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What do prospective teachers know about sustainable nutrition?

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Summary

Sustainable nutritional behaviour is an important contribution to sustainable development. Properly qualified teachers are needed to communicate this to children and adolescents. For this reason, the present study is intended to find out how much student teachers in home economics know about sustainable nutrition and to use the results as a basis for developing specific teaching. The results show that student teachers in home economics possess fundamental content knowledge of sustainable nutrition – even in the initial phase of their course. On the other hand, the foundation of this content knowledge is often one dimensional and is inadequately differentiated. This emphasises where the focus should lie in later phases of the course.

Keywords: Education in Sustainable Development (ESD), sustainable nutrition, nutrition education, consumer education, home economics, sustainability

Introduction

As laid down by the United Nations Agenda 2030 for Sustainable Development (SD), education in sustainable development (ESD) is still supported in the Swiss educational system [1]. ESD is intended to help schoolchildren to think and act for the future. Each pupil should be capable and prepared to make responsible decisions [2]. One important precondition for the successful implementation of ESD in schools is that teachers should be specifically trained in subjects related to ESD [2]. As individual nutritional behaviour is of great significance for SD [3], it is particularly important to support those subjects that aim to develop competence in nutritional and consumption behaviour. In German-speaking Switzerland, this is the case in Secondary School Level I in the subjects "Home Economics" (HE) and "Economics, Work, Household" (EWH). In both Switzerland and Germany, specific lectures on nutrition are planned for both schools and for teacher training. In teacher training, these are conceived as technical-practical courses. They offer a realistic link between theory and practice and give student teachers a good opportunity to integrate sustainable nutritional behaviour into ESD together with their pupils. In particular, these courses could claim to do justice to the wide variety of requirements needed for sustainable nutrition [4]. These include knowledge, ability and skills related to food preparation.

Thus, in the professional development and education of student teachers in nutrition and consumption, the issue of sustainable nutrition is based on very complex content knowledge. However, there have been no scientific studies on the extent to which future teachers possess this knowledge and what they require of their course. The few existing studies on knowledge and sustainability concentrate on the target group of adolescents and often focus on environmental aspects [5–7]. The data on sustainable nutrition are even sparser. Thus, a group discussion showed that only a few adolescents can address the theme of sustainable nutrition and, even if they can, then ecological aspects are dominant [8].

In view of the state of the research and the objective of implementing sustainable nutrition in subject specific teacher training, the present study aims to record how much knowledge student teachers in HE/EWH possess. The findings are to be used to plan relevant technical-practical courses in HE/EWH in

