will be highly threatened by the consequences derived from unsustainable farming practices. This calls for action to educate and empower children to understand and tackle these challenges. In this context food system education (FSE) is a growing field. This study used food literacy as a concept, which if applied, can help children to make personal decisions that are beneficial for themselves in terms of health, but also on a social, environmental, economic and cultural level. Through seven, in-depth interviews with teachers from the compulsory school level in Sweden, the study aimed to explore how teachers perceive, practice, and wish to educate about food systems. According to the findings, the Swedish school curriculum already embeds relevant aspects that can be used to develop a stronger focus on FSE. The freedom of the teachers, to interpret parts of the curriculum individually, can be seen as a benefit to adapt and design interactive lessons. However, teachers are time constrained and sometimes do not have the competence nor availability of relevant teaching material to educate about complex food systems. A cross-curricular approach that integrates FSE throughout the school years and within different disciplines is suggested. In that way children get a holistic picture of food that also incorporates a sustainability dimension. It is furthermore recommended to create networks of people within the food industry who share their knowledge in school lessons, as it is already practiced in post-secondary education. However, future research is needed to examine how teachers could cope with a cross-curricular approach and what kind of training would be needed to make FSE lastingly thriving in Swedish schools.

Keywords: Food system education, System thinking, Experienced-based learning, Swedish school curriculum, Food education, Food literacy, Pedagogical approaches with children

Table of contents

List of tables	8
List of figures.....	9
Abbreviations	10
1. Introduction.....	11
1.1. Problem background	11
1.2. Problem	12
1.3. Aim, research question and objectives.....	13
2. Method.....	14
2.1. Data collection and analyses.....	15
2.2. Settings and participants	17
2.3. Validity and reliability	18
2.4. Ethical considerations.....	18
2.5. Literature review	19
2.6. Limitations and delimitations	19
3. Literature review and theoretical framework.....	21
3.1. Food systems	21
3.1.1. Food system education.....	23
3.1.2. Children's understanding of food systems.....	24
3.2. Pedagogical approaches to food system education.....	26
3.2.1. Food literacy	26
3.2.2. System thinking.....	28
3.2.3. Experienced-based learning	30
4. The Swedish school curriculum	32
4.1. Reframing curriculum	34
5. Results.....	35
5.1. Teachers' perceptions of FSE	35
5.1.1. Diversity of food lectures	35
5.1.2. The connection of food to different disciplines	36
5.2. Children's level of knowledge and ability to transform food systems.....	37

5.2.1.	Differences in family backgrounds	37
5.2.2.	Food literacy in children	38
5.3.	Learning methods and pedagogical approaches to FSE	39
5.3.1.	Common materials	39
5.3.2.	Study visits and community-based approaches	39
5.3.3.	Usage of system-thinking in the classroom	41
5.4.	Teachers' capabilities and competences	41
5.4.1.	Teachers' interpretation of the Swedish school curriculum	42
5.4.2.	Different ways to engage in food education	43
5.5.	Opportunities for FSE in Swedish schools	44
6.	Discussion and analysis of research results	47
6.1.	Food system education in Sweden's compulsory school systems	48
6.2.	Challenges and opportunities in FSE	50
6.3.	Food literacy as a concept to embed FSE into the Swedish public-school curriculum	51
6.4.	Recommendations	53
6.5.	Suggestions for future research	54
7.	Conclusion	56
	References	57
	Acknowledgements.....	62
	Appendix	63

List of tables

Table 1. Thematic analysis – coded data	16
Table 2. Overview about interview participants	17
Table 3. Overview of subjects that are taken from the Swedish curriculum that connect to a broader sense of food (derived from Skolverket, 2018).....	33

List of figures

Figure 1. A simplified illustration of a food system adapted from Ericksen (2008) and ShiftN (2016)	22
Figure 2. The 4 pillars of critical food systems education adapted by Meek & Tarlau (2016)	23
Figure 3. Dimensions of food literacy in an educational context adapted by Slater (2013)	27
Figure 4. Food literacy in Swedish public schools: Adaption of the food literacy dimensions (Francis et al. 2011) and combined with the results obtained from the interviews	48

Abbreviations

FSE Food system education

FL Food literacy

1. Introduction

The pressure that current food systems put on natural resources and societies is immense. Food insecurity, depletion of resources, environmental damages and social exploitation are just a few of the threats that are caused by the unsustainable use of food producing systems (FAO & IFAD 2021). In addition, the progressing anthropogenic climate change will presumably reinforce these occurrences (Myers et al. 2017). Education can be utilized as a powerful tool to sustainably transform food systems in the long term with an overreaching goal of global food security which:

exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life (World Food Summit 1996).

1.1. Problem background

Present food systems are defined as complex networks that embed a large range of processes that are shaped by ecological as well as social elements which interact with each other (Ericksen 2008). Challenges that are connected to this area are usually of a “wicked” nature, implying that they are diverse and unpredictable (Rittel & Webber 1973).

Food system education (FSE) is a growing field rooted in curricula and pedagogical settings, especially in postsecondary education (Salomonsson et al. 2009; Hilimire et al. 2014; Valley et al. 2018). Elementary and middle schools are lately developing their food education in terms of school gardens, often to promote better knowledge about health and nutrition (Morgan et al. 2010; Day et al. 2022).

FSE seeks to communicate the processes and challenges that occur within food producing systems and intends to find more sustainable practices. System thinking as well as experienced-based learning approaches are commonly attached to this field of education (Francis et al. 2011). Food literacy as one of the key concepts in FSE aims to create more sustainable consumers that know what impact their food choices have on health, planet and society (Nanayakkara et al. 2017).

1.2. Problem

Children will be highly threatened by the various consequences that human driven, modern food systems have on people and the planet (Vermeulen et al. 2012). This calls for action to educate and empower children to understand and tackle these challenges. Researchers, such as Fleming et al. (2021), indicate that not only are children familiar with basic processes that happen along the food value chain, but they also articulate a strong desire to be part of the ongoing discussions about food insecurity, environmental threats, and healthy food. Children are curious and eager to learn and thus should be included in the required food system transformation (Fleming et al. 2021).

When addressing the subject in schools, the complexity of food systems quickly becomes overwhelming. Therefore, educators and learners need to embrace a system thinking viewpoint. It can be helpful to separate food systems into different segments to understand main conflicts and to discover ‘hotspots’ that need to be understood and analysed. There is a great need to make food systems more sustainable and sufficient (Jordan et al. 2014).

Schools play a vital role as educational institutions since they have the possibility to reach most children who are ripe to act as audience for complex systems. Schools have the power to shape and influence the knowledge that is transferred to children, as well as the ability to apply practical, political and pedagogical approaches that are deeply connected to FSE (Jordan et al. 2014; Meek & Tarlau 2016).

The Swedish curriculum for the compulsory school system integrates several disciplines within biology, home and consumer studies and during field trip days, that intend to make children familiar with the impact that food production has on people and the planet (Skolverket 2018). There are also efforts made to educate about sustainable food choices. However, a lack of connection has been found between the different domains that shape and are shaped by food systems (ibid.). This points to the potential and need for additional learning opportunities, where children improve their system thinking capacities and understanding of food related topics to be able to actively transform food systems more sustainable.

1.3. Aim, research question and objectives

The purpose of this thesis is to explore how FSE can be embedded into the Swedish public-school curriculum. To meet this goal, the following questions will be asked:

1. How is FSE currently addressed in Swedish public schools, concerning the compulsory school system (grade 1-9/ age 7-16)?
2. What is the teacher's perception regarding FSE?
3. What are the challenges and opportunities for Swedish public schools when it comes to FSE?

To help answering these questions the following objectives were determined

- Explain the current stand of FSE
- Describe key concepts that, if applied, help to foster school-children's understanding of the processes of food production
- Analyse the current Swedish school curriculum in terms of sustainability and food related topics
- Define pedagogical approaches that comprehend and transfer the knowledge of complex food systems

2. Method

The following section will describe the methods that are applied to collect and analyse the data relevant for this study.

Schools serve as the main place of this study, including actors that are involved in this social construct. Therefore, qualitative research was found to be a suitable approach as it is widely used in social science to gain insight to social settings that are expressed by individuals or groups of people (Robson & McCartan 2016).

The research is seen through a lens of social constructivism which “indicates a view that social properties are constructed through interactions between people, rather than having a separate existence” (Robson & McCartan 2016:24). This means that world views and visions are created by the various differences of people’s realities and interpretation of their surroundings (ibid.). My own background, as a non-Swedish citizen, creates the opportunity to view and reflect on the Swedish school system as an “outsider”, enabling to look for patterns and systemic structures.

In-depth, semi-structured interviews were chosen to be the method of choice since they are appropriate to explore real-world situations and to obtain multiple perspectives within the field of study. As stated by Cohen et al. (2007):

Interviews enable participants – be they interviewers or interviewees – to discuss their interpretations of the world in which they live, and to express how they regard situations from their own point of view. In these senses the interview is not simply concerned with collecting data about life: it is part of life itself, its human embeddedness is inescapable (Cohen et al.2007:349).

The interviews were analysed by coding the qualitative data to construct a thematical structure of the findings (Robson & McCartan 2016). The coding process will be described in more detail in section 2.1.

2.1. Data collection and analyses

In order to answer the research questions, semi-structured interviews were conducted. Key questions (see appendix for interview guide) for the interviews were defined prior to the interview, covering the most important fields of this study. Depending on the flow of the interviews, questions were added or slightly modified (Kvale 2007). Interviews with teachers, currently working at Swedish schools, were chosen to get an understanding of their experiences.

To find participants for this study, 20 random schools across Sweden were contacted through emails. The email was usually addressed to the school principal with a friendly request to forward the project description to the available teachers. Five of the schools took time to respond. In respect of the limited time of this study, the researcher decided to make use of two indirect contacts to teachers to get two more interviewees.

The interviews were recorded and transcribed manually. However, only relevant sections that were supporting the aim and research questions of this study were transcribed. This resulted in an average of two pages of written text for each of the participants. The interviews were made in Swedish. However, the coding process was performed in their original language in order to not lose sight of information and meaning. Only phrases that were used in the coding table and in text quotes were translated into English with considered carefulness and accuracy.

To analyse the qualitative data set, a thematic analysis was performed (Table 1). The overall intention was to distinguish specific patterns that are from importance and give meaning to the data extracted from the interviews (Neuendorf 2019). First of all, the goal was to grasp the bigger picture when listening or reading through the material followed by scribbling first ideas that came to mind. The intention was to look for the context of meaning rather than the actual body of information (ibid.). The data was compiled and analysed inductively, through interaction with the extracted information and the reviewed literature (Robson & McCartan 2016). In the first steps of compilation, initial codes that consist of a few letters and that symbolically capture the essence of different themes were applied to the data set (Neuendorf 2019). The questions for the interviews (see appendix) eased the process to predetermine codes and themes early on. This means that the data set was “labelled” with the initial codes to easier identify common patterns (here theme description). During the next phase the unit of meaning were derived from the transcribed interviews in form of short quotes or sequences of words (see appendix). The unit of meaning were the result of an analytical process (ibid.). All the extracted themes helped to finally structure the result section.

Table 1. Thematic analysis – coded data

Code	Theme	Theme Description	Unit of meaning
ENG	Children's background and capabilities to learn about food systems	Differences in age groups Cultural differences Family background	<ul style="list-style-type: none"> - Adapting the level of complexity - Farmer and hunter families - Dinner family food talks - Team class spirit
TRA	Children's skills to transform food systems	Learned competences Capabilities to feel empowered Abilities to make positive decisions concerning food	<ul style="list-style-type: none"> - Young children are knowledgeable about food and climate change - Awareness of the consequences connected to food production - Carbon footprint - Awareness of having choices - Critical observation
ST	System thinking	Understanding complex settings	<ul style="list-style-type: none"> - Understanding consequences - Purchasing locally makes a difference on a wider scale - Environment, society and political structures are involved
TC	Teachers' competences	Use of resources Personal engagement	<ul style="list-style-type: none"> - Freedom of choosing own teaching material - Using the web to seek information - Interpretation of the curriculum depending on the teacher - Personal motivation and passion for a certain topic
TP	Teachers' perception of FSE	Pedagogical approaches Difficulties connected to teaching	<ul style="list-style-type: none"> - Diversity in teaching material: books, videos, digital learning platforms - Experience based learning: gardening, study visits, external lecturer, competitions - Time as a constraining factor - Lack of recourse, guidance - Undefined learning objectives

P	Possibilities for FSE	Learning methods Cooperation Connection between different subjects	<ul style="list-style-type: none"> - Integrate the knowledge of the kitchen staff - Create cooperation with actors of the food industry - Apply food education throughout the curriculum - Making use of specific study programs (NGO's, farmers associations...)
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2.2. Settings and participants

The interviews conducted with teachers were performed during March 2022. In total, seven participants were interviewed during this time. Five of the interviews were conducted on zoom and two in person. The teachers were educating at different levels, subjects and locations (Table 2). The gender of the participants is not of meaning for this study and they will therefore be referred to as T1, T2 and so forth.

Table 2. Overview about interview participants

Teacher*	Subject	Grade	Years as a teacher	Location
1	All	1-6	10	Hedemora kommun
2	Home and consumer studies, History	6-9	23	Solna kommun
3	All except Art, Music and Physical education & health	5	24	Sandvikens kommun
4	Biology, Chemistry, Physic and Technology	6-9	33	Uppsala kommun
5	Home and consumer studies, Society oriented studies	6-9	20	Hofors kommun
6	Society oriented studies	Gymnasium**	13	Trelleborg kommun
7	Biology and Chemistry	7-9	25	Tibro kommun

* The teachers will be referred to as T1, T2 and so forth in the text

**T6 was included because of his valuable experiences a teacher located in an interesting area closely connected to food production. Only general insights were incorporated in the result section to not collide with the age group educated at the compulsory school level.

2.3. Validity and reliability

The quality of research is deeply connected to its validity and reliability. According to Houtkoop-Steenstra (2000:1):

The research method is valid when it generates the research data that it is designed to collect. This means that the questions should measure the dimension or construct of interest [...]. Furthermore, the research method must be reliable. The concept of reliability refers to the degree of variation among responses [...] and with different interviewers Houtkoop-Steenstra (2000:1).

