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6. PEDAGOGICS IN HOME ECONOMICS MEET EVERYDAY LIFE

Crossing Boundaries and Developing Insight in Finland and Japan

INTRODUCTION

The purpose of this chapter is to describe home economics as both an academic discipline and a science. First, it provides insights into home economics education in the Finnish and Japanese contexts by giving examples of both cultures. Second, it reviews the previous research on improving the quality of learning in an academic context (i.e., in higher education) by stressing the pedagogical and science educational approach. The authors present the following research projects:

1. Science Integration Studies in Home Economics Teacher Education (Rauma & Väisänen, 2003a; 2003b; Rauma, Himanen, & Väisänen, 2006);
2. Student Beliefs Concerning the Nature of Scientific Knowledge in Higher Education; and
3. Reflective Thought and Practical Reasoning Methods in Home Economics (Arai, 2014).

HOME ECONOMICS AS AN ACADEMIC DISCIPLINE AND A SCIENCE

Development from a Practical School Subject to an Academic Discipline

Home economics is constructed and developed as both a practical discipline and as a human science. The field of home economics has a specific cultural research object: the household and its activities. The activities of the home, the household, and homemaking are the particular phenomena under observation in this discipline, which focuses on the interaction between individuals, families, and society. Household activities comprise all material and immaterial modes of action that are linked to

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housing, housekeeping, care, and economics (Rauma, 2005, p. 199). There are many ways to define, understand, and practice home economics. Turkki (2005) described the core idea of the subject: "[T]he field works for human basic needs such as food, shelter and care" (p. 273). Moreover, the ultimate goal of the subject is to improve the quality of everyday life for individuals, families, and households in society. The subject of home economics also serves the aims of gender equality, a democratic upbringing, and multiculturalism (Janhonen-Abruquah & Palojoki, 2005, p. 363).

Historically, major shifts had taken place in Western societies (e.g., the U.S.A., the U.K., Germany, and Sweden) by the end of the nineteenth century. These shifts created a basis for establishing home economics as a discipline. The household had traditionally been a site of production, but industrialization (e.g., technology and new products) and growth of the markets associated with it transformed the home into a site of consumption (Goldstein, 2012, pp. 98–100). Hence, women needed new skills and competences to become knowledgeable consumers. An increasing number of women also began to work outside the home, which required education and counseling in cooking and nutrition for families. Thus, one aim of introducing home economics into the school curriculum was to provide knowledge and skills that could be used to reduce poverty and malnourishment (Håkansson, 2015).

The first home economics conferences, which were held in Lake Placid, New York (1898–1908), had a marked effect on home economics education and research. The field of study known as home economics was formally established in 1909 with the founding of the American Home Economics Association during the tenth Lake Placid Conference (Richards, 2000, p. 81). Today, home economics is studied as an academic discipline under names such as human ecology, consumer and family sciences, home science, family and consumer sciences, home science education, and home and consumer studies. In Finland and Japan, the academic discipline in the local language translates literally as "home economics."

Home economics was developed as a field of study in the late nineteenth century in many countries, including Finland and Japan. It was based on the desire to teach young women to apply science to the management of their homes (Sysiharju, 1995, pp. 72–76; Yoo, 1999, pp. 1–2; Richards, 2000, p. 81; Soo & Chua, 2014, pp. 69–72). The mission of home economics education is to promote the welfare of both individuals and families (Gillespie, 1991, p. 173; Kellet, 1994, p. 85; Yoo, 1999, pp. 1–9; Green, 2001, p. 1). Hence, home economics education is firmly connected to the development of society and well-being of families. In Finland, for example, home economics and crafts became elementary and secondary school subjects at the end of the 1800s when the community began to take responsibility for elementary education (Sysiharju, 1995, pp. 72–76). The Finnish Society of Home Economics was founded in 1918.

In Japan, the compulsory education system was started in 1872. Initially, the curriculum made no gender distinctions; however, in 1879, the practical subject of sewing was introduced only for girls in order to increase their school attendance rate. Until the end of the Second World War, girls were encouraged to study the subject

"homemaking and sewing" in order to become a "good wife and wise mother," which aligned with the paternalistic family structure of the time.

In Japan, home economics education started in 1947, two years after the end of the Second World War, in a period when the new values of democracy were starting to spread throughout the country. Home economics, along with social studies, was included in school curricula as a mean of spreading new values, thus playing a vital role in advancing the concept of a democratic home and society. The school subject of home economics thus began to nurture homemakers who managed safe and healthy households in equal partnership between females and males. However, during the economic revival of the 1960s and 1970s, the slogan, "Men at Work, Women at Home," was used to rally industry and the country to achieve rapid economic growth. This notion certainly influenced the education system: at the senior high-school level, home economics was forced to be a girls-only subject. In the 1980s, there were active movements by citizens and teachers who wanted co-educational home economics. Finally, the Ministry of Education announced "the 1989 Course of Study for Senior High Schools." Home economics then became a required subject for both sexes under the strong influence of "The Convention on the Elimination of All Forms of Discrimination against Women," which was led by the United Nations (Arai, 2012, pp. 31–34).

In Finland, the clear need for home economics research was stated in the committee report published by the pre-independence Finnish government in 1915 (Sysiharju, 1995, p. 72). However, research related to the field of home economics began only in the 1940s when two new professors in the nutrition and household economics sciences were appointed in 1946 to the Faculty of Agriculture and Forestry at Helsinki University. Later, in 1969, a professor of household technology was appointed to the same faculty. In 1995, household economics changed under the name of consumer economics.

Actual home economics research and teaching, however, did not occur at the academic level until the 1970s when teacher training colleges became part of the faculties of education at Finnish universities (Antikainen & Pitkänen, 2014, p. 8). Home economics (*kotitalous*) became a separate academic discipline, and the name was changed to the science of home economics (*kotitaloustiede*), which clearly designated it as an academic discipline. At both Helsinki University and the University of Eastern Finland, students can take a master's degree in home economics, and both universities have appointed full-time professors in home economics (Kaukinen & Rauma, 1998, pp. 3–4).