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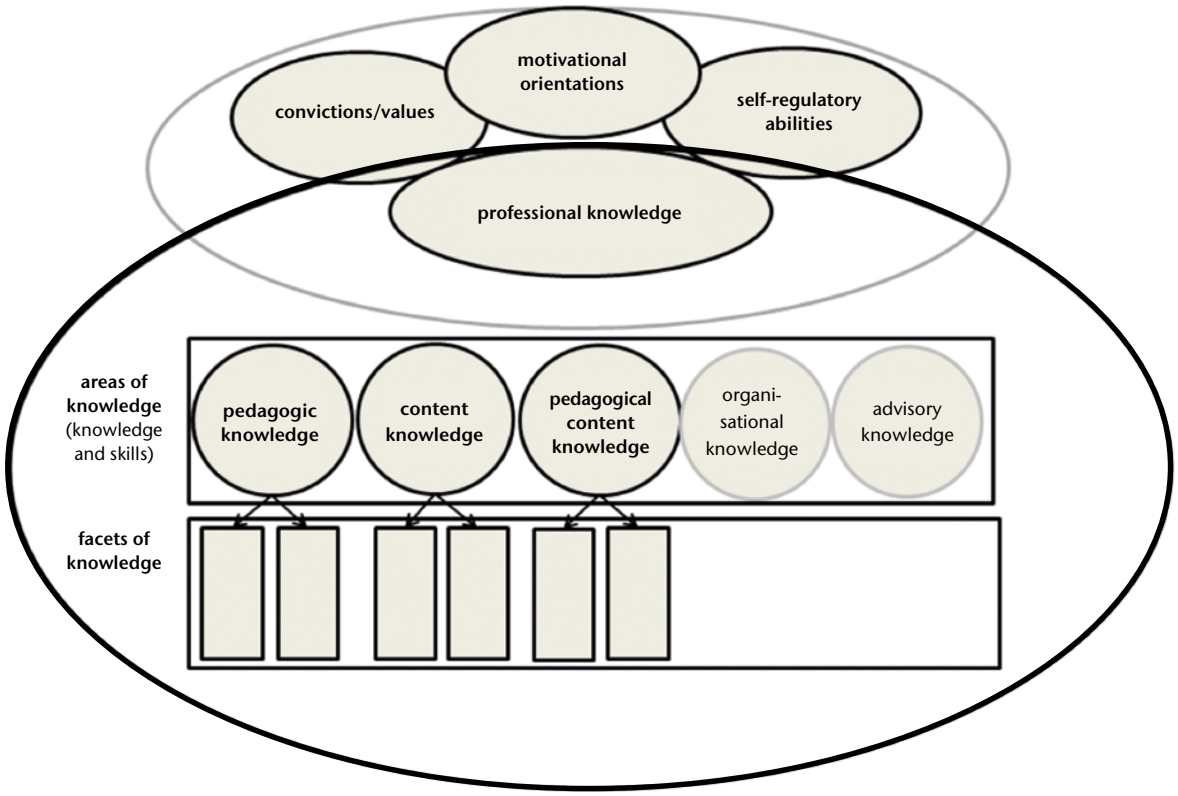

Fig. 1: **Model of teachers' professional competence** [9]

an appropriate manner and to implement them in a suitable form. Thus, the investigation served not only to evaluate the available knowledge at the end of the course, but also to assess their initial knowledge.

Research question and method

This study addressed two overall research questions:

1. How much content knowledge do students already have about sustainable nutrition?
2. To what extent are students capable of interlinking or integrating content knowledge about sustainable nutrition?

The research questions were based on two reference models: the theoretical framework for teacher competence [9] and the four dimensions of sustainable nutrition [10].

The expression "content knowledge", as used in the course of this investigation is linked to the reference theory of the "theoretical framework for teacher competence" (◆ Figure 1). According to this, content knowledge includes knowledge, abilities and skills as parts of the "professional knowledge" of teachers and includes "declarative and procedural knowledge" [9]. The term "declarative knowledge" refers to factual knowledge and knowledge of complex interconnections (e.g. the significance of food waste and its link to sustainable development). In contrast, "procedural knowledge" can be equated with the everyday expression of "ability" and relates to "how something is done" [11]; for example, this would include the structure of working techniques in food preparation (e.g., processing residues to avoid food waste). Aside from "content knowledge", professional knowledge includes other areas of knowledge, although these are not addressed by the present investigation. The purpose of acquiring professional knowledge is to support student teachers in giving instruction. The primary goal is not to influence their behaviour in everyday life – although of course this possibility cannot be excluded.

The four dimensions of sustainable nutrition[1] include the three known dimensions of sustainable nutrition (ecology, society, economics), together with the dimension of health. According to the model, all four dimensions exhibit continuous mutual interactions and are regarded as being of equal significance [10, 12]. At the end of their course, student teachers should have recourse to a multifaceted and profound knowledge of these dimensions (referred to below as "differentiated knowledge").

[1] The underlying concept and the nutritional principles are also described in *"Nachhaltigkeit und Ernährung"* [Sustainability and Nutrition] (Ernährungs Umschau 9/2011 from p. B33) [13].