The aim of this study was to explore how FSE can be embedded into the Swedish public-school curriculum. The interviews helped to give an overview of teachers' perceptions, their possibilities, teaching methods and pedagogical approaches in context of food education. The study was not limited to a specific class-grade but encompasses the whole compulsory school education. FSE is relevant for both younger children and older ones, while the complexity and connections of different disciplines can be enhanced throughout the years. This means that in order to gain a representative picture of the whole school system and to understand how FSE can be implemented in the Swedish school system, a different scope, several actors that are operating in the school context such as children and curriculum researcher would need to be considered.

2.4. Ethical considerations

Different methods and best practices on how to conduct interviews in an ethical way have been proposed. This research follows a set of key areas that have been offered by Kvale (2007). These are: confidentiality, informed consent, consequences and the role of the researcher.

The responsibility of the researcher relies thereby on several aspects, such as the consciousness about the asymmetric power relations between the interviewee and the interviewer (Kvale 2009). It should thus be considered that questioning in one-way direction may seem intimidating for some participants and therefore lead to answers they did not intend to give.

Each respondent was informed about the procedure, the recording of the interview and was asked to sign a General Data Protection Regulation compliance (see appendix) in order to verify that they had read and understood the processing of data and the information given to them. They were also notified about the possibility to look through the material before the thesis publication. It was also made sure that they knew about the possibility to stop the interview at any time.

2.5. Literature review

To gather information for the theoretical background (see section 3: Literature review and theoretical background) and to set previous research in context of the connected fields of this study, a literature review was carried out. The literature was obtained by utilizing 4 different data bases (Web of science, Scopus, ProQuest and Agris). The following search words were used as a foundation for each of the databases while the last searches were made on the 01/04/22 and have not been revised during the performance of this thesis: [*Food system education; System thinking; Experienced-based learning; Swedish school curriculum; Food education; Food literacy; Pedagogical approaches with children*]. Once an article was identified as suitable for the research, it was utilized to find additional, context-relevant literature. There were no limitations used for the publishing years of the scientific literature, though if possible latest insights were included. The English language was selected for all the searches. The consideration regarding the selection of literature was done by the author based on relevance.

2.6. Limitations and delimitations

Limitations were mainly caused by time-constraints and sudden cancellation of interviews due to the Covid-19 pandemic. The interviewees were located in different but still just a few public schools in Sweden, which does not give a fully representative insight of the broader school system, nor the perceptions of all the teachers that act within them. People that were chosen to be interviewed were accessible and not entirely randomly recruited. A description of the topic, aim of the study and procedure was sent to the participants beforehand which might have led to participants that have a personal experience, interest, or motivation to participate.

The focus of the interviews was to get an understanding of how teachers in Swedish public-school experience FSE. What pedagogical approaches are they using and what are the opportunities and challenges that are connected to FSE. Some boundaries were set to be able to focus on the research questions and main concepts of this thesis: (1) Interviewees were not specifically asked about their private motivation for the topic of food and food systems. (2) The focus was not set on restrictions or limitations that teacher experience in order to be able to teach about food systems.

Assumptions were made, that all schools in Sweden, regardless of their location, have the same access to material and educated staff. This is following a general aim of Swedish schools to maintain uniform school education all across Sweden

(Riksdagsförvaltningen 2010). Socio-economic structures were not examined in this study, though inequalities and ethnic segregation are not ignored within the Swedish context (Yang Hansen et al. 2011).

3. Literature review and theoretical framework

This section aims to introduce food systems as a concept and describes the current state of FSE including common pedagogical approaches used in this kind of education. Food literacy (FL) is illustrated as the main concept and adapted with a system thinking approach. FL will be used to analyse and discuss the results.

3.1. Food systems

Food systems can be simplified as a series of processes that occur between different stages, often simplified as “farm to fork” (Garnett et al. 2016).

What exactly constitutes “sustainable food systems” is not clearly defined (Röös 2017). However, the Food and Agricultural Organization offers a definition which is suitable on many levels. According to that, a sustainable food system is:

one that delivers food security and nutrition for all in such a way that the economic, social and environmental bases to generate food security and nutrition for future generation is not compromised. This means that it is profitable throughout, ensuring economic sustainability, it has broad-based benefits for society, securing social sustainability, and that it has a positive or neutral impact on the natural resource environment, safeguarding the sustainability of the environment. FAO (2022)

Food systems constitute of larger networks that are shaped by their drivers and actors. All the different elements comprised have an impact on the food systems activities and outcomes which in addition can take place on different spatial and temporal scales (Figure 1). As stated by Garnett et al. (2016:7) “in reality, there is no single ‘food system’ but rather multiple ‘food systems’ operating at different spatial or social scales, which interact with one another to varying degrees”. When describing food systems from a simplistic economic point of view, one often refers to ‘food supply chains’. However, this term puts focus primarily on the goods that are being exchanged, meaning the stages of production, processing, distribution, retail and sometimes disposal. ‘Food value chains’, in contrast, incorporate participants that shape and add value to the system (Garnett et al. 2016).

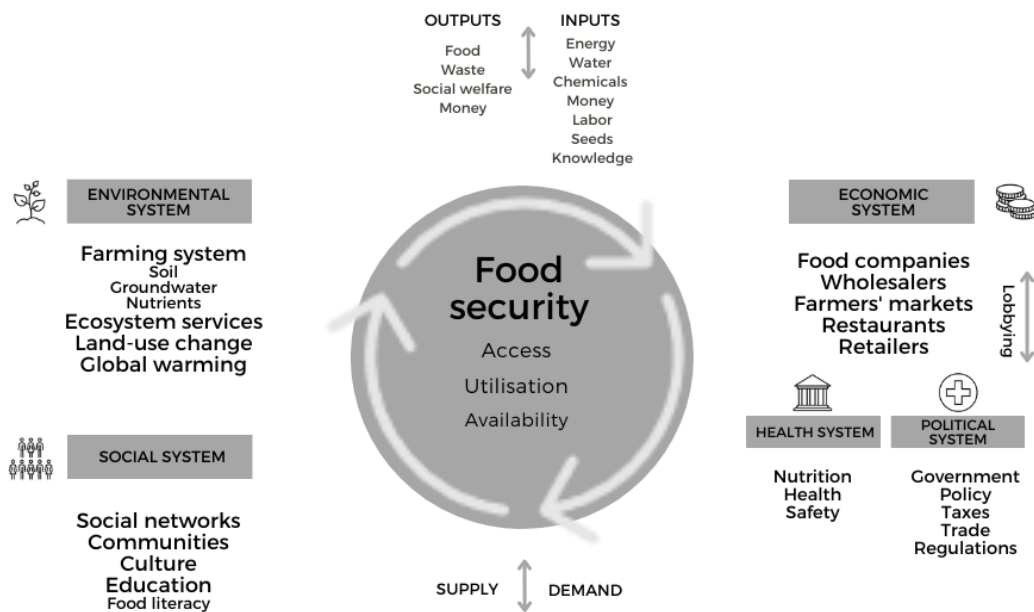


Figure 1. A simplified illustration of a food system adapted from Ericksen (2008) and ShiftN (2016)

The environment is affected by the activities that occur due to the production of food. Global warming being one of the biggest threats of humankind is to a great extent caused by the emissions of greenhouse gases. This is not least fired by unsustainable farming practices and especially land-use change (Vermeulen et al. 2012). Water and soil are getting polluted, while ecosystem services decline. However, agricultural systems are dependent on these services. Only well-functioning natural environments have the capacity to serve as a base for sustaining food systems in the long run (ibid.)

Food systems do not only interact with the environment but also with society. They influence people's health, thousands of livelihoods, economic relations, and political structures. If food systems are not managed in accordance with people and nature, food insecurity and inequalities will prevail. Instead, food security and equity are desired (Myers et al. 2017). Different kind of environments are shaping food systems, while various interactions and feedback loops are impacting and creating new drivers and so forth (Ericksen 2008). One example is the growth of population which can be seen as a socio-economic driver, influencing the state of food security which in turn is affecting the dynamics of the system (Béné et al. 2019). These causalities lead to the innovation of new agricultural technologies and governmental regulations (Garnett et al. 2016).

3.1.1. Food system education

FSE has become increasingly popular during the last decades (Salomonsson et al. 2009; Meek & Tarlau 2016; Massari 2017). However, the concepts and teaching methods which are being used to effectively teach and pedagogically approach this subject are various (ibid.).

Hilimire et al. (2014) determined four approaches to FSE which are suitable for both older and younger learners:

- (1) Early contact to a food producing system
- (2) Case studies as a learning method
- (3) Learning based on experience
- (4) Collaborative group lessons

Meek & Tarlau (2016) stress the importance of embedding a critical compound into the framework for FSE and they emphasize the risk of FSE being too narrowed on school gardening practices that build upon a sustainable vision. Their proposed framework tries to connect the pedagogic quality of teaching with the ability to transform social systems. The authors embed four pillars (see Figure 2) into the framework, which are: popular education, food justice, food sovereignty and agroecology.



Figure 2. The 4 pillars of critical food systems education adapted by Meek & Tarlau (2016)

Popular education is referred to as “education for critical consciousness” and is a teaching approach shaped by the Brazilian author and pedagogue Paulo Freire (Freire 2000). Meek & Tarlau (2016) use this educational approach to recognize and understand the various drivers and elements that are compromised in food producing systems and thus human lives. The purpose is to improve the skills that are needed to sustainably transform these systems.

Food justice as a movement is used by the authors to scrutinize structures that are shaped by power, privilege and racial inequalities, and which are part of food producing systems.

Agroecology can be defined as:

“the integration of research, education, action and change that brings sustainability to all parts of the food system: ecological, economic, and social [...]” (Gliessman 2018:599).

Meek & Tarlau (2016) take this further by expressing the necessity to reflect upon political events that steer the agribusiness.

Lastly, food sovereignty which was firstly launched in 1996 by La Via Campesina, an international farmers organization, as:

“the right of peoples to healthy and culturally appropriate food produced through ecologically sound and sustainable methods, and their right to define their own food and agriculture systems” (Patel 2009:).

Meek & Tarlau (2016) use the term ‘food sovereignty’ to connect FSE to a larger, globalized movement that depicts the right for identifying food and food systems, regardless of cultural or spatial context.

3.1.2. Children’s understanding of food systems

Calabrese Barton et al. (2005) revealed that children attending elementary schools in urban setting have their own understanding about food systems. They have ideas about the happenings along the food production chain such as, main production, packaging and transport. However, the authors found a visible lack of combining all these processes in order to understand the greater impact of food systems as a whole on the natural environment. There is need and opportunity for schools to act as a venue for communicating such comprehensive constructions as they appear in the natural world (Carlsson & Williams 2008).

Another recent study in collaboration with UNICEF (Fleming et al. 2021) included over 700 children, with various backgrounds (aged 10 to 19). The children were

asked about their perception and fears concerning food systems and plans for action to sustainably transform them. Children of 18 countries participated, and for the study both digital, on-site interactive workshops and a survey were conducted (ibid.). In contrast to Calabrese Barton et al. (2005), children in this study had an encompassing understanding of where their food comes from and which different stages it passed on the way to their plates. They also showed a great sensitivity for the impact food has on the environment, and in particular the consequences of global warming. They further expressed concerns about long transport ways, impacting food availability and affordability. Overall, children were able to connect different parts of the food system to environmental, social and economic challenges and even proposed recommendations to change the food system sustainably (Fleming et al. 2021). One of the participants stated: “We are the future of the country and we want the government to engage us in different aspects of food systems” (Fleming et al.2021:44).

The children acknowledged their own function in transforming current food systems. They articulated that all members of society must be participants of change and that personal commitment is essential to create that transformation. However, they were also putting high hopes on governments, who should be made accountable for their actions and start to support local food systems towards sustainable development.

The study by Calabrese Barton et al. (2005) point to discrepancies in how children perceive current food systems compared to the study by Fleming et al. (2021). However, the focus of the studies was on different age groups as well as different socio-economic settings. Also, the scope of the studies differed rather much. Yet, both studies showed that children have relevant background knowledge, and are eager to learn about food as it has a strong impact on their life's.

Another important aspect that could have influenced the study by Fleming et al. (2021) is a visible transition in environmental consciousness enhanced by sustainability issues and inequalities of current systems, especially seen among young people (Wallis & Loy 2021).

Food takes on different roles in children's lives. May it be environmental, health concerns, economically or even socially driven concerns such as the joy and identification connected to food (Fleming et al. 2021). Giving children the possibility to learn and engage in FSE activities at an early school age can only be beneficial, as they will become adult members of society. They will purchase food and play an essential role for converting food value chains towards more sustainable systems that thrive not only now but for future generations (Hilimire et al. 2014).

3.2. Pedagogical approaches to food system education

3.2.1. Food literacy

Health advocating concepts have become more popular while the terms which are being used are ambiguous (Truman et al. 2017). Health literacy, nutrition literacy and FL are frequently used when discussing health promoting education. Krause et al. (2018) systematically reviewed these concepts and found that both nutrition and FL can be understood as a particular type of health literacy. While nutrition literacy is primarily used to express skills that encompass the assessment and evaluation of nutrition, FL merges several areas of the understanding of food.

FL and system thinking will be used as the main concepts to promote and foster FSE. Both concepts are understood to be suitable for the education of complex systems that merge sustainability and critical thinking (Francis et al. 2011; Wiek et al. 2011).

The term ‘food literacy’ embodies a multitude of concepts that do not agree on a common definition. However, attempts are made to distinguish these concepts. FL as a concept describes the competence to perform individual decisions related to food that have a positive impact on social, environmental, economic and cultural levels (Cullen et al. 2015).

In order to use FL in an educational context, one must classify key themes that make it possible to evaluate and utilize it in practice. Truman et al. (2017) identified six of such themes which are: (1) related to the personal abilities to handle food, for example the preparation of food; (2) the capacity to make informed decisions that are favourable for a healthy diet; (3) cultural related activities that involve strong social aspects; (4) the competence to collect, assess and judge food related content; (5) the impact of personal viewpoints and inspirations that are referred to as emotions and lastly; (6) the awareness about food that interacts in a broader system which includes all the processes that are taking place along the food value chain and that have an impact on the environment, social and economic systems.