Several Japanese researchers went to universities in the United States to study home economics. One of them, Mr. Jinzo Naruse, a pioneer in the field of higher education for women, founded the Japan Women's University in 2001, where scientific theory and laboratory research were introduced into the study of home economics. Many graduates of the university went on to become teachers in the advanced schools for girls throughout the country, where they introduced scientific approaches to homemaking and family resource management.

After the Second World War, the Japan Society of Home Economics (JSHE), which was founded in 1949, focused on home economics as an academic discipline. The JSHE described home economics as an integrated, practical science oriented toward family life. Research then was conducted to determine the interaction between humans and their environment. The results were used to improve living conditions and promote welfare. The Japan Association of Home Economics Education was established in 1958. Since then, theoretical research, historical analysis, and action research have been conducted on home economics education by researchers, teachers, and graduate students throughout Japan.

The Scientific Aspects of Home Economics

The scientific approach to home economics, which was derived from the theoretical models of home economics, allows the use of different research paradigms. The scientific aspects of home economics can be examined and defined from at least three different perspectives. Home economics can be viewed as an applied science, a human science, and an integrative new science (Rauma, 2005, p. 199).

The history of home economics education in Finland, as well as in many other countries, is based on the concept that home economics is a practice-oriented science that was originally developed to promote the professional interests of home economists (Richards, 2000, pp. 81–82). The material and educational care of households was regarded as a useful skill for which teachers needed an academic education. In this sense and context, home economics belongs to the applied sciences (Davis, 1993, pp. 27–32; Yoo, 1999, pp. 3–4; Rauma, 2005, p. 202).

The existence and justification of modern applied sciences, such as nursing science, meat technology, craft science, and industrial design emerged from using scientific theories (Niiniluoto, 2003, pp. 136–137); the focus of research in these fields is of a pragmatic nature. These sciences developed as design sciences in which the skills and techniques used were tested by scientific research methods. A typical feature of design science research is that it does not problematize its' aim because the ideal is to be free of values. In this respect, home economics is not a pure design science because everyday life is not solely technical; on the contrary, our activities are always value dependent (Peterat & Smith, 2000, p. 4). Based on this fact, home economics researchers (Baldwin, 1991, pp. 42–48; Vaines, 1993, p. 21; Craig, 1996, pp. 147–150; Yoo, 1999, pp. 7–8) have emphasized home economics as a practical applied (design) science rather than a technical science because human actions and ambitions are always associated with the question of the common good.

However, home economics can also be seen as not only a design science, but also as a science with a clear cultural object, which has become an emerging research topic: the household and its activities (Rauma, 2005, p. 199). Hence, home economics can be regarded as a human (cultural) science that studies the construction of the household and its interaction with different environments.

The scientific aspect of home economics has also been explained through the integration of the sciences (Darling, 1995, pp. 371–377; Yoo, 1999, pp. 4–5); specifically, in order to explain, understand, and reveal the existence of an action in a household, it is necessary to use the perspectives of different sciences. For example, preparing food requires both scientific (e.g., cooking temperature and chemistry) and cultural (e.g., Eastern food and Christianity; traditional Japanese food, religion, and historical tradition) understanding. This interdisciplinary aspect of home economics is similar to new modern sciences, such as family research, gender studies, science studies, peace research, youth studies, and research on the future.

Similar to an educational scientist, the home economist can be orientated philosophically, psychologically, or sociologically. The scientific scope of home economics is similar to the interests of the social sciences in which the researcher examines the interaction between the individual, the family, and the society. In teacher education, home economics is similar to the behavioral sciences, specifically the scope of human science, which entails connections to practical philosophy, educational sciences, sociology, and applied economic sciences, such as Consumer Economics. Because it has strong roots in design science, home economics research can also include applied natural sciences such as nutrition and household technology.

The home economist is interested in the cultural, economic, and social action of households. Ontological questions raised by researchers include the following: What is home like? How do the household and its members work both together and separately? What kinds of interactions do households have with their environment? How are the home and home economics valued? What is the household culture like? What kind of education is given in homes and families? Because of its theoretical background, relevant research topics for home economists are the household's material and immaterial resources, consumerism, sustainable development, gender, and family issues.

Paradigms and Methods – Crossing Boundaries

Searching for an appropriate paradigm of home economics has been one of the most challenging tasks for every home economist throughout the history of this field (Yoo, 1999, p. 1). Because the scope of home economics is broad, there are many potential areas of research. Hence, it is not sensible to restrict research to gaining knowledge about a certain paradigm. Instead, based on practice, the knowledge of home economics can be technical, theoretical, hermeneutic, or emancipatory, depending on the research questions. In this sense home economists need quantitative, qualitative, and contextual research methods.

The technical-empirical approach (Vaines, 1993, p. 21; Tuomi-Gröhn & Palojoki, 2000, pp. 113–120) originated from the positivist research paradigm. This approach is feasible in the research of daily activities if new and better instructions for these activities are to be found. An example is sensory evaluation research, which emphasizes home economics as a technical design science.

The theoretical approach differs from the technical approach in its attempt to point out the laws and theories that explain phenomena in the effort to understand the research object. Theoretical interest in knowledge broadens understanding and develops the ability to think. The researcher is not merely interested in knowledge that improves instructions (what and how); instead, the aim is to determine the reason (Haaparanta & Niiniluoto, 1986). An example of this is experimental cooking. In this approach, home economics can be regarded as an applied natural science that focuses on explaining the reasons behind the phenomena. Nonetheless, cooking practices can been seen a culturally embedded subject (e.g., traditional Finnish and Japanese meals).