Question Complex (QC) Knowledge of sustainable nutrition	Explanation
1: Principles (c)	General principles of sustainable nutrition, as in Von Körber [◆ Overview 1]
2: Principles of action, facts and concepts (c)	a) Sustainable action along the food supply chain and b) Knowledge of food waste
3: Nutritional recommendations (Swiss Nutrition Society [SGE]) (c)	Nutritional recommendations for the groups meat, vegetables and fruits
4: Animal products (c)	Especially consequences of meat consumption
5: Food groups (c)	Knowledge of the allocation of foods and evaluation of their potential as sources of protein
6: Labels (o)	Awareness of labels and knowledge of their criteria
7: Plant products (c)	Evaluation of production and transport methods
8: Origin and production conditions (c)	Consideration of criteria (seasonal, regional, biological and fair trading) when purchasing foods
9: Meat consumption (o)	Specify and explain aspects that can influence meat consumption
10: Meatless dishes (o)	Knowledge of meatless dishes
11: Application of meatless dishes (o)	Number and type of meatless dishes already prepared in HE/EWH course or practical training*
12: Dishes that fulfil the requirements for sustainable nutrition (o)	Knowledge of dishes and reasons for their selection in the context of sustainability – beyond considerations of seasons and region
13: Purchasing food (o)	Evaluation of the purchase of two breakfast components and reasons for the decision
14: Food waste (o)	a) Explanation of the link between food waste and sustainable development b) options for action and obstacles

Tab. 1: **Thematic structure of the questionnaire**
*In Switzerland, student teachers have the opportunity during the course to teach school classes, under the supervision of practical instructors
c = closed questions; HE = home economics; o = open questions; WAH = economics, work, household

To ascertain the content knowledge, a written survey was performed. A questionnaire was developed for this purpose; its construction is described elsewhere [12].

The questionnaire consisted of 14 question complexes (QC), with both closed and open questions (◆ Table 1). The closed questions (QC 1–5, 7, 8) predominantly serve to address research question 1. In accordance with research question 2, the open questions (QC 6, 9–14) require the students to interconnect various factors influencing sustainable nutrition.

In view of the status of the research, it was not possible to generate hypotheses as in quantitative empirical research. Nevertheless, in view of the individual scientific findings (see above), as well as the lively presence of the relevant aspects in public campaigns, it was presumed that the ecological perspective – especially regionality – would dominate the sustainability issue. Therefore individual questions or subquestions were designed to ascertain this (QC 1, 4, 9, 12, 13). The questionnaire was checked by two experts and piloted through two test runs.

The study was performed in the context of a teaching function for the subject HE/EWH at teachers' training colleges in Switzerland (Basel, Bern, Brugg, St. Gallen, Zurich). The survey lasted from February 2014 to November 2015; n = 157 (median 26 years old) and included both male (26%) and female students (74%). At the time point of the investigation, a total of 374 students were registered for this subject (31% male, 69% female). The project was supported by the innovation pool of the PH FHNW (Teachers' Training College, Northwest Switzerland Technical College).

The evaluation considered 147 students and was performed with the statistics program IBM SPSS Statistics23. The closed questions were formulated in the form of multiple choice questions or with a scaled question procedure. The open questions were evaluated with Mayring's qualitative content analysis [15]. For this purpose, a category system and codes were first developed deductively and scaled with points. The categories were then assigned and evaluated in accordance with the points. ◆ Table 2 shows an extract of the category system.

Results

◆ Figure 2 shows an overview of all results. The essential results will now be discussed, as marked with * in ◆ Figure 2. The fraction of correct answers is given in the text as arithmetic mean ± standard deviation.

The students correctly answered more than half the questions on sustainable nutrition (QC1). The

questions on ecological perspectives were answered very confidently. Thus, a large proportion of students (80% ± 3) considered that environmentally friendly production and packaging of food is one of the principles of sustainable nutrition; even higher values were given for regionality and seasonality (86% ± 3).

More than half of the questions on the principles of action in sustainable nutrition (QC2) were also answered correctly. These included questions on content knowledge in food preparation – such as energy efficiency – and the evaluation of food quality (FQ2a), of which 80% (± 3.6) were correctly answered. The other questions in this complex ascertained content knowledge on the use of food (QC2b). A mean of 51% (± 11) of these questions were correctly answered.