Hence, the concept of FL does not only focus on one aspect of food but on a broad range of topics. Even though the preparation of food and education about nutrition of food have been prevailing in school education, research has shown that an enhanced awareness about nutrition does not inevitably lead to adjustments when it comes to food related skills (Nanayakkara et al. 2017). Therefore, new approaches consider a more holistic view that encompass the value chains of food systems with all its compounds (Truman et al. 2017).

Slater (2013) suggests three dimensions of FL that help to develop a school curriculum which embeds food system education. These are: interactive, functional and critical FL. The framework embeds the different themes identified by Truman et al. (2017), which were mentioned earlier, to utilize FL in practice (see Figure 3). In this thesis the framework was extended by a system thinking dimension as it is acknowledged to be from great relevance when studying complex settings that include food systems and sustainability (Francis et al. 2011; Wiek et al. 2011). System thinking as a core competency for FL and thus FSE will be further explored in section 3.2.2.

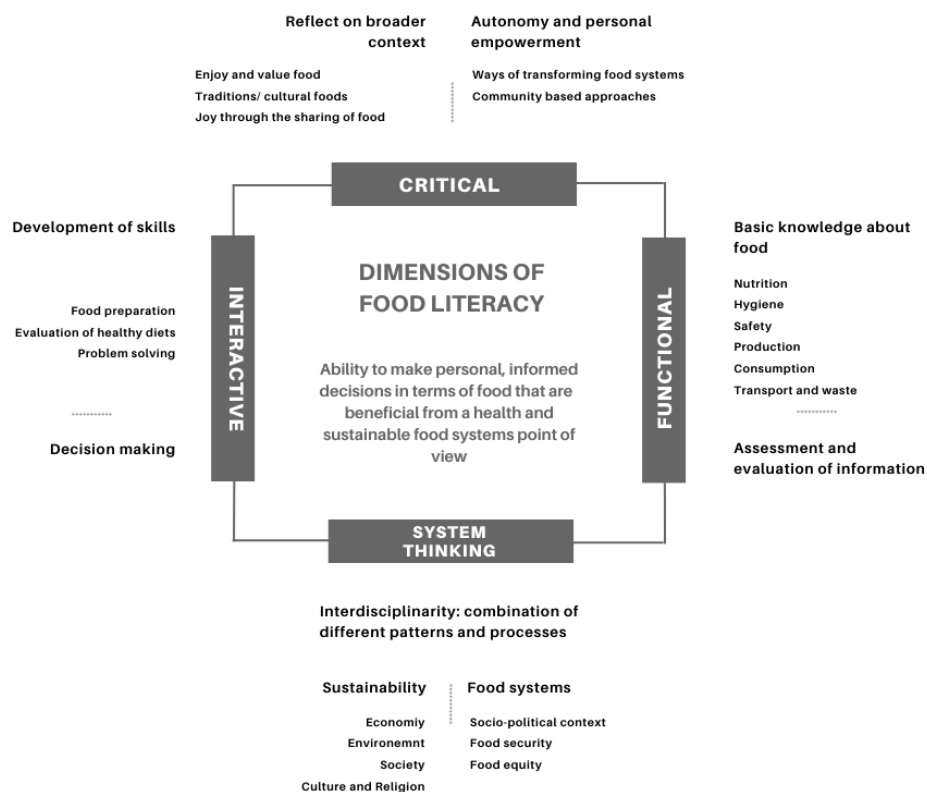


Figure 3. Dimensions of food literacy in an educational context adapted by Slater (2013)

Slater (2013) describes the learning outcome of ‘functional food literacy’ as the fundamental communication skills that are needed to understand, access and evaluate information about food and their dietary, hygiene and safety aspects. ‘Interactive food literacy’ is described as a personal ability to make informed and goal directed decisions that are beneficial for one’s own well-being, including the preparation of food. ‘Critical food literacy’ incorporates a more community-based approach where FL is used to promote greater health within communities, but also to reflect on the broader context of food producing systems. In this context it should be mentioned that the enjoyment to eat and prepare food with others is of great

meaning especially for younger people, focusing on the socialising part cooking and eating (Slater 2013; Vidgen & Gallegos 2014).

Kelly and Nash (2021) made a recent systematic review with the aim to understand how FL is occurring in elementary schools. They found that only a limited number of the reviewed schools were embedding all dimensions of FL into their learning concepts. They further observed that an incorporation of FL into a broad range of school subjects can help to conquer obstacles that are connected to restrictions such as time and money, as well as to involve teachers and children with food and sustainability on a broader scale. Experienced-based activities, the involvement of family members as well as the collaboration with other actors of the food industry were seen as beneficial to integrate FL into school settings (ibid.).

Previous research demonstrates that due to the complex nature of food systems and dietary knowledge, FL has been primarily developed for secondary education (Nanayakkara et al. 2017). However, Kelly and Nash (2021) suggest that it may be beneficial to not only teach FL to adolescents and adults, but also in primary schools. This generates the possibility to create “food literate” school children that build up on their knowledge as they continue to attend school. Depending on their abilities and emotional capacity, a student can strive to create a deeper understanding of the connections between food and the systems they emerge in. As an improved understanding about nutrition does not necessarily increase the students understanding of a broader meaning of food (Slater 2013; Nanayakkara et al. 2017), it is crucial to assess the various dimensions of FL in curricula (Nanayakkara et al. 2017; Kelly & Nash 2021). This includes, among others, an understanding of socio-political contexts and environmental awareness (Pendergast et al. 2011). However, when educating about food it is important to observe where the motivation stems from and who is involved in the generation of teaching material, since aim and approaches of food education may differ to a great extent depending on who is steering the direction (Kimura 2011).

Thus, FL gives children, future adults, the possibility to make personal decisions that are beneficial for themselves in terms of nutritional intake, but also for the broader society as choices are made from a sustainable point of view that encompasses a broader spectrum of food. That knowledge is needed to create change and to construct more sustainable food systems that thrive not only today but for future generations (Cullen et al. 2015).

3.2.2. System thinking

System thinking is a critical competence to tackle sustainability questions, and not least to understand the complexity of systems that act across a set of areas as seen

in food value chains (Wiek et al. 2011). It gives practitioners the possibility to talk about complex settings based on a holistic approach. The focus is not set on specific aspects but on scrutinizing happenings from a broader perspective to grasp the overwhelming structures of systems that span different time and geographic spaces. It helps to assess how feedback loops and cascading consequences might influence the inputs and outputs of a system (Kim 1999).

Food systems as defined in section 3.1. are the epitome of complex systems. They can be defined on a global and local level, they include several actors, and they encompass various activities that interact with each other. Feedback loops are numerous and so are the in- and outputs that are involved in the system (Ericksen 2008).

Francis et al. (2011) acknowledge a need for system approaches if interdisciplinary topics such as food systems are taught. They state that:

The systems approach [...] is a multi-perspective way of seeing the world, distinct from that employed by single disciplines. Holistic thinking requires a systemic approach to observing and analysing complex situations in agriculture and food systems (Francis et al. 2011:227).

Interdisciplinarity on the other hand is often used as a complement to system thinking, as “interdisciplinarity defines the mode of inquiry in food systems studies, a systems approach helps to define the object of inquiry” (Hilimire et al. 2014:726). This means, while interdisciplinarity links methods from various disciplines and thus defines how knowledge is gathered, system approaches oblige that the object of study is part of a system instead of being a sequestered element within a set of activities (ibid.)

To be able for learners to apply system thinking, Jordan et al. (2014) identified four key capacities that are needed to become a “system thinker”:

- (1) The ability to critically reflect on different models and worldviews that are not only one’s own by including people from different disciplines to tackle sustainability and complex challenges
- (2) The capacity to observe and reflect on biophysical and socio-economic aspects of the food system in order to create experienced-based models through the collaboration with different actors
- (3) The competence to integrate various stakeholders with different views and visions to achieve success on all levels of society in the long term
- (4) The skill to take responsible action as a group of people that reflect on their own abilities as well as on the structures and ethical dimensions

As stressed by Evagorou et al. (2009), system thinking is not only appealing for students or adults but should be integrated into the early school education. Assessing the effectiveness of simulation-based learning to develop necessary skills for system thinking (Evagorou et al. 2009) showed that children attending elementary school (age 10-12) have the capacity to understand complex processes within a system. Simulations were used as a medium and shown to be successful to help enhancing system thinking in children. However, children found it difficult to understand feedback loops that can alter the inputs and outputs of a system in a positive or negative way. In another study, Feriver et al. (2019) involved children attending preschool. They used a story-telling method followed by individual interviews to explore which system thinking skills can be discovered in younger children. The study confirms the findings of the study conducted by Evagorou et al. (2009) and contributes with additional evidence that indicate children's struggles to describe hidden mechanisms of systems as well as the lack of understanding different boundaries, partly caused by their limited observational and descriptive language skills.

Nevertheless, the ability to understand the dynamics of processes, assess future challenges of a system and challenge issues on a broader perspective are crucial not only for FSE but any other subjects as complex systems appear in various ways in the environment. Children have the ability to build system thinking skills. However, the curriculum should adapt a steady commitment to systemic characteristics by starting with the basic components of a system and finishing with relationships and behaviour of complex systems (Evagorou et al. 2009).

3.2.3. Experienced-based learning

The first discussions and analyses of experience-based learning emerged as a reaction to more conventional classroom lectures by philosopher and educational theorist John Dewey (1916), stressing the importance of education grounded on experience, as “learning by doing”.

Learners of food systems usually gain knowledge of various disciplines such as innovation, management, horticulture, agroecology, and more general social science fields. Even though class-based lectures provide students with necessary background information and analytical tools, experiences-based learning is a crucial complement to give practical insights into real world settings. There are various possibilities on how to embed experience-based learning into the school curriculum (Hilimire et al. 2014).

Farms are usually seen as suitable study locations due to their size and ability to host several students. In Sweden the concept of so called, “4H” farms is broadly used to motivate children in becoming responsible, healthy and engaged citizen of

society, respecting their natural surroundings. The letter H stands for: head, health, hands and heart, embedding knowledge, skills, compassion, and a healthy lifestyle (4H-gårdar n.d.). The employees of the farm can provide personal insights to the pupils that enhance their understanding of the primary stage of the food chain. However, to be able to create an exhaustive picture of the food systems schools should consider engaging with other actors of the food industry. Field trips to retailers, manufacturers, community gardens or governmental bodies are just to name some other possible locations (Hilimire et al. 2014).

Especially study visits that encourage hands-on activities can have an effective and positive impact on the learning outcome of the students. In this context, the student's personal motivation and engagement of the guiding person can further influence the experience of the study visit (Nadelson & Jordan 2012). If it is not feasible to find a suitable host, schools can consider inviting guest lecturers that talk about their job, personal visions and concerns (Hilimire et al. 2014). Direct exposure to segments of the food production chain can broaden students' perspectives on food systems and provide them with critical analytical skills. It gives them also the opportunity to engage with actors of the food systems that are crucial to involve in food system discussions (Francis et al. 2011). Especially for younger children, school-based gardens serve as a great possibility to provide experience about the production of food and importance of healthy and nutritious food intake. It is however challenging to present the whole food system in a school garden, though with the combination of other pedagogical approaches it can enhance the sensitivity for sustainability challenges and complex systems (Day et al. 2022).

Another important field within experienced-based learning settings are varying outdoor spaces and the usage of present class-room resources which can enhance children's imagination and creativity in discovering new things to a great extent. It can also trigger the interest to discuss certain topics as children experience their surroundings differently. The possibilities presented by lessons and learning approaches in outdoor spaces, in contrast to more conventional classroom lessons, are diverse and give a more flexible dimension to learning (Mårtensson & Fägerstam 2020).

4. The Swedish school curriculum

The Swedish school system is grounded on democratic values. The curriculum is divided into different syllabuses covering different subjects that are defined by activities, learning objectives, core content as well as overarching aims. Furthermore, at the end of each syllabus, one can find a statement about the knowledge that should be recalled as well as the requirements for achieving a certain grade (Skolverket 2018).

In 2011 a new Education act (Skollag 2010:800) resulted in a new curriculum for the compulsory school system in Sweden (Riksdagsförvaltningen 2010). The compulsory school system in Sweden encompasses the school grades one to nine (ages 7-16). The new Education act improved the stance of sustainability and sustainable development, as they appear in several parts of the syllabus. One of the fundamental values of the school is to provide pupils with an environmental perspective, that nurture personal activities that support sustainable development (Skolverket, 2018). However, how this perspective is implemented and interpreted, as well as which disciplines are possibly connected to food production is not fully visible from a simple look at the curriculum. Table 3 shows subjects of the Swedish school curriculum that are found to be connected to food, and which create a linkage to a broader perspective of food for example to health or the environment. Search words that were used to extract relevant content within the Swedish school curriculum were: food, food systems, value chain, ecosystems, sustainable development, field studies, consumers, diversity.

The aim of teaching ‘Home and consumer Studies’ is stated to give learners the “opportunity to develop awareness of the consequences of making different choices in the household on health, well-being and use of resources” and further prepare the pupils to “assess choices and actions in the home and as a consumer [...] from the perspective of sustainable development” (Skolverket, 2018). The subject of biology instructs that the children should be able to “manage practical, ethical and aesthetic situations involving health, use of natural resources and ecological sustainability”. Some of the content stated in the curriculum appears to cover important aspects of the food chain such as: “the difference between advertising and objective

information for consumers” but does not clearly link the knowledge to a broader food system meaning.