Thus, understanding the behavior of people in households necessitates the use of a human-based approach with its roots in hermeneutics and phenomenology (Tuomi-Gröhn & Palojoki, 2000, pp. 113–120). This approach makes home economics a cultural human-centric science in which the researchers' interest lies in human intentions, meanings, values, practices, and other human and socio-cultural aspects that construct the actions of individuals (ibid.) and families.

In using the critical emancipatory approach (Vaines, 1993, p. 23; Darling, 1995; Yoo, 1999, p. 8; Tuomi-Gröhn & Palojoki, 2000, pp. 113–120), the researcher aims to increase the awareness of the common good in all everyday activities. The main idea is the quality of human interaction. In this paradigm, home economics approaches the paradigm of critical social science in which the objective is to make people question their own actions and look critically at the interaction between households and the community (Green, 2001, pp. 3–4). Vaines (1994, p. 62) suggested that the empowerment orientation is most appropriate in home economics because it is consistent with the mission of the field, an example of which is action research (Tuomi-Gröhn & Palojoki, 2000, pp. 113–120).

PEDAGOGICS IN HOME ECONOMICS

Home Economics Curriculum, Learning Concepts, and Environment

In both Finland and Japan, teacher education in home economics is situated in the context of teacher education. In Finland, university curricula are revised every fourth year and basic curricula are revised every tenth year. The most recent curricula reforms took place in 2014 in both home economics teacher education (*UEF// Opinto-opas 2015–2016*, 2015, pp. 70–75), and in compulsory education (FNBE, 2014). In Japan, elementary, lower- secondary, and upper-secondary school curricula are revised approximately every ten years. The most recent curriculum reforms were made in 2008 and 2009. Curriculum reforms are made even less frequently at universities that are authorized to issue teaching certificates. The new curricula reforms at the elementary, lower-secondary, and upper-secondary education levels have been discussed by a special educational committee and will be announced in 2016 or 2017.

Because of the wide extent of the sciences on which it is based, the home economics curriculum is wide in scope. In Finnish secondary schools, practical everyday management is emphasized and is an important part of the pedagogical content of home economics lessons. In university curricula, practical skill training comprises only some five percent of the student workload. In contrast to this, students in teacher education study the basics of sciences, pedagogy, and theory in different areas of home economics. Home economics education at the school level and at the university level includes courses and thematic entities in food culture, housing, and consumer studies (*UEF//Opinto-opas 2015–2016*, 2015; see FNBE, 2014, pp. 437–440).

In Japan, the contents of home economics curricula at the elementary (grades 5–6), lower-secondary (grades 7–9), upper-secondary (grades 10–12), and university levels are based on wide and holistic perspectives. The content is significantly influenced by home economics education in the United States, including the following: (a) family resource management (including family relations and household economics, and consumer issues), (b) textiles and clothing (including clothes making), (c) food science (including dietetics, sitology, and food preparation), (d) housing and environmental science, and (e) the science of child development (including practice and home care). At the university level, students are required to study various kinds of pedagogy and teaching practices as well as the theoretical and practical bases of each specialized field of home economics (Yanagi, 2012, pp. 85–90).

According to the current concept of learning (Yilmaz, 2008, pp. 168–170), the learner is an active participant who works either alone or in collaboration with other learners in setting goals or solving problems. Learning topics that respond to real-life issues as well as guidance by emotionally intelligent teachers nurture the learner motivation and delight in learning. The study of larger theme entities is encouraged because in problem solving, learners need to combine their knowledge of different fields.

The use of different environments, such as homes, shops, museums, work places, forests, cities, social media, and the Web, as learning environments is encouraged. Examples of constructivist learning models are the following: experiential learning, self-directed learning, discovery learning, inquiry training, problem-based learning, and reflective practice (ibid., p. 169). Design Orientated Pedagogy (DOP) was recently developed to enhance collaborative learning activities both in and outside school (Vartiainen & Enkenberg, 2013, p. 59). In DOP, the learning community is large, and mobile technologies, especially social media and mobile technologies, are used to collect data and share ideas.

High-Quality Learning and University Teaching

In university teaching, a frequently discussed problem is the inertness of knowledge (Vermunt & Verloop, 1999, pp. 257–280). This concerns the issue of the knowledge

domains acquired through education are often studied in isolation from the context of knowledge use and are therefore difficult to access (Gallagher, 2000, pp. 310–318). The inertness of knowledge also refers to problems in the practical application of knowledge. Although students might have acquired considerable knowledge, they may not be capable of solving problems in practice.

To avoid this problem, Biggs (2000, pp. 40–43) suggested that university teaching should facilitate the learning of functioning knowledge, which requires a solid foundation in declarative knowledge (i.e., "knowing-what"), but it should also involve knowing how to do things (i.e., "procedural" or "knowing-how") and when to do these things (i.e., "conditional" or "knowing-why").

Furthermore, one of the most demanding challenges in higher education is to create learning environments that encourage students to become active learners who develop professional competence and generic skills. Väisänen and Rauma (2003, pp. 1–2) suggested using meaningful learning activities that correspond to real-life problems, in addition to problem-based learning and learning portfolios, both of which require the learner to have high levels of cognitive and metacognitive skills. Because home economics is a skill subject, university teaching should also emphasize the importance of functioning knowledge.

In addition to practical skills, home economics has developed a scientific approach (e.g., methods and a paradigm) that emphasizes the importance of science education. Van Dijk (2014, p. 398) stressed the role of science education and literacy in developing the manner in which students understand the nature of knowledge. This leads them to become critical thinkers who master and increase scientific skills and resources (Smith & Siegel, 2004, p. 553; Zhou, 2012, p. 109). In the context of higher education, including home economics, science education refers to the process of understanding the scientific epistemologies of knowledge (Siegel, 2014, p. 373) and different paradigms, such as those offered by hermeneutics and the critical emancipatory approach. Furthermore, in the process of creating scientific knowledge, home economics should provide the pedagogical skills and competencies (e.g., inquiry and problem-based methods) necessary for creating subject matter (e.g., family meals, healthy eating, and financial literacy).