QC4 required more intensive consideration of the issue of meat and sustainability. More than half of the questions were answered correctly. This was followed by greenhouse gas emission (91% ± 2), virtual water consumption (61% ± 4), healthy nutrition (78% ± 4) and overall nutritional safety (76% ± 4). Moreover, in 10% (± 3) of cases, it was recognised that product regionality may not always be equated with sustainable activity.

The questions on labelling criteria could be answered less comprehensively (QC6). Although a mean of 94% of the respondents stated that they were familiar with two of the common listed bio-seals and 99% were familiar with the Fairtrade Seal, their answers were primarily related to obvious associations, such as "biological cultivation", "Swiss origin" or "fair wages and working conditions". They were less familiar with the labels "Demeter" (44%) and "Fidelio" (14%), a Swiss label for species-appropriate animal husbandry based on strict guidelines.

Evaluation of the QC9 with respect to aspects that might influence meat consumption shows that a quarter of the required responses were listed. Key words included "poor husbandry" and "giving up meat spares the environment". The most frequent reasons were related to ecological aspects (41% of the entries); 64% of these were related to the ethical treatment of animals. Aside from ecological reasons, health (27%), economic (26%) and social (4%) reasons were given. 3% of the reasons given could not be unambiguously assigned.

In most cases, the requirements for QC10 were fulfilled. Spaghetti Napoli/pesto, vegetable soup and risotto were the three most frequently given meatless dishes. Of the few students who already had teaching experience (n = 31), 43% (± 4) had already used these meatless dishes in HE instruction (QC11).

It was also found that only a few students (n = 47) described "sustainable" dishes in the context of SD, if the aspects of "regionality" and "seasonality" were omitted as alternative answers (QC12). The answers were mostly incomplete. They were rarely multidimensional or differentiated.

A fictional decision to select either apple or orange juice for breakfast was intended to incorporate content knowledge and to encourage the students to interconnect and consider content knowledge. (QC13). It was found that the regional product was mostly preferred.

In QC14 on food waste, just over a third of the questions were correctly answered. These included ques-

OVERVIEW 1: PRINCIPLES OF SUSTAINABLE NUTRITION, FROM VON KÖRBER [14]

1. predominantly lacto-vegetarian nutrition
2. ecologically produced food
3. regional and seasonal products
4. slightly or moderately processed food
5. products packed in an environmentally acceptable manner
6. socially acceptable products
7. pleasure in eating

QC 12: Which other dishes have you heard of that support sustainable nutrition? Aside from regionality and seasonality – why are these sustainable?			
Category: Name a sustainable dish	**Definition: Aspect or reason**	**Basic example**	**Points**
Not given	–	–	0
Example related to seasonality and regionality	wrong reasons (question)	fried eggs: eggs from farmers next door	0
Example	–	vegetable soup	1
Example	plus one aspect without other reasons	vegetable soup => using residues	2
Example	plus one aspect plus superficial reason	vegetable soup => using residues: to avoid wasting residues	3
Example	plus one aspect plus unreliable more detailed reasons	vegetable soup => using residues: Poorer vegetables can be used. Energy, water consumption and work needed to cultivate the vegetables are not wasted.	4
Maximally 4 points needed per entry. Maximally 3 entries are possible.			

