

HEALTH SCIENCES

TEIJA RÄIHÄ

*Nutrition Health Project Using an
ICT-based Learning Environment
– Participatory Action Research in
Eastern Finland*

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EASTERN FINLAND

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Finland*

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ABSTRACT

This study describes the *From Puijo to the World with Health Lunch* development and research project (2000 – 2004), which was a part of the wider European Network of Health Promoting Schools programme (ENHPS; since 2008, Schools for Health in Europe (SHE)) in Finland. The purpose of the study was to design, develop and evaluate the nutrition health learning and education delivered from the seventh to the ninth grades in secondary schools. In addition, the study investigated the opportunities for an information and communication technology (ICT) -based learning environment to deliver nutrition health learning and education.

The study design was participatory action research. Applied quantitative and qualitative methods of collecting and analysing materials were carried out from 2002 to 2004. The pupils' eating habits and nutrition knowledge, as well as the use of computers and the internet, were recorded using a questionnaire, given to the seventh grade in spring 2002 and to the ninth grade in spring 2004 at two experimental schools and two control schools. The data were analysed using Fisher's exact test, factor analysis, logistic regression analysis, the Mann-Whitney test, the Wilcoxon test and the McNemar test as statistical methods. In addition, the ICT-based learning environment experiences of the pupils from the seventh to the ninth grade at the experimental schools were evaluated using a questionnaire at the end of the ninth grade. The data were analysed by using factor analysis and the two-way variance analysis. When the nutrition health project ended in spring 2004, an interview based on a recall technique revealed the views of the teachers, school health nurses and school catering managers about the implementation of the nutrition health project and the potential of an ICT-based learning environment in secondary school. The material was analysed using content analysis, with the Atlas.ti software.

The results of the study indicated that the nutrition knowledge of pupils at schools that participated in the nutrition health project increased markedly. In addition, the pupils at the experimental schools developed healthier eating habits from the seventh to the ninth grade. The results showed that the use of an ICT-based learning environment supported pupils' health education and it developed their critical reading skills for nutrition and health information that could be found on the internet. The results indicated that implementing the nutrition health project as well as the utilisation of an ICT-based learning environment for nutrition health education required the participation of all the school staff.

The results of this study produced information that can be adapted in practice by the pupils, by the pupils' parents and school staff when planning and updating nutrition health education and teaching and learning environments for it.

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TIIVISTELMÄ

Tässä tutkimuksessa raportoidaan *Terveyseväin Puijolta Maailmalle* kehittämis- ja tutkimushanke (2000-2004), joka oli osa laajempaa Euroopan Terveet Koulut ohjelman toteuttamista Suomessa. Tutkimuksen tarkoituksena oli suunnitella, kehittää ja arvioida yläkoulun ravitsemusterveysoppimista ja -opettamista seitsemänneltä yhdeksännelle luokalle. Lisäksi tutkimuksessa oltiin kiinnostuneita tieto- ja viestintätekniikan (TVT) käyttömahdollisuuksista ravitsemusterveysoppimisessa ja -opetuksessa.

Vuosina 2002-2004 toteutetussa tutkimuksessa sovellettiin kvantitatiivisia ja kvalitatiivisia aineiston hankinnan ja aineiston analysoinnin menetelmiä. Oppilaiden ruokailutottumuksia ja ravitsemustietoa sekä tietokoneen ja Internetin käyttöä selvitettiin kyselylomakkeella seitsemännellä luokalla keväällä 2002 ja yhdeksännellä luokalla keväällä 2004 kahdessa kokeilukoulussa ja kahdessa vertailukoulussa. Aineistot analysoitiin käyttämällä tilastollisina menetelminä Fisherin eksaktia testiä, faktorianalyysiä, logistista regressioanalyysiä, Mann-Whitneyn, Wilcoxonin ja McNemarin testejä. Lisäksi kokeilukoulujen oppilaiden TVT-oppimisympäristön käyttökokemuksia seitsemänneltä yhdeksännelle luokalle arvioitiin kyselylomakkeella yläasteen päättyessä yhdeksännellä luokalla. Aineisto analysoitiin faktorianalyysillä ja kaksisuuntaisella varianssianalyysillä. Ravitsemusterveysprojektin päättyessä keväällä 2004 muistelutekniikkaan perustuvalla haastattelulla selvitettiin opettajien, kouluterveydenhoitajien ja kouluruokailun esimiesten näkemyksiä ravitsemusterveysprojektin toteuttamisesta sekä tieto- ja viestintätekniikan käyttömahdollisuuksista ravitsemusterveysprojektin toteuttamisessa. Aineisto analysoitiin sisällönanalyysillä, hyödyntäen Atlas.ti ohjelmistoa.