As argued above, one function of home economics as an applied science is to build bridges between the natural sciences and the social sciences. The following sections will elaborate on how science teaching can be a part of home economics learning within the context of chemistry and biotechnology, and on how science teaching can be combined with the epistemic beliefs and scientific knowledge of those been taught. We also introduce the principles of the practical reasoning method. This method is a suitable pedagogical model for home economics because its' objectives are to help solve problems and improve lives.

The Scientific Teaching Method as a Means of Professional Learning in Home Economics

In the science of home economics various phenomena, observations, and incidents are explained based on both behavioral and natural sciences (Davis, 1993, p. 27). The Finnish home economics curriculum emphasizes practical everyday management, which is an important part of pedagogical content. However, the broad scope of home economics also provides the teacher with opportunities to orient students to science education.

The teaching methods in science education, such as using projects, experiments, and models to explain phenomena, are suitable for application in home economics, where traditional learning has been strongly related to practical action. During a home economics lesson, scientific information can thus be integrated naturally. At its best, learning is both comprehensive and experiential (Barkman, 1996, pp. 44–48). Moreover, the home economics curriculum emphasizes problem solving, critical thinking, and the perception of entities (FNBE, 2014, p. 438). Kivilehto (1998, pp. 56–60) presented a special approach to science education in the home economics context. While teaching baking, she studied the development of scientific thinking and deductive skills in her students.

In Finnish secondary schools, food preparation is nearly always included in home economics courses (Hokkanen & Kosonen, 2013, pp. 1–2). Food preparation is a project, a theme entity, which is planned, carried out, and evaluated together. When preparing food, the students have to measure, mix, and heat substances. Changing the conditions allows students to follow reactions and make observations. However, deeper understanding of reactions and phenomena requires that students master the basics of chemistry, biology, and physics. Therefore, it is also necessary for the teacher to first master the basics of these sciences and know how to integrate the elements of these subjects into home economics teaching. Thus, the requirements for the pre-service and in-service education of home economics teachers are set accordingly.

Two studies were conducted concerning science education in home economics. The first study was an intervention study. It was implemented in an in-service training course for home economics teachers and was aimed at fostering their competence in integrating science into home economics teaching (Rauma & Väisänen, 2003a, pp. 97–98; Väisänen & Rauma, 2003, pp. 1–12). The second study examined how Finnish home economics teachers were integrating science and mathematics into their general teaching practices (Rauma et al., 2006, pp. 27–36).

Theoretical Foundations of the Chemistry and Biotechnology in Food Preparation Courses

Experts in food chemistry and nutrition taught the one-semester, three-credit course, Chemistry and Biotechnology in Food Preparation. The course was part of a project administered by the Finnish Board of Education, the aims of which were to enable

teachers to increase their knowledge of natural sciences and mathematics. The course was based on the principles of andragogy and social constructivism, with the emphasis on problem-based learning, experiential learning, and collaborative learning. It was an effort to produce high-quality learning. Active and enthusiastic learners, proficient questioning, and generalized tutoring, as well as collaborative working methods were the objectives of the teaching and learning situations. The learning activities and settings were planned to be meaningful, problem oriented, and contextual so that they would correspond to real-life problems in the setting of home economics (Rauma & Väisänen, 2003a, pp. 73–74; Väisänen & Rauma, 2003, pp. 1–12).

The exercises included experiments in kitchen chemistry: making popcorn and ice cream, in order to study the evaporation and freezing properties of water molecules; cheese-making to demonstrate how casein can be isolated from milk; and bread-making to demonstrate the formation of the gluten structure and enzyme activities. Traditional Finnish foods, such as sour whole milk (*piimä*) and a special pudding-like dish made from rye flour (*mämmi*) were prepared in order to follow the activities of lactobacilli and natural enzymes. The plan was for the teachers to do the same exercises with their own students before the next contact-education day.

All participants (N=18) were women. Seventeen were home economics teachers, with one being a chemistry teacher. Most (16 in all) were between the ages of thirty and forty. Nearly all participants taught in secondary schools; one taught in a vocational institute. The participants completed the questionnaire concerning their knowledge of chemistry and microbiology. They were also requested to keep a learning portfolio.

Lessons to Learn

According to the results of our study, integrating science education with home economics promoted high-quality learning and knowledge of pedagogical content. The home economics teachers were active in expanding their knowledge, and their independent learning received the support of those teaching them. Tutors, these being teaching experts participating in this project, learned that a problem-centered and experience-based style of learning requires much from teachers. Not only do they have to be able to accept uncertainty and master their own field, but they must also be pedagogically proficient.

The participants were highly motivated to learn how to integrate chemistry and microbiology into home economics. The previous inertness of their knowledge had complicated this integration. Their portfolios revealed that they had regarded their studies in pre-service teacher education as being too theoretical due to its lack of links to the practice of teaching and learning. The reasons that they had difficulty in remembering the basics of these sciences at the beginning of the course was explained by the teachers as follows:

> The problem with the chemistry courses related to the master's degree was that teaching did not proceed from the atom and molecule level to the level of practical life, and the

> points of connection with reality were not explained. Most chemistry teachers lack the ability and skills to do this.
>
> The four-credit chemistry course during my studies nearly ten years ago was very limited. As a matter of fact, the course consisted only of an exam on a thick package of books and contained almost no practical chemistry exercises. During the course, I also wanted to get tips and practical examples of how to use chemistry and microbiology in home economics teaching.