Table 3. Overview of subjects that are taken from the Swedish curriculum that connect to a broader sense of food (derived from Skolverket, 2018)

Subject	Content	Year 1-3	Year 4-6	Year 7-9
Biology	Nature and society	Simple food chains describing the relationship between organisms in ecosystems.	<p>People’s dependence on and the impact on nature and what this means for sustainable development. Ecosystem services, such as decomposition, pollination, and purification of water and air.</p> <p>Life of animals, plants and other organisms. Photosynthesis, combustion and ecological relationships, and the importance of knowledge with regard to agriculture and fishery.</p> <p>Ecosystems in the local environment, relationships between different organisms and the names of common species. Relationships between organisms and the non-living environment.</p>	<p>Impact of people on nature, locally and globally. Opportunities for consumers and citizens of society to contribute to sustainable development.</p> <p>Energy flow of ecosystems and recycling of materials. Photosynthesis, combustion and other ecosystem services.</p> <p>Biological diversity, and factors threatening and favouring this. Public discussions on biological diversity, such as in the relationship between forestry and hunting.</p> <p>Local ecosystems and how they can be studied from an ecological perspective. Relationships between populations and resources available in ecosystems. The local ecosystems in comparison with regional or global ecosystems.</p>
Home and consumer studies	<p>Food, meals and health</p> <p>Consumption and personal finance</p> <p>Environment and lifestyle</p>	<p>Choice and use of goods and services in the home, and how they impact the environment and health.</p>		<p>Issues to consider when choosing goods and services, such as the purchase of clothes, food and travel from the perspective of economic, social and environmental sustainability.</p> <p>How food and other goods are produced and transported, and how they impact the environment and health.</p> <p>Current societal issues concerning personal finances, food and health.</p>
Chemistry	Seasons of the year in nature	Simple food chains describing the relationship between organisms in ecosystems.	Conversion of materials through cultivation of raw materials to products, how they become waste which is handled and returned to nature.	
Geography	Living in the world	Environmental issues in relation to pupils’ everyday life, such as those involving traffic, energy and food.	How choices and priorities in everyday life can impact the environment and contribute to sustainable development.	Conflicts of interest over natural resources, such as access to water and land.

4.1. Reframing curriculum

Schools are part of a multi-faced institution that encompasses economic, political and social structures, with “[e]ducation [being] a central element in the public biography of individuals, greatly affecting their life chances” (Meyer 1977:55). Changes made in curricula can be of a reactive or proactive nature. This implies that changes in the study programme are either made because of external events such as climate change, or because foreseen challenges are counteracted and mitigated through initiated transformation of the curriculum (Ovens et al. 2013). Regardless of the changing drivers, when modifications are made, it is not only the students who have to adapt but also the teachers that need to be open-minded and skilled to be capable of performing under the new settings (ibid.).

Altering the programme of study is not negligible. As argued by Ovens et al. (2013:18) “pervasive attractor of the status quo, business-as-usual culture is not easily bifurcated”. What they mean to describe is a school environment that is strongly driven by a paradigm that makes use of traditional teaching and learning approaches such as one-way teaching that require listening, memorisation, and reproduction of content by the students, and which is not easily altered. However, those traditional learning methods are not suitable for all students nor do they foster FSE that benefits from experienced based and interactive learning methods (Francis et al. 2011; Hilimire et al. 2014; Day et al. 2022). Integrating FSE in school curricula “can create new spaces of learning that support core skill development [...] essential for future leadership in addressing the myriad challenges for global and local food systems” (Hilimire et al. 2014:740).

Changes made to the curricula need to include an involvement of people that are part of the schooling systems such as parents, teachers, administrators, and other relevant professions (Hilimire et al. 2014). As efforts are made to integrate FSE into the Swedish school curriculum, teachers need additional time to prepare themselves and to adapt new learning approaches. It is therefore important to keep the duration of necessary training session short but rather review and revise the experience to be able to consciously adapt to the needs of teachers and students. This in turn requires support and possibility for dialogue throughout the whole period of change (Salomonsson et al. 2009). Stinson (2010) suggests a so-called “cross-curricular approach” embedding FSE throughout the school years and within different disciplines. The author highlights the benefits with education that gives students the possibility to not only engage in FSE but to create meaningful learning experiences throughout the schooling period that yield in crucial thinking skills.

5. Results

This chapter illustrates the findings obtained from the seven semi-structured, in-depth interviews with teachers educating at the compulsory school level in Sweden. The different sections that are presented in the result chapter are based on the themes which were the results of the analytical process (see Table 1).

5.1. Teachers' perceptions of FSE

The interviewees had quite similar views on the current state of FSE in Swedish public schools. There seems to be consent that important aspects of food systems are being taught throughout the different years of school. However, food education is not viewed as an all-encompassing study topic but more applied as chunks of knowledge depending on the subject and grade. The responsibility of the teachers is to include content that is stated in the curriculum. Thus, a sustainability aspect should be considered for almost every subject, though there is no clear statement about how this should be achieved. Teachers are engaged to “embed those parts about health, environment, social and economic aspects related to food as good as possible” (T5) while T6 stated that it is important to not push the students towards an awareness of food and sustainability but to help them see those fragments themselves. All interviewees mentioned that there are great differences on how the curriculum is interpreted by the teachers and thus how food education is being communicated.

5.1.1. Diversity of food lectures

After asking the interviewees about how an example of a lecture, where the class talks about food could possibly look like, the answers were diverse.

According to T3, the class would start by talking about the historical background of food and food production, how it all started locally and how things became more globalized. The same teacher would cultivate own vegetables with the class to learn more about the production of food.

T5 would have a similar approach by starting with the basics, how plants grow, where they grow and why they are cultivated in a certain way. It is then really depending on where the focus of the lecture is lying, not all lectures would have emphasis on the sustainability aspects connected to food. The pupils can furthermore steer the lecture themselves, depending on the interests and motivation.

All teachers seem to talk about certification and labelling such as the Swedish eco label KRAV and fairtrade, a global sustainability label. This course content is also very specifically stated in the curriculum (Skolverket 2018). In this context the class would talk about different areas connected to food. Especially environmental but also social characteristics of food production, and what it means for Swedish producers and consumers to support Krav-production. Several teachers stated that the social aspects such as inequalities generated by the food systems would otherwise not be covered as much as the environmental issues. T2 emphasized that “there are a lot of discussions going on about chicken being environmentally friendly, but there is not so much talking about how bad chicken actually have it and I think that is really, really important to highlight”. The same teacher articulated that there is not enough time to talk about the whole value chain of food but that it is still important to put emphasis on the whole picture if possible.

5.1.2. The connection of food to different disciplines

There is much focus on children’s capabilities to learn about food in relation to its health aspects. T4 describes how they would talk about the different nutritional aspects of food, like carbs, proteins, and fatty acids and how they impact one’s body. They would furthermore talk about the digestive system and how different enzymes are absorbed. They describe the biology lessons as rather technical, though discussions about the environmental impacts of certain foods is getting incorporated if possible.

T1 stated that it was important to “discuss the obvious”, meaning that one talks about what children have on their plates for lunch. The teacher and children would for example talk about where the rice is coming from and how it had been produced. T5 expressed the need for children to learn about the preparation of food that are in season and to show them that they have a choice to reduce package materials when they prepare food with natural ingredients. “Many of the pieces that generate a broader picture of food go hand in hand with the topic we talk about such as the importance of seasonal grown food” (T5). T6 articulated that food discussion are also emerging due to current political situations which can lead to the fact that

certain food topics are put lastly. “Maybe food talks are not first on the list, because we primary need to know where the energy comes from to produce food” (T6).

Economy is also an important aspect of the food chain and noticeably part of the curriculum in various ways. T1 noticed that children are keen to know how much money they would save by decreasing their food waste for example and how much food they could get for a certain amount of money.

5.2. Children’s level of knowledge and ability to transform food systems

The responses of the participants highlight the different levels of knowledge and engagement that occur between different children. Surely children who already engage in own grocery shopping activities are more involved compared to children that just started to connect their own eating to a broader meaning. However, when asking about the level of excitement of food education, teachers agreed that most of the children regardless of age, are excited to learn about food topics. They are interested to learn not only about the nutritional aspect of food, but also about the production, transport and consequences that food has on social and environmental systems.

5.2.1. Differences in family backgrounds

T4 claimed that they experienced an increase in children that are following a vegetarian diet and that those children are usually more informed. “They have taken a stand to something and maybe talk more about the circle of food within their own families” (T4).

Other examples were given by T1 who stated that in their school it was common to have children coming from farmer families. Those kids usually have more knowledge about the production of food and can spur other children. The teacher imagined that discussions about food in a class resulted in students that were:

becoming so well-informed about what they shove into their mouth, that they started to discuss with other children about why they did not take protein, saying that they can not only take carbs which further ended in a discussion about why they would not build up muscles by only eating carbon rich food (T1).

However, regardless of the children's background it is also important to realize that each class has a different team spirit and connection to their teachers. "Some classes are so easy to handle, and others are more chaotic. There is a lot to consider" (T7).

5.2.2. Food literacy in children

Several teachers noted that there are children that are not interested in food related topics. They evaluated that it could be connected to their family backgrounds such as not having grown up with a broader interest in food and simply consumed and ate what they got served. However, according to the teachers that number of children is rather small.

Already children in grade five are quite knowledgeable about certain aspects of food. They have for example heard about climate change and know to some extent how one can influence these happenings by, among others, reducing meat consumption. It is important and possible to adapt the level of complexity depending on the age of the children. There is something to learn and teach about food for every age group. The importance lies upon "the preciseness and that they are allowed to do things and be able to influence stuff themselves" (T1).

In one interview the aspects of children's' attitude towards home and consumer studies were highlighted:

"When they come to my subject, they don't want to talk about the theoretical backgrounds, they want to be there and prepare food. That is different from when they go into a history lecture where they know it is going to be theoretical" (T2)

T5 shared the experience that a mixture of theory and practice was the winning concept. "It is like a small reward for the students after each theoretical part some more practical and fun activities are following". That is why this school extended their home and consumer lecture hours to 120 min instead of 60 min, which gave them the possibility to have interactive classes where children get the opportunity to express their interests in food in a more comprehensive way.

Sometimes you have an idea about what the lecture will look like, but the pupils are interested in something completely else, so we start talking about other things. It is good to focus on areas they pay attention to since the chance is higher that they will get caught up in it (T5).

However, many teachers put emphasis on the need to educate the children so they can make good choices around food that are beneficial for themselves but also for

their surrounding environment. “Children should be conscious about their impact [on the environment and society], they should be active participants and realize that they have choices” (T5). T6 framed it as: “they should become aware consumers that know about the consequences of certain food”. T7 called it “consequence-based decision making”.

5.3. Learning methods and pedagogical approaches to FSE

Experience-based learning was seen as important by all the teachers interviewed. Children are usually tired of all the theory they learn during a regular school day whereas food education usually comes along with great possibilities to integrate interactive parts. Teachers expressed the value of cultivating vegetables and herbs with their students as well as to prepare and discuss food in various ways.

5.3.1. Common materials

Ordinary schoolbooks, lessons in form of PowerPoint presentations, short movies, YouTube clips and the digital platform Binogi were used among others, to educate the children in the matter of food. Fairtrade, the Swedish- food, agriculture, consumers and nature agency was named among others, to support teachers with good learning material. T1 found it helpful especially for the younger children to “instead of buying books that one is stuck to”, it is fun to let them write and thus formulate their own thoughts in a little report. T5 referred moreover to a Facebook page where teachers for home and consumer studies would share learning materials and inspiring teaching tips with each other.

Overall, the teachers appreciated the freedom to collect and choose material themselves, which they thought are suitable for the lessons.

5.3.2. Study visits and community-based approaches

T1 stated that the school participates on Skräpplockardagar (garbage collecting days) which is an initiative of Håll Sverige rent (Keep Sweden Tidy Foundation)¹. The participation in garbage collection days were expressed to help creating general awareness about the waste issues that are connected to fast-food and packaged food items. The teacher would additionally talk about these challenges in class. T1 also initiated competitions, where the class with the least amount of food waste during a specific period of time would win a basket with fruits.

Some teachers stated that excursions are an inherent part of the curriculum, thus the school would visit a farm every year, visit a waste facility or be part of a baking day in a bakery. However, most of the teachers articulated that those practical school trips were way too seldom and usually affected by the lack of time and organizational effort. T5 stood out by saying “everyone seems rushed by time. If you ask a colleague if you could borrow their students for a study trip the responses are usually not that positive”. This is mainly due to the requirement to cover certain content in a subject until the end of a school year. It was also mentioned by several of the teachers, that they had the feeling, that study trips have become more unusual the older the students get but agreed, that it would be as supportive for the older pupils to have study trips. All teachers said that they would try to get different actors of the food industry in the classroom as often as possible. One teacher pointed out, how much value it would give to the regular lessons and how beneficial it is for children “to see how it looks outside of our school doors” (T5). Several teachers were making use of players of the food industry that are closely positioned to the school environment. T6 wondered and occasionally discussed with the class about things like: “what happens if we only buy tomatoes from Trelleborg, how does that affect the environment and local economy?”. Similarly, T7 mentioned a company which is located close to the school, that grows salad, herbs, and tomatoes in an environmentally friendly way. The teacher stated that the company is not only beneficial as they serve as a field trip location, but also to open up discussions around local food production.

Some teachers pointed out how children in the younger classes enjoyed engaging in role play, which they did when they talked about banana production. Some children were the plantation owner, others were the producers or wholesalers. The students had to decide how much money each of the actors should get. This type of approach to learn new things helped them spark deeper discussions about food that they would not that easy forget. However, T7 highlighted that one should not underestimate the extra time needed for a good preparation, in contrast to normal lessons. Otherwise, it could happen that the students are confused and are not able

¹ More information about this initiative can be found on the following webpage: <https://hsr.se/skrapplockardagarna>

to put themselves in specific roles, which is necessary to use role play as an effective learning method.

Overall, more experienced-based, practical approaches were seen as a “fun” and needed diversion to the more one-sided lessons. Many teachers raised the importance of creating “independent thinkers” and that experienced-based learning opportunities were an effective way to make the children capable to think by themselves.

5.3.3. Usage of system-thinking in the classroom

The last part of the interview sought to understand how teachers are making use of ‘system thinking’ or, if even understood in the context of food education. On the one hand, system thinking as a concept was not entirely recognized by all of the participants. T4 stated for example that they do not have something called ‘system thinking’ in their curriculum. However, when they continued explaining how they were discussing the production, environmental consequences, advantages, and disadvantages of the food that is lying on children’s plates, they realized that that was partially what was meant by system thinking. Some were realizing that a lot of what educators refer to as system thinking is done unconsciously. However, not all teachers may have the competence and knowledge to “always merge the different parts of food education to engender a holistic picture” (T5). Even though, most of the teachers claimed that they were trying to do so. T3 summarized what other teachers articulated similarly: “it is up to the teacher to combine the important aspects related to food and combine them to each other”

On the other hand, critical thinking was named important by several of the participants. T3 were emphasizing that children should learn to find information about different food labels and their origin by themselves. They further stated that there is a great need to remind children to be “critical about any information they receive, especially when browsing through the web”. To critically question any type of material is also strongly indicated in the Swedish school curriculum (Skolverket 2018).