Tutkimuksen tulokset osoittivat, että ravitsemusterveysprojektiin osallistuneiden koulujen oppilaiden ravitsemustieto lisääntyi merkittävästi yläkoulun aikana. Lisäksi projektikoulujen oppilaat paransivat ruokailutottumuksiaan säännöllisempään ja terveellisempään suuntaan seitsemänneltä yhdeksännelle luokalle. Tieto- ja viestintätekniikan käyttö tuki oppilaiden terveysoppimista ja kehitti oppilaiden kriittistä lukutaitoa Internetistä löydettävää ravitsemus- ja terveystietoa kohtaan. Ravitsemusterveysprojektin toteuttaminen sekä tieto- ja viestintätekniikan hyödyntäminen ravitsemusterveysopetuksessa edellytti koko koulun henkilöstön osallistumista.

Tämän tutkimuksen tulokset tuottivat käytäntöön perustuvaa tietoa oppilaille, oppilaiden vanhemmille ja koulun henkilöstölle suunniteltaessa ja kehitettäessä yläkoulun ravitsemusterveysoppimista ja -opetusta sekä tieto- ja viestintätekniikan käyttömahdollisuuksia ravitsemusterveysprojektissa.

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Yleinen Suomalainen asiasanasto (YSA): koulut; yläkoulu; oppilaat; opettajat; kouluterveydenhuolto; kouluruokailu; ravitsemuskasvatus; terveystieteiden tiedekunta; verkko-opetus; tieto- ja viestintätekniikka

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Mikkeli, March 2013

Teija Räihä

List of the original publications

This dissertation is based on the following original publications:

- I Rähkä T, Tossavainen K, Turunen H, Enkenberg J and Halonen P. Adolescents' nutrition health issues: opinions of Finnish seventh-graders. *Health Education* 106(2): 114-132, 2006.
- II Rähkä T, Tossavainen K, Turunen H, Enkenberg J and Kiviniemi V. Effects of nutrition health intervention on pupils' nutrition knowledge and eating habits. *Scandinavian Journal of Educational Research* 56(3): 277-294, 2012.
- III Rähkä T, Tossavainen K, Enkenberg J and Turunen H. Pupils' views on an ICT-based learning environment in health learning. *Technology, Pedagogy and Education* (Accepted for publication).
- IV Rähkä T, Tossavainen K, Enkenberg J and Turunen H. Implementation of an ICT-based learning environment in a nutrition health project. *Health Education* 112(3): 217-235, 2012.

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Abbreviations

ENHPS	European Network of Health Promoting Schools
SHE	School for Health in Europe
PAR	Participatory action research
ICT	Information and communication technology
WHO	World Health Organization
NGO	Non-governmental organization
SHP	School Health Promotion study
AHLS	Adolescents Health and Lifestyle Survey
HBSC	Health Behaviour in School-Aged Children Study
STRIP	Special Turku Coronary Risk Factor Intervention Project
WebCT	Online learning course tool.
NIGZ	Netherlands Institute for Health Promotion
FCHP	Finnish Centre for Health Promotion
SOSTE	Finnish Society for Social and Health
HEPS	Healthy Eating and Physical Activity project
MM	Mixed method
OR	Odds ratio

1 Introduction

The need for the promotion of nutrition health in schools is evident and it can be integrated into general health promotion, school curricula and activities (Kwan et al., 2005; Oliver et al., 2006; Shepherd et al., 2006). Thus, pupils can be provided with skills that enable them to make decisions about healthy nutrition and to adopt a healthy lifestyle (Neumark-Sztainer et al., 2003a; Long & Stevens, 2004; Matvienko, 2007). Nowadays, many pupils skip meals and they are more likely to grab fast food from a restaurant or vending machine (Wiecha et al., 2006; Croezen et al., 2009; Kerr et al., 2009). Unfortunately, these meals are high in fat and sugar and tend to contain little nutritional value (Keski-Rahkonen et al., 2003; Kubik et al., 2003). Furthermore, eating too much fast food can lead to obesity and, in some cases, diabetes and heart diseases (Daniels, 2006; Baker et al., 2007; Jääskeläinen et al., 2011).