After the course, the participants thought they could use what they had learned to solve problems in practice. This was because a main principle was followed in teaching the course: the integration of the declarative, procedural, conditional, and functioning domains of knowledge (Biggs, 2000, pp. 40–43). The aim was for the participants to produce rich, interwoven, and complex memory representations (Prawat, 1989).

When the participants were asked about their knowledge of a few basic concepts in chemistry and microbiology, two of them mentioned the following in their portfolios:

> I noticed already after the first time that I have terrible gaps in the basic vocabulary of chemistry alone. Sometimes I felt a subject surpassed my comprehension totally, when I started to think of a term I did not understand.
>
> To my satisfaction, I can state that the words and phenomena, such as enzyme, flavonoid, fermentation, and so on, do not sound strange any longer and I can give them some kind of a "scientific" explanation.

The portfolio work helped the teachers attain a high level of self-assessment and a more holistic view of their learning and teaching. Two teachers wrote about integration, suggesting that choosing the perspective of instruction is not easy because home economics as a discipline is wide and interdisciplinary in nature.

> In cooperation with my home economics colleagues, I have noticed that, in particular, the use of the perspective of chemistry in the observation of the subjects taught is very limited. The teacher herself chooses the observation perspective: for example, whether to observe the baking of buns from the standpoint of economics or food preparation techniques, from the perspective of role division within a family or of human relations, or from the perspective of the chemical reactions taking place in the dough. I have often also offered the latter aspect and thus integrated chemistry into home economics lessons.
>
> My objective was also to create functioning prerequisites for the integration of education of chemistry, biology, and home economics. Also, this objective was achieved even better than expected. Already in the spring term we will start experiments, and in the next school year we will offer our students the elective course Natural-Scientific Phenomena of Everyday Life in which home economics will be one part, together with chemistry and biology.

The teachers also expressed their willingness to cooperate with science teachers. The experiences gained from the course strengthened the preconceptions held by the

tutors that the integration of science into home economics is meaningful and easily applicable. The participants in the course were volunteers and the evaluations of the learning outcomes were based on their self-ratings. Nevertheless, the data and open discussions indicated that home economics teachers in general would feel that home economics lessons should have more science education content. The results of the study suggest that in pre-service teacher education, the integration of science education into home economics teaching should be the focus of more attention.

The results of the survey (Rauma et al., 2006, pp. 29–41) supported the findings observed in the pilot study (Rauma & Väisänen, 2003a, pp. 97–98). Although home economics teachers sometimes integrate science and mathematics into their subject, in most cases, the forms of integration are not developed or planned well beforehand. The teachers who were prone to integrate such material had a deeper background. Consequently, they were more self-confident about their teaching. They also used student-centered working methods, and they based their teaching on both national and local curricula.

The results of our studies reflect the importance of pre-service training, and they provide a basis for further developing university pedagogy. The results also suggest that integration should be used in university teaching. Teachers should be provided with home economics textbooks that include information on kitchen chemistry experiments. This could more effectively motivate teachers to integrate and students to learn. Finally, based on their research on home economics, Hokkanen and Kosonen (2013, p. 284) suggested that the more textbook exercises should promote cooperation and focus on the environments in which adolescents live.

Students' Beliefs in the Nature of the Scientific Knowledge Used in Higher Education

When home economics became an independent discipline at Finnish universities, the science approach was stressed (i.e., the name was transformed into the science of home economics) (Rauma & Väisänen, 2003a; Rauma et al., 2006). In Japan, scientific theory and laboratory research have been emphasized in home economics studies since the beginning of the twenty-first century. The importance of understanding the nature of science and scientific knowledge is now emphasized in the educational system from elementary school to university. Science education at the university level should include analysis of how students think about science at the early stage of their studies and how this scientific knowledge develops over the course of their higher education. This line of research is epistemological by nature (Hofer & Pintrich, 1997, p. 88).

The epistemological beliefs of teachers, students, and children have been the object of research (e.g., Delandshere & Petrosky, 1994; Yang, 2005; Tucker-Raymond, Varelas, Pappas, Korzh, & Wentland, 2006), but this research has emphasized the natural sciences, such as biology and physics. Only a few studies focused on the scientific mind-set of university students in the human and social sciences. However, in the Finnish context, Kaartinen-Koutaniemi and Lindblom-Ylänne (2008, p.

179) studied the personal epistemology of students of theology, psychology, and pharmacy. This study focused on how the students understood knowledge, thinking, and reasoning in science. Specifically, it analyzed the development of their scientific thinking from absolutist knowing (e.g., facts and objectivity) to evaluative knowing (e.g., alternatives, evidence, argument, and reflection) (see Table 1) based on the arguments presented by Kuhn, Cheney, and Weinstock (2000, p. 311) regarding students' understanding of knowledge. In other words, they studied what students think science is about and how students construct the knowledge and understanding of the world over the course of their studies.

Table 1. Reality, Knowledge, and Critical Thinking in Absolutist and Evaluative Knowing

Level	Reality	Knowledge	Critical Thinking
Absolutist	Directly knowable	Comes from an external source and is certain	A vehicle for comparing assertion to reality and determining truths or falsehood
Evaluative	Not directly knowable	Generated by human minds and is uncertain	A vehicle promoting sound assertions and enhances understanding

In practice, the home economist should be knowledgeable about issues such as nutrition and healthy diets (Janhonen, Mäkelä, & Palojoki, 2015), family structure, or financial literacy skills for young people (Autio, Wilska, Kaartinen, & Lähteenmaa, 2009, p. 413). Furthermore, students should understand the differences between the natural sciences and the human sciences in knowledge production (McGregor, 2011, p. 566). Such understanding is also relevant to the questions of how researchers and students of home economics produce scientific knowledge of those issues, and how they use theoretical standpoints to do so. Based on the results of their study, Kaartinen-Koutaniemi and Lindblom-Ylänne (2012, p. 7) argued that if teachers want to promote the development of reflective and thoughtful students, they should use teaching methods such as argumentative debate, cooperative learning (Janhonen-Abruquah & Palojoki, 2005, p. 361), practical research assignments, and reflection in their own work. Otherwise, students rely on authorities such as teachers or the course literature. Furthermore, they hold a conception of knowledge that emphasizes the importance of the knowledge transmitted by teachers. Hence, students do not become critical thinkers (see Table 1). According to Håkansson (2015), teachers of home economics often see their work as a matter of transferring social norms to their students (Höijer, Hjälmeskog, & Fjellström, 2011, p. 515), in addition to which they see themselves as conveying a pessimistic view of consumption.