5.4. Teachers’ capabilities and competences

All teachers interviewed were agreeing on a diverse level of both quality and quantity when it comes to food related topics. The interviews revealed that this is partly due to different capabilities and competences of the teachers. As stated by T1: “Food system education is only partly integrated in the curriculum and therefore

highly dependent on the teacher who is educating the children”. The meaning of having supporting teaching material available as well as having the ability to interpret the curriculum individually, was stated as important.

5.4.1. Teachers’ interpretation of the Swedish school curriculum

There seems to be great differences in what is being thought and how. The curriculum allows for personal interpretation of the content that needs to be transferred to the students. If children should learn about food as an item that wanders through different stages and has influence as well as becomes affected by various aspects, one must be able to find suitable material and create own lessons that gives children that holistic view. There are several parts in the curriculum that connect to different areas related to food, but it is not clearly to what level nor how the information should be transmitted.

T4 acknowledged that even though one should consider sustainability aspects in every subject that is being taught, one can not be sure that this means that all teachers take it into account. They also stated that one relies on other teachers to include specific learning objectives, without having a conversation if that is actually the case.

They said that:

One hopes that the teacher for natural science covers a certain aspect and the social science teacher another, but it is quite seldom that one discusses with other teachers about who does cover what. So, one is not always aware of concrete aims when it comes to food education. But yes, it is surely depending on the teacher, there are subjects one is more passionate than others (T4).

Similar concerns were expressed by T7 saying that it could help to clearly connect the pillars of sustainability in the curriculum to make sure that all teachers in their subjects are able to link different content to each other and across disciplines. Several teachers stated that if the knowledge around food is supposed to be equally present among the students at the end of the compulsory school, it would maybe be beneficial to have more concrete aims and objectives that lead to a more consistent food education.

T3 stated that:

Even if it seems good by looking at the curriculum, it is completely up to the teacher and which kind of opportunities they have. There is nothing wrong with the curriculum, everything can be taught perfectly relating to what is stated in the curriculum, but it could also be taught really really bad, sparse. It depends also much on what kind of supporting material teachers have available. If I haven't had the material that is provided by Grönsaks målet I could not teach as well as I do it now.

T5 highlighted the positive aspects about the curriculum, allowing the teachers to interpret the leaning content by themselves, even though some aspects could be helpful to see more distinctly stated.

However, one thing stood out among the teachers. Food can be a fun topic, food education does not need to be boring nor solely theoretical or as T6 puts is: "everyone has to eat" so they should be some kind of interest to do it the right way. The interviews revealed the need for more guidance especially when it comes to food education which should embed sustainability aspects. However, the freedom of designing own lessons in respect of one's own and the classes interests were viewed positively.

5.4.2. Different ways to engage in food education

Teachers' capabilities and competences impact how children are taught about food, how they experience food in a system approach, and how they learn to connect food to sustainability issues.

"Grönsaks målet"² (the vegetable goal/meal) is a competition available for all five graders attending Swedish schools. The competition is partly funded by the EU, while the competition itself is planned by a group of Swedish vegetable producers that are responsible for several initiatives within the Swedish market. The competitions aim is to get schoolchildren to eat more vegetables. The competition consists of three main parts: education, preparation of food and cultivation of cucumbers. The winning price for the class that completes the most, lessons, recipes and grows own vegetables wins a monetary price of 25 000 Swedish crowns (Grönsaks målet 2022).

T1 acknowledged that a special motivation stemmed from those teachers that were part of the environmental school department. Teachers involved in this council had the possibility to participate in special training days and learn about pedagogical approaches on how, for example, communicate global warming challenges and

² Further information can be found on the following webpage: <https://gronsaksmalet.se/>

food production. Personal motivation and passion in general were acknowledged as important. T7 talked about their traveling and linked passion for the rainforest. It would both lead to more conversation with the class about challenges connected to rainforest logging and palm oil cultivation but also help the children to better grasp the bigger picture of food systems.

The location of schools was viewed as another factor that determines the availability of resources. T6 school is located in Trelleborg, which is the south of Sweden. It became clear, that due to that position, the school is located in a hotspot of food production, especially for Swedish standards. Children that are being educated in this neighborhood have at least more opportunities to see with their own eye's what food production means. "There is no one in this school that does not know a farmer" (T6).

To summarize, the Swedish curriculum leaves a lot of space for interpretation and own structuring of the class. This is partially viewed positively by the teachers in terms of not being too constrained in how the school lessons will be designed. The risk of not being able to bring together all the food system related topics that are taught in different subjects throughout the school years is being observed. A lot is determined by the teachers' motivation, experience, knowledge, access to teaching material and not least, geographical position. A recurrent theme in the interviews was a sense amongst interviewees that the lack of time is one of the most prominent limiting factors. Not being able to manage the subjects that have to be covered during a school year was one of the biggest concerns.

5.5. Opportunities for FSE in Swedish schools

The opportunities and fields which can be explored to strengthen the school education that is concerned about food and its systems are various. Some teachers are naming prospects that could possibly be integrated in a broader context and along the different school grades. The Keep Sweden Tidy Foundation (see 5.3.2.), is one of the NGOs that create awareness about waste and environmental issues. School classes can participate and for example compete by collecting garbage in their surroundings. Another initiative that is driven by this foundation is an international eco-school program that gives schools and their communities the opportunity to hold a license that reflects the sustainability development work they are doing. In Sweden this license is called Grönflagg³ (green flag) and the aim is to engage children to become sustainability agents with a great experienced-based

³ More information can be found on the following webpage: <https://hsr.se/gronflagg>

learning focus. The teachers are getting support in form of teaching material and inspiration. This type of education is focusing on the sustainable development of any sector and thus does not focus solely on food, though it strongly integrates it.

Several of the teachers acknowledged the competence of the kitchen staff that works in the schools to daily serve lunch to the children. Thus, it happened that the kitchen staff was interviewed by the children about the journey of the food on their plate. T4 reported that the canteen would measure the food waste that would be thrown during a day. The children could see the number on a screen. T1 even expresses that:

It would be a good idea to integrate the kitchen staff, when time allows, to discuss food with the children. To bring them into the classroom. They know a lot and children would learn through the food they get served by the person that prepares and serves the food (T1).

The “grönsaks målet” (the vegetable goal/ meal) creates another opportunity to deepen the understanding of the production, preparation, social and environmental consequences connected to food. This study program and learning opportunity provides the teacher with teaching material and integrates food education in more unusual subjects such as Swedish and Math. Unfortunately, as for now, this educational program is only available for five graders.

T1 pointed out that they would write weekly letters to the parents to inform about what the class had been learning and discussing about. According to the teacher, it was seen as a suitable tool to move food related talks to the homes of the children. Parents were describing that their children were excited to share what they had learned and that it would lead to discussions at the dinner table, on for example, the consumption of Swedish raised chicken.

Discussions were mentioned as good opportunities to intensify the knowledge connected to food as it is lively and not too monotonous. This was stated by several teachers. “It is fun if a group can dive into a topic and share with others what they think” (T1).

In response to the question: ‘How a dream lecture about food could possibly look like?’, a range of responses was elicited. One teacher stated: “Maybe one could face-time with someone who lives in a completely different country, with other circumstances, what do they eat, how do they produce their food and so on” (T2). The possibility of having several actors of the food business involved in the classroom was also regarded as valuable by T4: “To be able to complement the own teaching with someone from outside, so that one has several actors, that leads to

more lively experiences for the children, maybe a grain producer or dairy farmer for example” (T4). Being able to have lessons that promote long-term learning was agreed as one of the greatest desires among several of the participants. Talking about this theme T3 indicates that:

it is good if you have time to cultivate vegetables and make a recipe out of it, so you use something you have created yourselves. This means not only a lecture but something that last in the student’s heads (T3).

To make lessons somewhat longer, exceeding the regular time span of 60 minutes was described as helpful by T5. This gives the ability to integrate both practical and theoretical learning approaches that support food education. In general, it was expressed as wishful to get more time dedicated to home and consumer studies. This was voiced with a discontent towards the space that gets devoted to music and art.

T5 describes the benefits of potentially having a national test in home and consumer studies, which is not the case at this point. They speculate how “fun it would be to have the national test in every subject. It would be exciting to see how the students are competing against other schools.”

All together, these results provide important insights into Swedish public schools on how teachers talk about food, what their perceptions and concerns are and how children are handling food related topics.

6. Discussion and analysis of research results

The following chapter discusses the material extracted from the interviews in light of the theory presented earlier. With help of the concept of food literacy, the results will be analysed, discussed and brought up to a more general level.

The results obtained from the interviews indicate that food education is only partially integrated in the Swedish school curriculum. This means that relevant aspects are already in place but need to be revised and adapted in order to reach food literacy in school children. The teachers' perception of children's ability to learn about food systems is differing depending on their background and own motivation to learn about food. Additionally, the team spirit of the class is very important to make complex toppings catch the children's interest. The teachers voice, that it is vital to not push content through, but rather to let the pupils steer the lessons themselves, questioning, what does catch their interest and what is on their mind. It was also revealed that teachers like to have the freedom to choose material themselves and to design their school lessons as they enjoy. This indicates that the curriculum leaves room for interpretation especially when it comes to sustainability questions. In this context, the variety of methods and pedagogical approaches that were used by the teachers to educate about food were ambitious and diverse. Critical thinking as well as consequence-based thinking were seen as important tools to prepare the students for complex settings. System thinking was not directly used as a concept but rather indirectly as it naturally goes hand in hand when talking about food system activities. Lack of time was seen as the biggest concern. Furthermore, troubles, to not be able to cover other content of the curriculum, led to challenges in discussing the whole food value chain. Most of the teachers however, claimed to try giving the children a holistic picture of food. The teachers' agreed that food is a fun topic that does not necessarily need to be taught in a boring way. The teachers mentioned various opportunities to make the lessons around food more interactive. One aspect that stood out was the desire to invite more food actors into the classroom to show children different angles of the food industry. The aim is to have children being long-term learners who can critically think and actively make sustainable choices for themselves and the environment.

An overview of the results is visualized in Figure 4 and further discussed in the following sections.

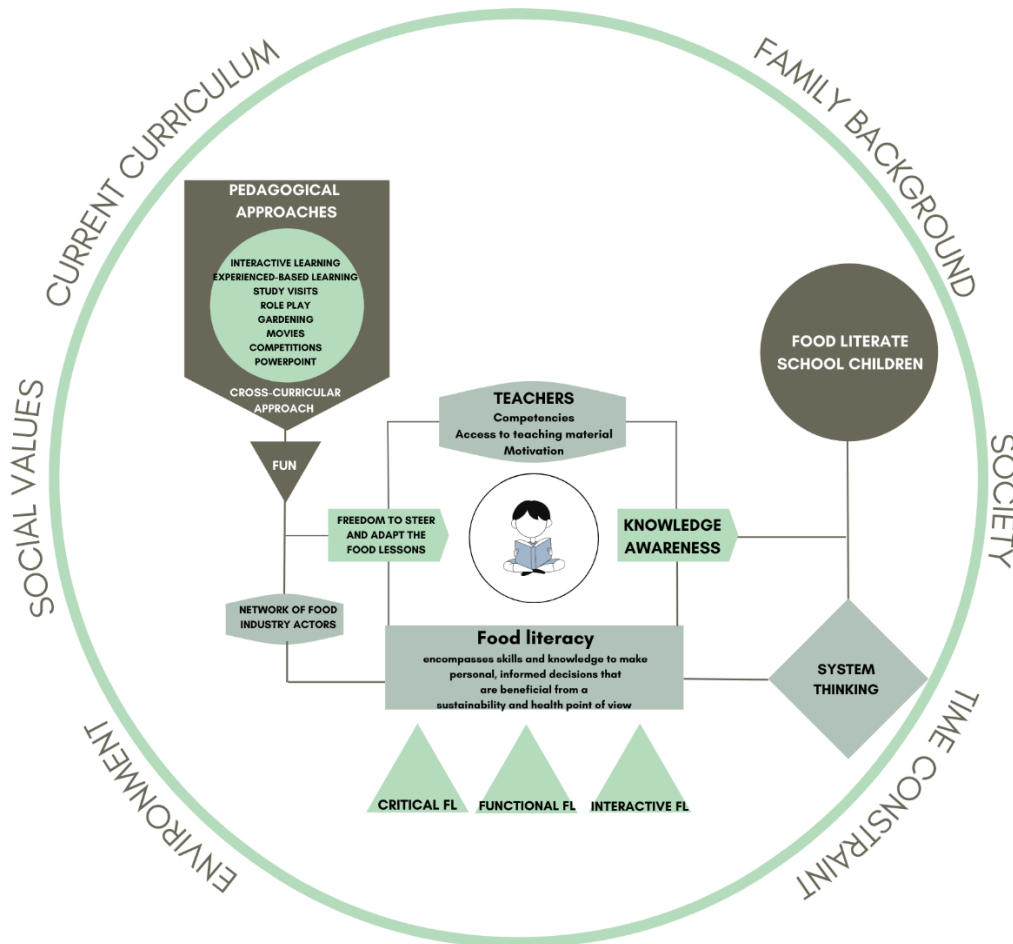


Figure 4. Food literacy in Swedish public schools: Adaption of the food literacy dimensions (Francis et al. 2011) and combined with the results obtained from the interviews

6.1. Food system education in Sweden’s compulsory school systems

One aspect that is worth noting when examining the Swedish school curriculum, is the inconsistency in subjects that relate to food in a broader meaning. Especially for the subjects of chemistry and geography, a decrease in food related topics appears with an increase of the grade of school. While year’s 1-3 begin with relevant content such as “simple food chains [and] the relationship between organisms in ecosystems” (Skolverket 2018), it is not clearly developed in other years of teaching. Grade 4-6 discusses “how choices and priorities in everyday life can impact the environment and contribute to sustainable development”

(Skolverket 2018). Giving the last example, it is not even clear if food is part of this content. It seems like food education becomes more abstract and thus more dependent on the teacher that is educating. Especially food in relation to social aspects is being neglected and often put last. However, food labeling as one example is clearly stated as content in the curriculum and thus was mentioned by several teachers.