This thesis evaluates the *From Puijo to the World with Health Lunch* project carried out within one of the development and research programmes of the European Network of Health Promoting Schools (ENHPS, since 2008, Schools for Health in Europe; SHE) in Finland. The study is participatory action research (PAR) in the field of nursing science, in particular from the viewpoint of health promotion, where schools play a key role in developing pupils' nutrition health. This study is based on a community approach, in which the development and research processes ran with co-operation from the researcher, school, school health care, school catering, families and pupils (Jensen & Simovska, 2005).

The study consisted of quantitative research into nutrition health behaviour and the learning of nutrition health by pupils from the seventh to the ninth grades in experimental and control schools. Throughout this dissertation, the term "experimental schools" refers to schools that took part in the nutrition health project; "control schools" are schools that did not. This complemented a qualitative study of the experiences of the school staff (teachers, school health nurses and school catering managers) of a nutrition health project in secondary school. Furthermore, the study focused on an evaluation of the information and communication technology (ICT) -based learning environment, providing valuable knowledge about the integration and sustainability of nutrition health in education.

There has been a great deal of research on the relationship between ICT-based learning environments and nutrition health education in recent years (Korp, 2006; Papastergiou, 2009). ICT-based learning environments increase the openness of nutrition health education and the number of choices available to the pupils. This challenges the pupils to direct their emotions, motivation and energies towards nutrition health learning and not into merely playing games or surfing the internet (Bottino, 2004; Yien et al., 2011).

Improvement in the nutrition health of pupils is increasingly being recognised as a significant factor in maintaining or effecting improvements in overall health. It is therefore important that people working in nursing science and the health promotion industry have a good understanding of nutrition health (Casey, 2007). This gives researchers an understanding of nutrition health from a science-based perspective and of the role that nutrition health plays in social contexts (Coveney, 2004). Researchers tend to explore concepts of nutrition health using the language of nutrition science. Different aspects of nutrition health tend to be defined and routine ways of measuring these explored. Other aspects of nutrition health involve describing the general principles on which nutrition requirements are determined and how information on the nutritional content of foods can be found. Table 1 presents the concepts of the nutrition health project in this study, which have been used to further the understanding and improve the nutrition health of pupils in the school community.

Table 1. Concepts of nutrition health

Concept	Indicator
Nutrition health	Malnutrition Undernutrition Deficiency Overweight Obesity
Nutrition knowledge	Know the characteristic of nutrients e.g. carbohydrates, proteins, fats, vitamin and minerals or other diet-related consumption (e.g. water)
Nutrition health attitudes	Meal pattern Snacking Personal tastes Food availability
Nutrition health values	Eating at home Social eating Food rituals Role of food in families and communities
Nutrition health skills	Access to shops Cookery Selection of food e.g. low fat
Nutrition health education	Public health Health education Nutrition education e.g. home economics Food hygiene Marketing and labelling Role of health professionals e.g. dieticians, experts of health promotion, school health nurses, school catering workers
Nutrition health learning	Nutrition information Knowledge and understanding of nutrition guidelines
ICT-based learning environment	Distance education / learning Collaborative learning Interaction Share and search for information

1.1 NUTRITION HEALTH IN SCHOOLS AS A TOPIC IN HEALTH RESEARCH

This chapter describes Finnish research into nutrition health and what kind of changes nutrition health research has seen over the years in Finland. In the 1970s, there was a growing interest in nutrition policy and dietary intervention in Finland (Pietinen et al., 2001). The North Karelia Project was the first major community-based intervention programme, launching in Finland in 1972 in response to a local petition to obtain urgent and effective help to reduce the great burden of exceptionally high coronary heart disease mortality rates in the area (Puska et al., 1983; Puska, 2002). In co-operation with local and national authorities and experts, as well as with WHO, the North Karelia Project planned and implemented a comprehensive intervention through the community organizations and the action of the people themselves. Comprehensive activities have been used, involving health and other services, schools, NGOs, innovative media campaigns, local media, supermarkets, food industry, agriculture etc. (Puska, 1995). The North Karelia Project has included a comprehensive evaluation and has acted as a major demonstration programme