As previously argued, the discipline of home economics emphasizes both social and humanistic approaches as well as the natural science perspective in the development of student knowledge (e.g., Rauma et al., 2006; McGregor, 2011), which is intriguing. The natural sciences focus on the relation to truth, its correspondence to reality, and causal explanations. Similarly, the social and human sciences emphasize interpretations of the world that are constructed socially, historically, and linguistically. The latter approach uses discussions of hermeneutics, phenomenology, and cultural studies (e.g., stories, pictures, discourses). Scientific realism relies on empirical results (e.g., truth, facts, testing, and models) that are obtained by using objective approaches and the positivist research paradigm (Tuomi-Gröhn & Palojoki, 2000, pp. 113–120).

These two scientific standpoints in home economics signify that the focus of interest should not only be what students personally think about scientific knowledge but also what they should learn about the scientific (epistemic) nature of home economics. For example, this means that preparing food requires both scientific (e.g., cooking temperature and chemistry) and cultural (e.g., religion, historical tradition, and national food culture) understanding and skills that are usually used simultaneously. Students should understand that a vegetarian diet can be religion based (cultural), and a gluten-free diet can be health or allergy based (i.e., fact based). Furthermore, the Finnish and Japanese food cultures have similarities, such as eating raw fish, cultural differences, such as familial structures, understanding healthy eating (e.g., milk versus soya) and the appreciation of the visual aspects of food (which is highly important in Japanese culture). When home economists, whether in Finland, Japan, or another country, teach their students how to prepare healthy and tasty meals, they need the knowledge of chemistry, physics, measurements, the local culture, as well as pedagogical skills. Thus, both science education and cultural (practical) understanding are required in home economics learning and teaching.

Lessons to Learn – The Scientific Mind-Set of Students in Higher Education

According to Zhou (2012, pp. 120–125), science education takes place in a hybrid space of the everyday culture, traditional culture, and science culture. He argued that students' preconceptions are a product of their everyday life experiences and, combined with their traditional culture, constitute their life-world view. Science education, which has traditionally been pictured as a relatively objective discipline, aims to develop students' knowledge, skills, and scientific attitudes. Zhou also suggested that many students experience a conflict between their everyday and traditional understandings of life and the scientific norms, conventions, and thinking (ibid., p. 113). Schutz (2001, p. 271) observed that science as it is usually taught can easily become a "strange world" with little or no relation to the lives of students or everyday experiences. As a practical discipline, home economics relies on everyday culture, which reinforces the pragmatic views of science and the discipline held by students, which may cause conflicts in their minds.

A few studies have dealt with the issue of the scientific mind-sets of university students (e.g., Yang, 2005). According to Rauma and colleagues (2006, p. 30), teachers of home economics have often noticed how students have negative science learning experiences because they felt that science was too abstract and distanced from everyday life. These results raise questions about what students think that science education should be in the context of home economics and the kinds of thoughts they have about scientific knowledge.

Because studies on the scientific thinking among home economics students are not yet available, the present chapter utilizes "My understanding of science" narratives. These narratives were written by students in consumer economy (first year, N=64) in Finland and business studies (second and third year, N=57) in Sweden. The present study was guided by the assumption that students of home economics share thoughts on science and scientific knowledge that are similar to the thoughts of students of consumer economy, business studies, and theology (Kaartinen-Koutaniemi & Lindblom-Ylänne, 2008; 2012). The standpoint of this study is that the teaching and strengthening of scientific thinking and learning in home economics requires an understanding of the student scientific mind-set. As argued above, teachers of home economics experience science education as being too abstract and distanced from their everyday lives. Thus, it is essential to gain knowledge about how university students understand knowledge, thinking, and reasoning.

Science narratives provide important information concerning the beliefs about science held by students within the context of higher education. The research data were analyzed to determine the kind of understanding that students have about science, and whether they rely on truth and facts or see scientific knowledge as uncertain and generated by human minds (see Table 1). The essays written by the students revealed that they see the nature of science as abstract and challenging: "Science is intended for wise people" and "Science is an abstract concept that is difficult to understand. ... Science frightens me." In their narratives, the students described the principles of science, such as methods, data accumulation, and openness. Their narratives included the understanding of knowledge, such as absolutist knowing (e.g., facts and objectivity) and evaluative knowing (e.g., alternatives, evidence, argument, and reflection), as Kuhn and colleagues (2000) argued. The following is a treatment of the three categories the present research found to reflect how students conceptualize science.

Science is Facts and Objective Reality – "The Truth about a Phenomenon"

As Kuhn and associates (2000, p. 311) argued at the absolutist level, students see the products of knowing as facts that are objective, certain, and derived from an external reality that they depict. As Zhou (2012, p. 121) pointed out, science is pictured as a relatively objective discipline. In the category of "science is facts," students in higher education presume that scientific knowledge is the reflection of facts about external reality and truthfulness (see Table 1), and is essential. The following examples illustrate this category:

> I understand science as facts that I can trust without knowing the background information... Scientific research is carefully and faithfully conducted experiments, observation and so on. Its aim is to answer research questions. (Finnish narrative No. 1)

> Science is often something that is very "stable." By this I mean that what has been found is pure fact that will always stay as it is. (Swedish narrative No. 40)

> Science is the most likely explanation for something. The truth about a phenomenon that is the most likely at that point. – An attempt to objectively study reality. (Swedish narrative No. 47)

Students not only see knowledge as certain but also as stable. They might think about the "laws" of mathematics or chemistry that they learn in secondary school and in high school. This viewpoint follows the idea of natural science, which assumes that human influence does not exist. Sawyer (2006, p. 41) pointed out that very few schools teach students how to create knowledge; instead, students are taught that knowledge is static and complete, and they become experts at consuming knowledge rather than producing knowledge.