It appears that the Swedish school curriculum is touching upon topics that are highly relevant for FSE. It is, however, difficult to estimate how teachers are connecting the different fields of knowledge to enhance a greater understanding of the connections and relations of different food system compounds. The interviews highlighted the diversity in teaching methods and food content. The vague expression of food topics connected to sustainability in the curriculum gives the teachers great possibilities to interpret and perform the teaching as they are pleased. This can both lead to positive and negative consequences for the teaching quality. While for some teachers this independence of expressing their own ideas and creativity can be an advantage, other might have difficulties to teach food in context of a holistic picture. The risk is that food topics are seen as individual components rather than being part of a larger system. This can be frustrating especially as children become older, understanding that they are part of a greater system themselves (Salomonsson et al. 2009). However, in order to embed social, economic and environmental aspects, as well as the more technical teaching subjects such as chemical compounds, biological agents connected to health and food, time, competence and experienced based learning approaches are needed.

The Swedish school curriculum gives the impression that practical learning experience is of interest for several subjects. However, it does not seem to appear to be a requirement for the schools (Skolverket 2018). Interestingly, while the use of learning methods is described in the biology syllabus, it is not observable for home and consumer studies. In the case of biology, students learn through field studies, experiments, and different types of documentation both in paper and digital form, including the critical assessment of information. It seems to be up to the teacher to engage with other actors and to plan field trips for the class. In case of home and consumer studies the practical work is happening in the classroom as the students learn to prepare food for themselves (Skolverket 2018).

Practical learning opportunities were also voiced to be of great importance to all of the interview participants. This is in line with Nadelson & Jordan (2012), who found that field trips, especially if including hands-on activities, do have a positive impact on the learning outcome of students. Many teachers are already making great usage of their location, providing the possibility to visit local producers or food companies. Furthermore, teachers described that gardening activities, role

play, or zero food waste competitions are a fun and interactive way to attract children to food education. This is in line with numerous researchers that describe direct exposure to food system segments to be beneficial for various reasons as it facilitates abstract learning fragments to become more holistically approachable. Thus, it helps to connect diffuse concepts and theories of food producing systems to more concrete life settings (Hilimire et al. 2014; Valley et al. 2018; Day et al. 2022). This includes a critical interpretation of the sections that they can positively and sustainably alter themselves (Francis et al. 2011).

Time was expressed to be a prominent limiting factor. Nevertheless, generating the ability for children to become food literate does not mean that all the aspects connected to the food value chain do need to be taught in every single lesson. This would clearly be overwhelming nor possible. It would be both stressful for the teachers and ineffective for the children. What is needed is a so called “cross-curricular approach” (Stinson 2010:24). For the Swedish schools this would mean, to first of all, benefit from things that are already in place such as home and consumer study lessons, school gardens, educated kitchen staff and local producers. The teachers agreed that food is a fun and inevitable topic as everyone has to eat. Food education can be embedded into different school grades and across different disciplines. Why not use the history lessons to talk about conflicts that emerged due to droughts and that jeopardize food safety? Or what about calculating with numbers connected to food waste? There are various occasions in which one can talk about food (Stinson 2010).

6.2. Challenges and opportunities in FSE

Food systems are very complex and have heavily changed during time. Ericksen (2008:234) determines the main societal outcomes of food systems as “food security, ecosystem services and social welfare”. The food system in general is being shaped by interactions on a biophysical level, the actions that are needed to produce food themselves, their outcomes, drivers, and determinants. On top, relations occur between the various activities and actors involved that behave on different grounds and scales. Feedback loops and trade-off need to be considered. This means that for teachers that are engaged in food education it can be challenging to both understand the highly tangled web of food system activities themselves as well as having the competence to teach it to the students. It is recommended by several researchers to use a so called “system approach”, especially when it comes to sustainability and food (Francis et al. 2011; Wiek et al. 2011). The aim of system thinking is to grasp key factors that have a great impact on the ramifications of food producing systems, which are both ambiguous and hard to predict. In order to make

it easier for learners to understand that they are part of a greater system it is important:

to describe and analyze not only the component parts and actors, but the interactions among these parts and actors that produce variable outcomes. A goal of the system's description is thus to explain the patterns of interactions among the activities, external drivers, and the outcomes, so as to fully assess any emergent properties, as well as cause and effect (Ericksen 2008:243).

However, when assessing the Swedish curriculum, it appears that system thinking is not included as a core theme in the syllabus. Yet, the term 'systematic' can be found in different subjects, especially referring to working methods. Though, as expressed by Jordan et al. (2014) systematic working or thinking should not be confused with systemic or system thinking but rather seen as a complement. Systematic thinking is focusing more on the understanding and solution seeking with help of a profession and its associated methods, common for that specific discipline.

Regardless, these approaches need training and good allocation of resources and learning material. As stated by the teachers, a lot of the system thinking activities are more like a collateral-learning experience when talking for example about the Swedish KRAV label. If the curriculum is ought to be adapted to more concrete learning goals that foster system thinking, it should in any case be done with great consideration of the teachers' and students' capabilities (Ovens et al. 2013). It can be difficult to create a shift and to alter structures that have been prevailing since many decades, especially since they have been dominant due to efficiency reasoning (ibid.) Furthermore, younger children may have difficulties to understand the various boundaries that constrain different systems as well as to comprehend the hidden mechanisms (Feriver et al. 2019). It is therefore crucial to adapt the level of complexity according to the age group and knowledge background (Evagorou et al. 2009). As some of the teachers acknowledged, the children are usually capable of understanding and becoming fascinated by complex systems once it has caught their interest. It was therefore voiced as important to let children steer and influence the lessons themselves.

6.3. Food literacy as a concept to embed FSE into the Swedish public-school curriculum

Even though FL can be seen as a type of health literacy (Krause et al. 2018), FL encompasses a broader range of concepts. The focus does not only lie on dietary aspects, but also on food systems, cultural aspects, and the enjoyment of food. The

aim is to foster skills that help to make personal decisions that are beneficial for the people and the planet (Truman et al. 2017). In order for children to become food literate, they should be knowledgeable within different dimensions. Functional food literacy skills are based on fundamental skills that allow to access and evaluate information connected to food. This requires basic food knowledge around for example nutrition, hygiene and transport (Slater 2013). Children in Swedish schools are getting the opportunity to learn about these aspects through biology or home and consumer study lessons. Some of these lessons might be quite technical and theory based, as some of the teachers expressed. Interactive FL encompasses the preparation of food and furthermore aims to equipped students with the ability to make well-informed, sustainable, and healthy decisions (Slater 2013). Home and consumer studies consist of cooking classes and health education. Teachers communicated how they put great effort in explaining students the differences between Swedish and foreign produced food. Content about labels such as KRAV and fair trade are part of the curriculum and thus have been discussed in various ways (Skolverket 2018). Critical thinking as the third dimension of FL (Slater 2013) was well established among the questioned teachers and clearly stated in the curriculum. Several teachers said that children should understand that they are part of a greater system and that their choices affect the environment. Lastly, system thinking and thus ability to realize and connect different patterns and processes within the food systems are more vaguely approached in Swedish schools and highly depend on the teachers' capabilities to communicate and crosslink. It is probably difficult to estimate if there are countries that do have a clear system thinking approach embedded in their curricula, as it can be different depending on the school's personal aim and the motivation of the employees. However, schools with a great focus on sustainable development, usually have a deeper connection towards problem-solving and system thinking approaches (Feriver et al. 2019).

There is a great risk that children, especially in younger ages, do not understand the linkage between the purchase of food, preparation and impact on larger systems. It is important for children to realize that their choices affect among other their well-being, the way their food gets transported and thus affect the environment and further global warming. Otherwise, there is a great risk that children see food as a commodity, disconnected from a system. It is crucial to have children understand that the production of food is jeopardizing people and planet, but that each consumer has the power to influence and transform the food system to a more sustainable one (Calabrese Barton et al. 2005). Many of the teachers claimed to endeavor a holistic picture of food whenever possible. However, several of the participants expressed the wish for more clearly stated learning objectives.

6.4. Recommendations

The results in combination with the theory allow for some recommendations that could possibly help to foster food system education at the level of compulsory schools in Sweden.

To begin with, there is a great need to connect practice with theory. This is in line with Hilimire et al. (2014:740) who state that a student should “both [be] participant and observer, forming the basis of meaningful learning”. Especially for food education this can be really rewarding both for the teachers and the students. It could be beneficial to start the lecture with some theoretical knowledge in form of movies, reading assignments or short presentations and to use the second half for more practical exercises such as gardening or the preparation of food. In this case, students are looking forward to the interactive part, as it is usually more rewarding while higher levels of concentrations are attained for the theoretical part. However, in order to both have theory and practice combined as often as possible, the period of time for home and consumer studies need to be extended. The principal of each school usually has the possibility to divide the lecture hours individually (Skolverket 2018). As for now, usually more time is dedicated for Art and Music lessons. Experienced-based learning is one possibility to connect theory with practice. Making learning activities more accessible for the schools is one challenge that is faced by many schools. One possibility could be to ask local producers or food companies to come visit the school. Nevertheless, some schools are not as beneficial located as other to make use of these offers. It is therefore necessary to build up networks of actors in the food industry that are willing to engage with school classes. This is quite common on university level, as guest lecturer are a favored alternative to prepare students with farsightedness.

Secondly, teachers seem to like the freedom of choosing their own material and design their lessons according to their preferences. This is beneficial as both the teachers can express their own ideas and adapt according to the constitution of the class. The suggestion is therefore to keep the breadth and freedom for teachers to interpret the curriculum as well as possibility to shape lessons individually. However, since this freedom could lead to great differences in the quality of lessons, one could consider more concrete aims and learning objectives. Those can be flexible for example: children should be able to explain a simplified version of a food value chain of a product of their choice by the end of grade six. One could then complexify the steps that are influencing this chain as inputs, outputs and tradeoffs, with an increase in age. The need to continuously adapt the level of complication was also expressed as important by Evagorou et al. (2009). The curriculum should also help to guide the teachers on how sustainability could be

embedded within the subject of food. The content should make the children reflect on their own actions and help them to critically discuss the impact of their choices.

Thirdly and in accordance with the present results, Stinson (2010) demonstrates the importance to use a cross-curricular approach in order to connect food with sustainability, critical and system thinking. This approach is already in practice in programs like the “grönsaks målet”. These programs are not only interesting for five graders but should be applied on a general level. This gives children the possibility to engage with food topics throughout the school years and disciplines. It provides them furthermore with a holistic view on food. By means of this, children will also discuss food with a range of teachers which additionally can increase their perspectives on food. In any case, teachers need to be provided with good access to learning material and platforms. They should also be given the time to prepare for food educating lessons.

Fourth, while critical thinking seems to have established a place in the Swedish curriculum, system thinking seems to be more abstract and varies with the teacher and their ability to tie relevant parts of the food system with each other. Thus, it is much up to the teacher to connect different fields to generate a holistic picture of food. It should therefore be considered to offer trainings and materials that enhance the teacher’s capability to teach complex settings. One possibility could be to engage teachers to make use of their own school environment and resources to create creative leaning spaces that nurture children’s imagination and learning skills. The importance of outside teaching and the usage of, for example school gardens as an addition to more conventional class lessons, have been shown to strengthen children’s ability to make new experience and to enhance the possibility for more lively discussions in class (Mårtensson & Fägerstam 2020).

Lastly, educators and teachers should remember that when it comes to sustainability challenges, it is tremendously important to spread hope and not let children wind up in a negativity spiral, make them feel like it is too late to change their future to a better. Teachers should act as role models and give examples of how each student can positively impact and sustainably transform food systems through their personal choices.

6.5. Suggestions for future research

In consideration of the limitations that were mentioned before, further research is needed to understand which differences appear in the different age groups of school children concerning the ability to grasp complex setting. As pointed out by Feriver

et al. (2019), supportive learning methods that enhance students system thinking skills are an emerging field of research. The results from the interviews also reveal the need of additional material to educate food as a holistic subject. It would therefore be interesting to assess which kind of material and training is needed. The present study underlines the importance to evaluate how teachers could cope with a cross-curricular approach, involving food actors, educators, parents, and dietitians. Lastly, one potentially could consider national tests for home and consumer studies as it is done for the main subjects in Swedish schools. This could help to put more weight on FSE and equalize the quality of this type of education across the country. It would require a trial phase with national test in home and consumer studies, using different examination concepts and grading criteria.

7. Conclusion

FSE is not solely constrained within the boundaries of food but fosters children's understanding of complex systems that involve various actors. As food security is in danger due to unsustainable farming practices, there is a great need to transform food systems in harmony with people and the planet. However, knowledge is needed to adapt more sustainable ways to shape food systems and their value chains. Here is where the education of children is seen as a key element in creating this change.

The results obtained from the interviews in combination with important theoretical aspects show, that schools serve as a venue to communicate and teach children necessary skills to become well-informed, independent, and critical thinkers of the society.

In order for children to become food literate they have to be equipped with critical, functional, interactive and system thinking competencies. The aim is for children to make well-informed decisions around food that are both positive for their own well-being in terms of health and the broader society considering sustainability. However, this is only successful if students are having the opportunity to both connected practical knowledge with more theoretical aspects.

Many of the relevant aspects that are needed to embed FSE are already strongly integrated in the Swedish curriculum and thus support children's ability to become food literate. However, the curriculum seems to miss out on clear learning objectives that connect food to a broader picture. The lack of time and capabilities were seen as the most dominant restraining factor according to the teachers.

An adaption of the curriculum where food is integrated in various subjects and across the school grades would ease the time issue and give children the possibility to engage in food system topics as they become adults. Additionally, teachers must have access to teaching material and be trained to have the competence and confidence to teach about complex food systems.