Tab. 2: **Extract from category system based on question complex (QC) 12**

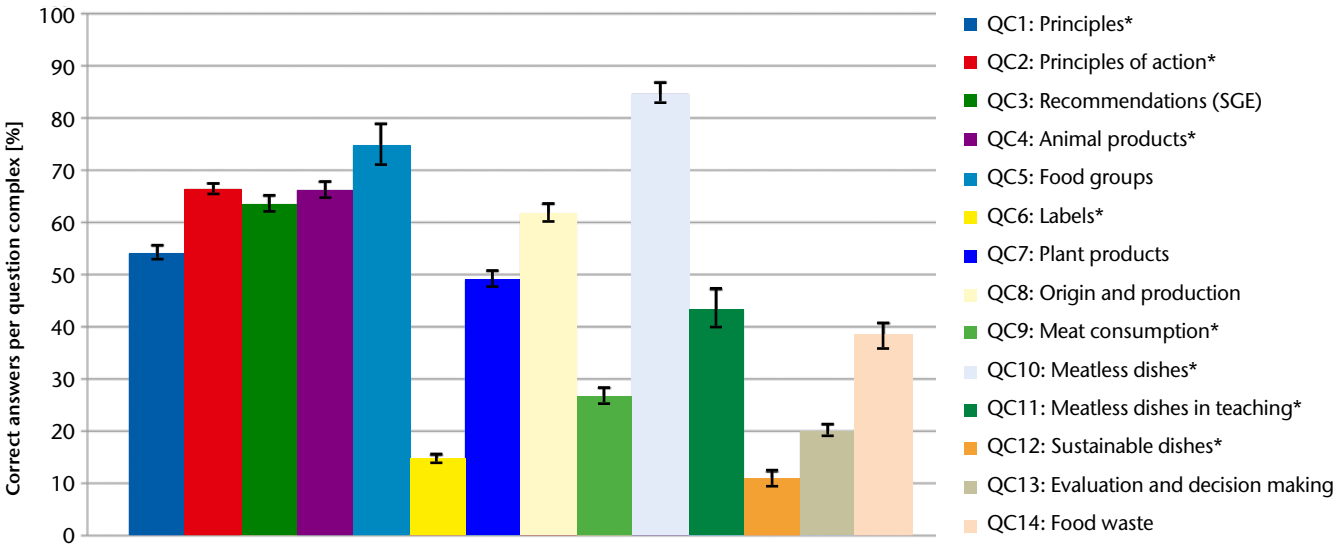

Fig. 2: **Overview of the results of the survey (n = 147)**
QC = question complex; SGE = Swiss Nutrition Society

tions that were intended to link the theme of food waste to SD (QC14a). The requirements in this subsection were reached by 19% (± 2). The other subsection was on possibilities of avoiding food waste and the conditions or circumstances that make this more difficult (QC14b); this was correctly answered by 65% (± 3). Most students listed conventional options for action, such as writing shopping lists and utilising residues. Analysis of the answers of all open questions showed that more than half of the answers could be assigned to the dimension of sustainability (◆ Figure 3).

The students were also familiar with principles of action to avoid food waste. These are of everyday value and may afford initial approaches to sustainable nutritional activities. This again can be supported by teaching sessions.

The students' content knowledge is mostly one dimensional and poorly differentiated

The objective is to illustrate sustainable nutritional behaviour to students, including consideration of economic, ecological, social and health aspects. They must be enabled to plan their actions deliberately and to assume appropriate responsibility [16]. If this is to be achieved, students in HE/EWH must possess the corresponding multidimensional differentiated knowledge (declarative knowledge). On the basis of the results, it may be concluded that the students strongly focused on the ecological dimension of sustainable nutrition. This is mainly evident in the open questions. In spite of the question, some of the students

Discussion

The students understand the principles of action of sustainable nutrition

The students possess content knowledge (procedural knowledge) about sustainable domestic procedures. In accordance with the first principle of sustainable nutrition (◆ Overview 1), they must master a specific, albeit simple, repertoire of meatless dishes. This can be supported by teaching sessions and serve (further) to develop declarative and procedural knowledge and their expedient linkage.

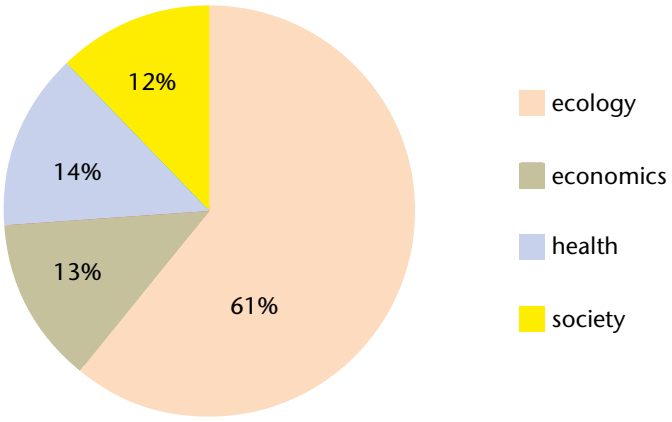

Fig. 3: **Allocation of answers (open questions) to the dimensions of sustainability**