It is notable that students of consumer economics and business study the social sciences as well as home economics. The view that scientific knowledge is certain and stable indicates that in their personal epistemology (thinking) students rely on absolutist knowledge and at any natural science that might evolve during their studies. As Kuhn (2001, p. 5) argued, the absolutist conception of knowledge is most likely transformed to a relativistic one.

The Reconstructive Nature of Science – "People Can Be Fallible"

In the second category, the "reconstructive nature of science," students realize that knowledge is uncertain, and that gaining real facts about reality is difficult. They recognize how human influence affects the production of knowledge. They understand that interpretations of the world change over time, and that scientists create new knowledge and methods. Scientists can also be fallible, which reinforces the conception of human influence. The following examples illustrate this category:

> Science is facts and knowledge. Scientific knowledge needs to be verified. ... Science is a tool that people use to explain the world around us. People can be fallible, and thus scientific knowledge is not about absolute facts. Specific to science is the updating of knowledge. ... Scientific research aims to be exact, and it explains phenomena as accurately as possible. (Finnish narrative No. 61)

> Rarely can [science] be applied broadly, because it depends on the time it is created: The society that creates it influences [science] with the scientific findings that are thought to be "valid" at the time, as well as with the assumptions that are made are based on knowledge people have. Probably, new science will replace what we now have as new phenomena are discovered in the future. (Swedish narrative No. 49)

Students have more reflective thoughts than scientific thoughts. In this category, their mind-sets approach evaluative knowing, which focuses on alternatives and

arguments. They also recognize the reconstructive nature of science. Moreover, students believe that science aims to discover reality and facts about life.

Science as a Discussion – Real Facts and Knowledge Do Not Exist

In the third category, students have belief systems that are in contrast to the first category. They stress discussion as an integral part of scientific knowledge and an understanding the world. They also emphasize the process of creating new knowledge and studies, something that can be contradictory. The many schools of thoughts and different theories in the social and human sciences yield conflicting results. In addition to discussion, students write about understanding the world rather than explaining it, although the latter is typical of the natural sciences.

> In science as a whole, the aim is to understand the world around us, and life... ”real” facts and knowledge do not exist; rather, there are only a viewpoint and attempts to understand. ... Discussion is the most important thing between scholars. (Finnish narrative No. 7)

> Science necessitates strong willpower and a passion to discover new things. ... It is important for us not to simply believe what is claimed in the name of science. It is better for science that people do not have faith in it. ... Actually, science is discussion... different research results are inconsistent with each other. (Finnish narrative No. 13)

> Science to me is when you try to dig deeper into a subject. It is not accepting a fact, but instead trying to understand why and how something is what it is. (Swedish narrative No. 17)

Students have belief systems that are based on evaluative knowing, in which alternatives, arguments, discussion, and reflective thinking are part of the understanding of science. This reinforces the aim of critical thinking in higher education by which students develop scientific skills and resources in order to understand different paradigms, such as the positivist, hermeneutic, or critical emancipatory approaches. According to Palmer and Marra (2004, p. 333), the development of personal epistemology shifts from simple views to multiple perspectives and is more likely to occur among students of the humanities and social sciences than among students of science.

However, the first category of student thinking raises a question about how to develop an understanding from absolutist knowing to evaluative knowing. Furthermore, if no research is conducted on the epistemological beliefs of home economists, teaching science education without knowing which categories of knowledge characterize their mind-sets would be difficult. Based on the narratives illustrated above, it is most likely that students of home economics also have different kinds of belief systems. Nevertheless, most important is that they learn over the course of their studies that home economics is a multidisciplinary subject (Rauma, 2005; McGregor, 2011; Tuomi-Gröhn & Palojoki, 2000), one that uses many paradigms and theoretical standpoints, and includes a variety of epistemological belief systems. In other words, home economists use both the “laws” of chemistry and their knowledge of culture in

their teaching. Furthermore, the scientific understanding of knowledge nurtures both problem-solving skills and critical thinking.

Reflective Thought, Critical Literacy, and Practical Reasoning in Home Economics

Today's world is rapidly changing. Environmental problems, such as global warming and acid rain, economic issues, such as the gap between rich and poor, the severe competition caused by the global economy, and social problems, such as human rights violations and gender discrimination, have all become more complex than ever before. The solutions to such problems require a new kind of development in which the emphasis is on protecting and harmonizing with the natural environment and ensuring social justice – in other words, pursuing sustainable development.

Home economics education is closely related to these issues because the important objectives of the field are not limited to the acquisition of knowledge and skills, and their application to everyday life. The goals of home economics include performing tasks, solving problems, and improving lives creatively. Critical literacy is required to identify the exact problems, examine them, and find plausible solutions.