References

- 4H-gårdar (n.d.). *Sveriges 4H*. <https://www.4h.se/gardar/> [2022-04-27]
- Béné, C., Prager, S.D., Achicanoy, H.A.E., Toro, P.A., Lamotte, L., Cedrez, C.B. & Mapes, B.R. (2019). Understanding food systems drivers: A critical review of the literature. *Global Food Security*, 23, 149–159. <https://doi.org/10.1016/j.gfs.2019.04.009>
- Calabrese Barton, A., Koch, P.D., Contento, I.R. & Hagiwara, S. (2005). From Global Sustainability to Inclusive Education: Understanding urban children's ideas about the food system. *International Journal of Science Education*, 27 (10), 1163–1186. <https://doi.org/10.1080/09500690500069467>
- Carlsson, L. & Williams, P.L. (2008). New Approaches to the Health Promoting School: Participation in Sustainable Food Systems. *Journal of Hunger & Environmental Nutrition*, 3 (4), 400–417. <https://doi.org/10.1080/19320240802529243>
- Cohen, L., Manion, L. & Morrison, K. (2007). *Research methods in education*. 6th ed. London ; New York: Routledge.
- Cullen, T., Hatch, J., Martin, W., Higgins, J.W. & Sheppard, R. (2015). Food Literacy: Definition and Framework for Action. *Canadian Journal of Dietetic Practice and Research: A Publication of Dietitians of Canada = Revue Canadienne De La Pratique Et De La Recherche En Dietetique: Une Publication Des Dietetistes Du Canada*, 76 (3), 140–145. <https://doi.org/10.3148/cjdpr-2015-010>
- Day, K., Tsupros, M.M. & Schober, D.J. (2022). To plant a garden is to believe in tomorrow: A case study of a Chicago community-based organization focused on health education through school gardens. *Journal of prevention & intervention in the community*, 50 (1), 65–81. <https://doi.org/10.1080/10852352.2021.1915938>
- Dewey, J. (1916). *Democracy and Education: An Introduction to the Philosophy of Education*. Macmillan.
- Ericksen, P.J. (2008). Conceptualizing food systems for global environmental change research. *Global Environmental Change*, 18 (1), 234–245. <https://doi.org/10.1016/j.gloenvcha.2007.09.002>
- Evagorou, M., Korfiatis, K., Nicolaou, C. & Constantinou, C. (2009). An Investigation of the Potential of Interactive Simulations for Developing System Thinking Skills in Elementary School: A case study with fifth-

- graders and sixth-graders. *International Journal of Science Education*, 31 (5), 655–674. <https://doi.org/10.1080/09500690701749313>
- FAO (2022). *Food Systems / Food and Agriculture Organization of the United Nations. Food systems*. <https://www.fao.org/food-systems/en/> [2022-04-27]
- FAO & IFAD (2021). *The State of Food Security and Nutrition in the World 2021: Transforming food systems for food security, improved nutrition and affordable healthy diets for all*. Rome, Italy: FAO. <https://doi.org/10.4060/cb4474en>
- Feriver, Ş., Olgan, R., Teksöz, G. & Barth, M. (2019). Systems Thinking Skills of Preschool Children in Early Childhood Education Contexts from Turkey and Germany. *Sustainability*, 11 (5), 1478. <https://doi.org/10.3390/su11051478>
- Fleming, C.A., Chandra, S., Hockey, K., Lala, G., Munn, L., Sharma, D. & Third, A. (2021). Fix My Food: Children’s Views on Transforming Food Systems. <https://doi.org/10.26183/6qhg-xn49>
- Francis, C.A., Jordan, N., Porter, P., Breland, T.A., Lieblein, G., Salomonsson, L., Sriskandarajah, N., Wiedenhoef, M., DeHaan, R., Braden, I. & Langer, V. (2011). Innovative Education in Agroecology: Experiential Learning for a Sustainable Agriculture. *Critical Reviews in Plant Sciences*, 30 (1–2), 226–237. <https://doi.org/10.1080/07352689.2011.554497>
- Freire, P. (2000). *Pedagogy of the oppressed*. 30th anniversary ed. New York: Continuum.
- Garnett, T., Benton, T., Nicholson, W. & Finch, J. (2016). Overview of food system challenges (Foodsource: chapters). Food Climate Research Network, University of Oxford.
- Gliessman, S. (2018). Defining Agroecology. *Agroecology and Sustainable Food Systems*, 42 (6), 599–600. <https://doi.org/10.1080/21683565.2018.1432329>
- Hilimire, K., Gillon, S., McLaughlin, B.C., Dowd-Urbe, B. & Monsen, K.L. (2014). Food for Thought: Developing Curricula for Sustainable Food Systems Education Programs. *Agroecology and Sustainable Food Systems*, 38 (6), 722–743. <https://doi.org/10.1080/21683565.2014.881456>
- Houtkoop-Steenstra, H. (2000). *Interaction and the Standardized Survey Interview: The Living Questionnaire*. Cambridge, UNITED KINGDOM: Cambridge University Press. <http://ebookcentral.proquest.com/lib/slub-ebooks/detail.action?docID=147324> [2022-04-27]
- Jordan, N., Grossman, J., Lawrence, P., Harmon, A., Dyer, W., Maxwell, B., Cadieux, K.V., Galt, R., Rojas, A., Byker, C., Ahmed, S., Bass, T., Kebreab, E., Singh, V., Michaels, T. & Tzenis, C. (2014). New Curricula for Undergraduate Food-Systems Education: A Sustainable Agriculture Education Perspective. *NACTA Journal*, 58 (4), 302–310

- Kelly, R.K. & Nash, R. (2021). Food Literacy Interventions in Elementary Schools: A Systematic Scoping Review*. *Journal of School Health*, 91 (8), 660–669. <https://doi.org/10.1111/josh.13053>
- Kim, D.H. (1999). Introduction to Systems Thinking. *Pegasus Communications*, 21
- Kimura, A.H. (2011). Food education as food literacy: privatized and gendered food knowledge in contemporary Japan. *Agriculture and Human Values*, 28 (4), 465–482. <https://doi.org/10.1007/s10460-010-9286-6>
- Krause, C., Sommerhalder, K., Beer-Borst, S. & Abel, T. (2018). Just a subtle difference? Findings from a systematic review on definitions of nutrition literacy and food literacy. *Health Promotion International*, 33 (3), 378–389. <https://doi.org/10.1093/heapro/daw084>
- Kvale, S. (2007). *Doing Interviews*. 1 Oliver’s Yard, 55 City Road, London England EC1Y 1SP United Kingdom: SAGE Publications, Ltd. <https://doi.org/10.4135/9781849208963>
- Kvale, S. (2009). *InterViews: learning the craft of qualitative research interviewing*. 2. ed. Los Angeles: Sage Publications.
- Mårtensson, F. & Fägerstam, E. (2020). *Platsens roll vid lektion på skolgård*
- Massari, S. (2017). Food design and food studies: Discussing creative and critical thinking in food system education and research. *International Journal of Food Design*, 2 (1), 117–133. https://doi.org/10.1386/ijfd.2.1.117_1
- Meek, D. & Tarlau, R. (2016). Critical food systems education (CFSE): educating for food sovereignty. *Agroecology and Sustainable Food Systems*, 40 (3), 237–260. <https://doi.org/10.1080/21683565.2015.1130764>
- Meyer, J.W. (1977). The Effects of Education as an Institution. *American Journal of Sociology*, 83 (1), 55–77
- Morgan, P.J., Warren, J.M., Lubans, D.R., Saunders, K.L., Quick, G.I. & Collins, C.E. (2010). The impact of nutrition education with and without a school garden on knowledge, vegetable intake and preferences and quality of school life among primary-school students. *Public Health Nutrition*, 13 (11), 1931–1940. <https://doi.org/10.1017/S1368980010000959>
- Myers, S.S., Smith, M.R., Guth, S., Golden, C.D., Vaitla, B., Mueller, N.D., Dangour, A.D. & Huybers, P. (2017). Climate Change and Global Food Systems: Potential Impacts on Food Security and Undernutrition. *Annual Review of Public Health*, 38 (1), 259–277. <https://doi.org/10.1146/annurev-publhealth-031816-044356>
- Nadelson, L.S. & Jordan, J.R. (2012). Student Attitudes Toward and Recall of Outside Day: An Environmental Science Field Trip. *The Journal of Educational Research*, 105 (3), 220–231. <https://doi.org/10.1080/00220671.2011.576715>
- Nanayakkara, J., Margerison, C. & Worsley, A. (2017). Importance of food literacy education for senior secondary school students: food system professionals’ opinions. *International Journal of Health Promotion and*

- Education*, 55 (5–6), 284–295.
<https://doi.org/10.1080/14635240.2017.1372695>
- Neuendorf, K.A. (2019). *Content analysis and thematic analysis*. (Brough, P., ed.). London ; New York: Routledge Taylor and Francis Group.
- Ovens, A., Hopper, T. & Butler, J. (2013). *Complexity Thinking in Physical Education: Reframing Curriculum, Pedagogy and Research*. London, UNITED KINGDOM: Taylor & Francis Group.
<http://ebookcentral.proquest.com/lib/slub-ebooks/detail.action?docID=1108600> [2022-01-20]
- Patel, R. (2009). Food sovereignty. *The Journal of Peasant Studies*, 36 (3), 663–706. <https://doi.org/10.1080/03066150903143079>
- Pendergast, D., Garvis, S. & Kanasa, H. (2011). Insight from the Public on Home Economics and Formal Food Literacy. *Family and Consumer Sciences Research Journal*, 39 (4), 415–430. <https://doi.org/10.1111/j.1552-3934.2011.02079.x>
- Riksdagsförvaltningen (2010). *Skollag (2010:800) Svensk författningssamling 2010:2010:800 t.o.m. SFS 2022:275 - Riksdagen*.
https://www.riksdagen.se/sv/dokument-lagar/dokument/svensk-forfattningssamling/skollag-2010800_sfs-2010-800 [2022-04-27]
- Rittel, H.W.J. & Webber, M.M. (1973). Dilemmas in a General Theory of Planning. *Policy Sciences*, 4 (2), 155–169
- Robson, C. & McCartan, K. (2016). *Real world research: a resource for users of social research methods in applied settings*. Fourth Edition. Hoboken: Wiley.
- Röös, E. (2017). The sustainable farm – does it exist? *SLU Future Food*, 32
- Salomonsson, L., Nilsson, A., Palmer, S., Roigart, A. & Francis, C. (2009). Farming systems education: Case study of Swedish test pilots. *Renewable Agriculture and Food Systems*, 24 (1), 48–59.
<https://doi.org/10.1017/S1742170508002408>
- ShiftN (2016). *Global Food System Map*.
<https://www.slideshare.net/pvandenbroeck/global-food-system-map-57053271> [2022-02-11]
- Skolverket (2018). *Curriculum for the compulsory school, preschool class and school-age educare*. <https://www.skolverket.se/publikationer?id=3984> [2022-01-19]
- Slater, J. (2013). Is cooking dead? The state of Home Economics Food and Nutrition education in a Canadian province. *International Journal of Consumer Studies*, 37 (6), 617–624. <https://doi.org/10.1111/ijcs.12042>
- Stinson, E. (2010). Eating the World: Food Literacy and its Place in Secondary School Classrooms. <https://dspace.library.uvic.ca/handle/1828/2841> [2022-02-02]
- Truman, E., Lane, D. & Elliott, C. (2017). Defining food literacy: A scoping review. *Appetite*, 116, 365–371.
<https://doi.org/10.1016/j.appet.2017.05.007>

- Valley, W., Wittman, H., Jordan, N., Ahmed, S. & Galt, R. (2018). An emerging signature pedagogy for sustainable food systems education. *Renewable Agriculture and Food Systems*, 33 (5), 467–480. <https://doi.org/10.1017/S1742170517000199>
- Vermeulen, S.J., Campbell, B.M. & Ingram, J.S.I. (2012). Climate Change and Food Systems. *Annual Review of Environment and Resources*, 37 (1), 195–222. <https://doi.org/10.1146/annurev-environ-020411-130608>
- Vidgen, H.A. & Gallegos, D. (2014). Defining food literacy and its components. *Appetite*, 76, 50–59. <https://doi.org/10.1016/j.appet.2014.01.010>
- Wallis, H. & Loy, L.S. (2021). What drives pro-environmental activism of young people? A survey study on the Fridays For Future movement. *Journal of Environmental Psychology*, 74, 101581. <https://doi.org/10.1016/j.jenvp.2021.101581>
- Wiek, A., Withycombe, L. & Redman, C.L. (2011). Key competencies in sustainability: a reference framework for academic program development. *Sustainability Science*, 6 (2), 203–218. <https://doi.org/10.1007/s11625-011-0132-6>
- World Food Summit (1996). *Declaration on World Food Security*. Rome. <https://www.fao.org/3/w3613e/w3613e00.htm> [2022-02-09]
- Yang Hansen, K., Rosén, M. & Gustafsson, J. (2011). Changes in the Multi-Level Effects of Socio-Economic Status on Reading Achievement in Sweden in 1991 and 2001. *Scandinavian Journal of Educational Research*, 55 (2), 197–211. <https://doi.org/10.1080/00313831.2011.554700>

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Appendix

A. Samtyckeblankett - GDPR



Sveriges lantbruksuniversitet
Swedish University of Agricultural Sciences

Institutionen för människa och samhälle
Hanna Weiss

2022-03-22

Samtyckeblankett: Personuppgiftsbehandling i forskningsprojekt

När du medverkar i arbetet med ett forskningsprojekt innebär det att SLU behandlar dina personuppgifter. Ditt samtycke är nödvändigt för att forskningen ska kunna genomföras. Denna blankett syftar till att ge dig all information som behövs för att du ska kunna ta ställning till om du vill ge ditt samtycke till att SLU hanterar dina personuppgifter eller inte.

Du har alltid rätt att ta tillbaka ditt samtycke utan att behöva ge några skäl för detta. SLU är ansvarig för behandlingen av dina personuppgifter, och du når SLUs dataskyddombud på dataskydd@slu.se eller via 018-67 20 90. Din kontaktperson för denna behandling är Hanna Weiss, haws0002@stud.slu.se eller Fredrik Fernqvist, fredrik.fernqvist@slu.se

Du medverkar i ett masterarbete som heter "Embedding food system education into Swedish public schools – teachers' perspectives" och vi registrerar att du medverkar i projektets referensgrupp.

Som medverkande deltar du i projektet genom intervju.

Det material (muntligt och skriftligt) som genereras under intervjuer spelas in, arkiveras, sammanställs och analyseras av medverkande student och forskare.