justified their selection of sustainable dishes with the ecological aspects of regionality and seasonality. They only rarely mentioned meatless dishes, dishes from the residues of the previous day or those with fair trade products, although these aspects were indeed mentioned elsewhere in the questionnaire (QC 6, 9, 14b).
The situation was similar with the fictional purchasing decision. In most cases, the regional product was preferred to the imported product and other dimensions of sustainability were neglected. A more recent study on students of subjects related to such ecologically influenced views [17].
Although most students concentrated on the ecological dimension of sustainability, they possessed little differentiated content knowledge. For example, this was clear in the question of label criteria. It is well known that consumers can learn about methods of food production from labels [18], and this may increase their options. As bio-markets and fair trade products are booming, it would be desirable for students to know more about the labels than the results indicate they do [18, 19]. Analogously, it is clear that the students' principles of action on food waste were based on poorly differentiated content knowledge.

The students' content knowledge tended to be multidimensional with respect to "meat", but not for other themes

It was found that students considered that meat consumption was related to concepts from different dimensions of meat consumption. At least three dimensions (ecology, economics and health) were thought to influence meat consumption. Students particularly often mentioned critical aspects of animal husbandry, although they failed to explain their statements in more detail. They also appeared to be lacking content knowledge about implementing ethical treatment of animals in meat consumption. Few students had heard of the Fidelio label, that i.a. controls the principles of species-appropriate animal husbandry and is one of the most recommendable Swiss labels for animal protection [18]. Thus, the results indicate that the students possess multidimensional content knowledge, but that this is poorly differentiated.
Other studies have found that consumers often associate meat consumption and sustainability, although their knowledge was often limited to the conditions for keeping farm animals or to expressions from mass animal husbandry [7, 17, 20]. The latter findings, as well as the results of the present study, may reflect discussions in the media on "our hunger for meat" and which concentrate intensively on mass animal husbandry and SD. Thus, it is frequently stated that the most important principle for sustainable development would be to reduce meat consumption [21–23].

Synopsis

In summary, it can be established that the students have – to some extent – declarative knowledge on sustainable aspects of nutrition and are familiar with fundamental procedures for sustainable domestic work (procedural knowledge). In some areas, their content knowledge appeared to be poorly differentiated and was mainly restricted to the ecological aspects of sustainability and specifically to regionality. Thus, the students do not yet have the necessary knowledge to use and consider the different parameters of sustainable nutrition (declarative knowledge). From this point of view, it can be understood that it was difficult for students to carry out a multidimensional discussion of a fictional conflict situation with diverse aspects related to sustainability.

Limitations

The questions and format of the questionnaire-based survey have been well tested in pilot studies and optimally adapted to the target group. Nevertheless, it is still possible that some students were not motivated enough to answer the open questions in detail. It does often appear that test persons are readier to answer fixed questions than to express themselves freely [24]. However, in view of the complexity of sustainable nutrition, an open question format was inevitable.

Conclusion

If they are to teach their pupils about sustainable education, future teachers require (i.a.) the content knowledge that covers sustainable nutrition in all its complexity and multidimensionality. It follows that if future teachers are to plan lessons in HE/EWH – or training in nutrition and consumption – they must initiate the development of a wide variety of professional knowledge on sustainable nutrition, particularly as related to food preparation. Bearing in mind their future teaching, trainee teachers are then enabled to prepare a wide variety of tasty and sustainable dishes and to provide an expert justification of their choices. This target has already been implemented in a second stage of the present project [25].

Questionnaire
Interested readers can request a copy of the questionnaire from the authors.

Conflict of Interest
The authors declare no conflict of interest.

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