The concept of "critical literacy" originally evolved from the theoretical writings of Jürgen Habermas. It involves powerful thinking, reading, speaking, and writing habits which are used to probe beneath the surface of the meanings of words in order to comprehend the root causes of problems. Critical literacy takes into account the contextual factors that influence our lives. It reflects on consequences with respect to the world around us (Brown, 1980; Rehm, 1999). To foster critical literacy in students, the new curriculum theory of practical reasoning in home economics was first proposed by Marjorie M. Brown. She declared that home economics needed to develop an attitude toward, and competence in, seeking out the implications of existing social conditions. Additionally, it needed to ask whether alternatives would be better for those we seek to serve (Brown, 1980). Brown's discourse was further developed and applied to curriculum theory in several states in the United States. Janet Laster, who developed a practical reasoning teaching strategy in Ohio based on Brown's theory, indicated the following: "Through questioning and practical reasoning, critical literacy promotes reflection, especially self-reflection, transformation, and action." "In home economics and family and consumer sciences education, critical literacy processes are nurtured through practical problem-based curriculum experiences" (Laster, 2008, p. 262).

All previous research and curriculum theories demonstrate that the subject of home economics makes students examine their private and public lives, both identifying their problems and trying to solve them. Therefore, home economics can nurture the problem-solving literacy of students to improve their well-being through practical reasoning processes (Arai, 2014, p. 229).

The most exciting feature of practical reasoning is that reflective deliberation is taken very seriously in each of the following four learning steps (Laster, 1998, p. 53):

1. Analyze the problem, including context and value conflicts between and within the various perspectives involved.
2. Set values and goals that form an acceptable standard for judging alternative actions.
3. Take possible actions.
4. Reflect on the consequences of these actions.

The core part of this problem solving and learning process is the questioning between teacher and student, between students, and within the student. These questions include the following: "What is the problem?" "What is the reason for the problem?" "What kinds of choices do we have?" "Is this information reliable?" "Are there any facts and/or opinions that support your choice?" By building on the experience of repeatedly asking these questions, students can deepen their thinking, comprehend the context of problems, and empower their decision-making skills and critical literacy. Thus, teachers need to prepare effective questions for students at each learning step.

As argued above, teachers should promote the development of reflective and thoughtful students by using argumentative debate, cooperative learning, and practical research assignments (McGregor, 2011, p. 566). The use of practical reasoning is one method of strengthening the critical literacy of home economists, as well as their competence in scientific thinking, and thus in home economics literacy (e.g., food, consumer issues, clothes, social media, household management, gender, sustainable society, and multiculturalism).

FUTURE CHALLENGES

In the future, students will need different sets of knowledge and skills. Home economics serves as a platform linking theory to practice. It can thus play a critical role in imparting these competencies (Soo & Chua, 2014, pp. 72–73). However, home economics pedagogics faces many challenges. These include determining the most effective way to use IC technology, developing the spirit of innovation and enterprise, and incorporating specific twenty-first-century skills, such as civic literacy, global awareness, and cross-cultural understanding into curricula (ibid., p. 73). Several policy makers and educators have discussed this issue. These include the U.S. Department of Education (the Partnership for 21st Century Skills and the Metiri Group [enGauge 21st Century Skills]) (ibid., p. 63).

One competency framework that influences the educational goals and methodologies in every country is "key competencies." This was designated in 2003 by the Definition and Selection of Competencies (DeSeCo) program, one of the educational projects of the Organization for Economic Cooperation and Development (OECD). In this framework, individuals nurture the following three key life-long competencies that are required if they are to face the complex challenges of today's world successfully (Rychen & Salganik, 2003, pp. 85–104):

1. using tools interactively (language, symbols, and texts; knowledge and information; and technology);
2. interacting in heterogeneous groups (relate well to others; cooperate and work in teams; and manage and resolve conflicts); and
3. acting autonomously (act within the big picture; form and conduct life plans and personal projects; and defend and assert rights, interests, limits, and needs).

All three competencies are closely related, with "reflectiveness" (reflective thought and action) being situated at the center of each. Reflectiveness implies the use of metacognitive skills, creative abilities, and taking a critical stance. This enables individuals to reach a level of social maturity that allows them to distance themselves from social pressures, have different perspectives, make independent judgements, and take responsibility for their actions.

How then does home economics relate to these key competencies? The relationship between the three competences and the basic aims and concepts of home economics education can be described as follows:

1. *Use tools interactively*. Use knowledge and technology interactively, which is necessary in daily life.
2. *Interact in heterogeneous groups*. Relate well to family and close members of society. Cooperate and manage family issues and daily life.
3. *Act autonomously*. Think and act in ways to improve life. Ensure well-being and the basic needs of human life.

From this point of view, home economics has the potential role of nurturing active and thoughtful citizens with well-balanced competencies, especially in their daily living (Arai, 2014, p. 230). Furthermore, strengthening critical literacy skills and science education among home economists and in home economic studies will foster the development of the key competences that are required in the twenty-first century.

Based on these key competencies in home economics pedagogy, we need to emphasize the ability of students to create knowledge, work collaboratively in acquiring and creating knowledge, and use reflective practices if they are to acquire critical literacy and become critical thinkers.

CONCLUSIONS

The empirical task of home economics can be regarded as a traditional mission that combines university teaching with societal tasks. Home economics education aims to promote the welfare of both individuals and families, and it has traditionally been linked to the paradigm of sustainability (Vaines, 1994, p. 59). At the primary level, home economics education has a social, cultural, and economic mission, particularly in today's changing societies, where the effects of global incidents are felt in households and families. This interconnectedness requires university pedagogics and home economists to study the interactions between individuals, families, and society in areas of everyday life, such as housing, housekeeping, and care.

This review discussed the scientific nature of home economics, and it explained the pedagogical models used to improve the quality of learning in higher education. The following recommendations are based on the lessons learned from previous studies: First, the development of academic thinking and research skills in home economics students needs to be strengthened in order to achieve the aim of critical thinking. We encourage teachers of home economics to study the epistemological beliefs of their students. Their scientific skills can be improved if their teachers are aware of the current mind-set in this respect. In formal learning, the integration of different subjects and the use of the practical reasoning method will increase the effectiveness of learning. Since the learning environment in home economics is the same as the living environment, we should use informal learning more often. The focus in home economics research should be on everyday activities.

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