SLU kommer även att behandla dina personuppgifter på de sätt som krävs för att SLU ska följa reglerna kring allmänna handlingar och myndigheters arkiv. Om du vill läsa mer information om hur SLU behandlar personuppgifter och om dina rättigheter kan du hitta den informationen på www.slu.se/personuppgifter.

Ändamålet med behandlingen av dina personuppgifter och din medverkan i studien är att samla in data för genomförande av studie samt publikation av vetenskaplig artikel enligt korrekt vetenskaplig metod. Vid publikation i vetenskaplig tidskrift är samtliga intervjuer anonymiserade, så att svar inte kan kopplas till individ.

Dina personuppgifter lagras så länge det krävs enligt lagstiftningen om allmänna handlingar och myndigheters arkiv.

Jag samtycker till att SLU behandlar personuppgifter om mig på det sätt som förklaras i denna text, inklusive känsliga uppgifter om jag lämnar sådana.

Underskrift

Plats, datum

B. Interview guide Swedish and English

Warm up questions:

1. *Hur länge har du jobbat som lärare?*
2. *Vilka ämnen undervisar du i?*
3. *Vilka årskurser undervisar du?*

Key questions

”Livsmedelssystemutbildning”:

Livsmedelsystem är komplexa och omfattar hela värdekedjan, från primärproduktion till konsument. De byggs upp av ekonomiska, sociala och miljömässiga grunderna som påverkar varandra. Det betyder att lärande i detta ämne utgår från olika uppdrag och övergripande mål för att kunna skapa ett hållbart livsmedelsystem:

1. *Till och börjar med: Hur ser en typisk lektion ut där ämnen som mat, matproduktion eller matavfall tas upp?*
2. *Vilka förmågor och kunskaper behöver barn för att förstå hur ett hållbart livsmedelsystem fungerar och kan skapas, detta med hänsyn att de kommer att växa upp till vuxna medlemmar i samhället?*
3. *Hur tycker du att ”Livsmedelsystemutbildning“ är integrerad i läroplanen?*
4. *Vilka pedagogiska strategier och metoder använder du i undervisningen om livsmedelsystem*
5. *Vilka undervisningsmaterial använder du i dina lektioner? Vem är utgivare av materialet?*
6. *Från din egen erfarenhet, vilka intryck får du när du undervisar om matproduktion osv. Vilken nivå av kunskap har barnen? Finns det stora skillnader mellan dem?*
7. *Om du fick bestämma helt själv, utan hänsyn till resurser, hur skulle en lektion se ut?*

I Sverige lärs många av de relevanta ämnen som har betydelse i livsmedelssystemutbildning ut t.ex. i biologi, hem och konsumentkunskap samt geografi

1. *Om du reflekterar över läroplanen, hur tycker du att olika discipliner som ekonomi, samhälle och miljön är relaterade till livsmedelsystemet så att barnen får en helhetsbild?*
2. *Hur utnyttjar du praktiskt lärande i din undervisning t. ex. en studiedag på en bondgård?*

Om man vill prata om komplexa system är det hjälpsam och kolla på förhållandena mellan alla delarna i ett system så att man kan begripa hur dessa förhållanden påverkar hela systemets beteende över tid. Och det kallas för systemtänkande.

1. *Hur är systemtänkande integrerat i läroplanen?*
2. *I vilka ämnen utnyttjas systemtänkande? I vilka former lärs det ut?*
3. *Har du genomfört en utbildning med relevans till systemtänkande och då menar jag hur man lär ut systemtänkande till barn?*

Har du andra tankar som du vill ta upp?

Warm up questions:

1. *How long have you been working as a teacher?*
2. *What subjects are you teaching?*
3. *On which level are you teaching?*

Key questions

Food system education (FSE)

Present food systems are defined as complex networks that include all the processes that happen between farm and fork and that are shaped by ecological as well as social elements that interact with each other.

That means that the learning objectives for food system education are aiming to provide knowledge on how to transform food systems sustainably and to create more healthier food value chains:

1. *To start off: How does a typical lesson where you talk about food, food production or even food waste look like?*
2. *In your opinion, what kind of skills and knowledge would children need to understand and support a fair and sustainable food system especially having in mind that they will become adult members of the society?*
3. *How is FSE or parts of it integrated in the Swedish school curriculum?*
4. *Which methods do you use to educate your pupils about food systems?*

5. *Which kind of teaching material do you use in your lessons that is relevant for FSE? Who is supporting you with these materials?*
6. *From your own experience, what impression do you get when talking about food consumption and production in your class. Which level of knowledge do the children have? Are there big differences between the children?*
7. *If you could decide freely, how would you personally prefer to teach your pupils in this matter?*

In Sweden many of the components that are relevant for this type of education are already being taught in different disciplines of the syllabus such as biology, home and consumer studies and geography

1. *If you reflect on the Swedish school curriculum, how are different disciplines connected to create a greater understanding of the relations between food intake, purchasing behavior and the effects that it has on the economic, social and environmental part of the food system?*
2. *How do you embed experience-based learning i.e., visiting farms or food processing manufactures into your education?*

When teaching about complex coherences (networks) 'system thinking' is used. That means that children learn to understand complex setting using a holistic approach.

1. *How is system thinking integrated in the Swedish school curriculum?*
2. *In which subject does it appear? How is it applied?*
3. *Have you been doing training with relevance to system thinking and by that I mean how you educate children about system thinking?*

Are there any other thoughts that came up during the interview that we have not talked about?

C. Extended coding table with quotes in original and translated language

Code	Theme	Theme Description	Unit of meaning	Example of text -translated	Original quotes
ENG	Children's background and capabilities to learn about food systems	Differences in age groups Cultural differences Family background	<ul style="list-style-type: none"> - Adapting the level of complexity - Farmer and hunter families - Dinner family food talks - Team class spirit 	<p>"One can see differences between the children. Farmers children for ex. who are more aware of cultivation and prime production influence other children with their knowledge." (T1)</p> <p>"There are great differences between the children's level of knowledge, that is the case for all subjects, a lot depends on the parents of the children" (T2)</p> <p>"Some classes are so easy to handle, and others are more chaotic. There is a lot to consider" (T7)</p>	<p>"Det finns skillnader mellan barn, bondbarn till ex. är kanske mer medvetna om odlingen, primärproduktionen och då påverkar de andra elever" (T1)</p> <p>"Det finns stora skillnader mellan barns kunskapsnivåer, det gäller alla ämnen, mycket beror på vilka föräldrar man har" (T2)</p> <p>Det beror på klassammansättningar, det blir kaos ibland, det är mycket som påverkar" (T7)</p>
67					
TRA	Children's skills to transform food systems	Learned competences Capabilities to feel empowered Abilities to make positive decisions concerning food	<ul style="list-style-type: none"> - Young children are knowledgeable about food and climate change - Awareness of the consequences connected to food production - Carbon footprint - Awareness of having choices - Critical observation 	<p>"Some children are becoming so well-informed about what they shove into their mouth, that they started to discuss with other children about why they did not take protein, saying that they can not only take carbs which further ended in a discussion about why they would not build up muscles by only eating carbon rich food" (T1)</p> <p>"Children should be conscious about their impact [on the environment and society], they should be active participants and realize that they have choices" (T5)</p>	<p>"Vi hade en tidigare klass och de blev så otroligt medvetna om vad de stoppar i sig, så de diskuterade med andra om varför de inte hade tagit något protein som 'du kan inte bara ta kolhydrater' och då gick den eleven till ett annat barn och de diskuterade tillsammans, att man inte får muskler om man bara äter kolhydrater" (T1)</p> <p>"Barn ska bli medvetna om vart maten kommer ifrån, att man kan laga själv och har ett val." (T5)</p>

ST	System thinking	Understanding complex settings	<ul style="list-style-type: none"> - Understanding consequences - Purchasing locally makes a difference on a wider scale - Environment, society and political structures are involved 	<p>“It is up to the teacher to combine the important aspects related to food and combine them to each other” (T3)</p> <p>“System thinking is maybe not really specified in the curriculum but we highlight the parts of a system when we look at the global perspective and which consequences [food production has on the environment]” (T1)</p>	<p>“Det är upp till läraren hur de kopplar de relevanta bitarna till varandra” (T3)</p> <p>“Systemtänkande är kanske inte integrerad så mycket i läroplanen specifikt, men vi lyfter ändå fram de bitarna när vi kollar på den globala bilden och vilka konsekvenser som uppstår” (T1)</p>
TC	Teachers' competences	Use of resources Personal engagement	<ul style="list-style-type: none"> - Freedom of choosing own teaching material - Using the web to seek information - Interpretation of the curriculum depending on the teacher - Personal motivation and passion for a certain topic 	<p>“Food system education is only partly integrated in the curriculum and therefore highly dependent on the teacher who is educating the children” (T1)</p> <p>“I think it is good that the curriculum is a bit comprehensive in a way that allows us teachers to interpret the learning content by ourselves, though some aspects would have been nice to see more distinctly” (T5).</p> <p>“One is not always aware of concrete aims when it comes to food education. But yes, it is surely depending on the teacher, there are subjects one is more passionate than others” (T4)</p>	<p>“Livsmedelssystemutbildning är bara integrerad delvis i läroplanen och därför är väldigt beroende på vilken lärare som undervisar” (T1)</p> <p>“Jag tycker det är skönt att [läroplanen] är lite övergripande så man får lägga in och tolka lite själv, men vissa bitar önskar man skulle finnas med” (T5)</p> <p>“Man kanske inte riktigt är målmedveten om man kolla på det stora hela [inom mat utbildning], men mycket beror på läraren, det finns ämnen man brinner mer för en för andra” (T4)</p>

<p>Teachers' perception of FSE</p>	<p>Pedagogical approaches</p> <p>Difficulties connected to teaching</p>	<ul style="list-style-type: none"> - Diversity in teaching material: books, videos, digital learning platforms - Experience based learning: gardening, study visits, external lecturer, competitions - Time as a constraining factor - Lack of recourse, guidance - Undefined learning objectives 	<p>"We do not only talk about food but rather try to connect food education into other subjects and topics [that emerge due to current crisis's]" (T6)</p> <p>"We start with the theoretical parts on how and where food is growing (...) then we continue with the practical part concerning a food item we already discussed. When we talk about food, we try to put focus on environmental aspects such as transport ways. We would for example watch a movie about the container ships arriving in Sweden, delivering food to the supermarkets" (T5)</p> <p>"When the children start with home and consumer studies, there is not enough time to talk in detail about the whole food production chain, but we do it partly" (T2)</p>	<p>"Vi pratar inte bara livsmedel utan man försöker även varva in det i den vanliga delen [i andra ämnen för att koppla till nuvarande kris]" (T6)</p> <p>" Vi startar med en teoretisk bit kring hur livsmedel växer, vart de växer, hur man odlar, varför man odlar på et visst sätt osv. och sen kör vi i gång med den praktiska biten kring det livsmedel som vi har pratat om i teoretiska biten. När vi pratar om livsmedel så försöker vi och ta in det miljömässiga, transporter osv. Vi kollar till ex. på en film om hur de stora containrarna kommer in på båtar och vidare till alla butiker" (T5)</p> <p>"När barnen kommer till kursen i hem och konsumentkunskap så har man inte tid och gå in på allt som händer inom livsmedelkedjan, men vi gör ju det delvis" (T2)</p>
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<p>ies for FSE</p>	<p>Learning methods</p>	<p>Cooperation Connection between different subjects</p>	<ul style="list-style-type: none"> - Integrate the knowledge of the kitchen staff - Create cooperation with actors of the food industry, networks - Merging food education throughout the curriculum - Making use of specific study programs 	<p>"It would be a good idea to integrate the kitchen staff when time allows, to discuss food with the children. They know a lot and children would learn through the food they get served by the person that prepares and serves the food" (T1).</p> <p>"Maybe one could face-time with someone who lives in a completely different country, with other circumstances, what do they eat, how do they produce their food and so on" (T2)</p>	<p>"Det vore bra om man kunde integrera kökspersonalen om man hinner, för att diskutera mat med barnen [i klassrummet]. Kökspersonalen vet mycket och barnen skulle lära sig genom maten de får från skolköket" (T2)</p> <p>"Kanske man kan 'facetimea' med en som bor i ett helt annat land, som har andra förutsättningar, vad äter de, hur produceras maten osv." (T2)</p>
<p>73</p>				<p>"It is good if you have time to cultivate vegetables and make a recipe out of it, so you use something you have created yourselves. This means not only a lecture but something that last in the student's heads" (T3).</p>	<p>"Det är bra när man ha tid för att odla någonting, göra recept på det, till ex. kan man använda gurkor som man själv har odlat. Då blir det inte bara en lektion utan mer långsiktigt" (T3)</p>

D. Popular Science Summary

Children will be highly threatened by the various consequences that modern food systems have on people and the planet. This calls for action to educate and empower children to understand and tackle these challenges. Children should take part in sustainably transform food systems that thrive not only today but for future generations. There is a need for children to understand that they are part of a greater system and that their food choices have an impact on their future. In this context, food system education is an important field.

This aim of this study was to explore how food system education can be embedded into the Swedish public-school curriculum (grade 1-9/ age 7-16). The following questions were asked: What are the teacher's perceptions about food education and how do they teach about food? What are the opportunities and challenges when it comes to food system education?

In order to answer the research questions, semi-structured interviews with teachers from Swedish public schools were conducted. The data was analysed through a thematic analysis in order to grasp relevant aspects which were of importance for this study.

The findings show that food education is only partly integrated in the Swedish school curriculum while the quality of food lessons is highly dependent on the teachers' competencies and individual interests. Many skills that are needed for children to critically reflect on food and to make sustainable choices around food are covered by the school curriculum but need more in-depth and connection to other disciplines. Lack of time was seen as the biggest constraint to teach about food in a more comprehensive matter.

A cross-curricular approach where food is integrated in various subjects and across the school grades would ease the time issue and give children the possibility to engage in food system topics as they become adults. However, teachers must have access to teaching material and clear learning objectives. They should feel confidence to teach about complex food systems and have a voice when it comes to the adaption of the curriculum. In general, teachers should help to convey hope to the children and give good examples on how they can positively impact food systems in a sustainable way.