with national and international applications (Vartiainen et al., 1994). Over the years, the scope of the North Karelia Project has been enlarged to include the broader objectives of integrated prevention of major non-communicable diseases and health promotion, as well as prevention of risk-related lifestyles in children and adolescents (Puska et al., 1981; Puska et al., 1982; Vartiainen et al., 1998; Puska et al., 2002). In this research context, school health and nutrition education has had long-standing experience of intervention and action research in special fields, health promotion in different school communities with pupils, families and school health nurses, as follows: 1984 – 1988 the Eastern Finland Youth Project (Vartiainen et al., 1990; Vartiainen et al., 1991), 1989 – 1992 the national Healthy School Project, 1993 – 2007 the European Network of Health Promoting Schools (ENHPS) (Rasmussen & Rivett, 2000), and since 2008, the School for Health in Europe (SHE) (Buijs, 2009a).

In addition, the wellbeing and health of Finnish adolescents has been monitored in schools since 1995 as part of the School Health Promotion (SHP) study (Kouvonen & Lintonen, 2002; Kaltiala-Heino et al., 2003; Mikkilä et al., 2003). Similarly, the eating habits of children and adolescents have been examined by the Adolescents Health and Lifestyle Surveys (AHLS) (Kautiainen, 2008), the Health Behaviour in School-Aged Children Study (HBSC) (Currie et al., 2004; Currie et al., 2009), the Cardiovascular Risk in Young Finns Study (Raitakari et al., 2008) and The Special Turku Coronary Risk Factor Intervention Project (STRIP) (Kallio et al., 2009; Hakanen et al., 2010; Pahkala et al., 2010; 2012; Ruottinen et al., 2010). The AHLS is a multidisciplinary research programme started in 1977 with the purpose of following the health and health behaviours of 12 to 18 year olds (Koivusilta et al., 2003). The primary focus of the programme, to monitor the effects of the Tobacco Act (Rimpelä & Rainio, 2004), has gradually been expanded to include a growing number of health behaviours, perceived health, biological maturation and the effects on health of information and communication technology (ICT) (Kautiainen et al., 2005; Koivusilta et al., 2005). Furthermore, the HBSC was established over 20 years ago to increase the understanding of adolescents' health (Roberts et al., 2007). The Cardiovascular Risk in Young Finns Study is one of the largest follow-up studies into cardiovascular risk from childhood to adulthood (Juonala et al., 2004; Mikkilä et al., 2004). The main aim of that study is to determine the contribution made by childhood lifestyle, with biological and psychological measures, to the risk of cardiovascular diseases in adulthood (Mikkilä et al., 2005). Similarly, the STRIP project attempted the prevention of atherosclerosis and coronary heart disease by a lifestyle intervention which began in infancy and continued through puberty and early adulthood. The project was launched in 1990 when 7 month old children and their families were enrolled (Kaitosaari et al., 2003) and it continued until participants reached the age of 20 years.

1.2 NUTRITION HEALTH EDUCATION FOR PUPILS IN FINLAND

In Finland, attitudes towards nutrition health education are positive. Nutrition health education has been taught in Finnish schools as part of home economics studies since 1921. Initially, home economics was mostly taught to girls, but also to boys in some areas. In 1923, it became compulsory for all students, including boys. Currently, home economics is taught as part of basic education in grades seven to nine. It includes three compulsory lesson units or lessons per week in the seventh grade, where one lesson unit includes 38 lessons and each lesson lasts 45 – 60 minutes. In addition, home economics is an optional subject in the eighth and ninth grades. The purpose of home economics is to develop co-operative attitudes, information acquisition and practical working skills required to manage day-to-day life, as well as the application of these skills in everyday situations. Core contents for nutrition-related topics include nutrition recommendations and healthy

nutrition, food quality and safety, basic methods of preparing food and meal planning. Moreover, core contents also include learning about food cultures and traditions, as well as different eating circumstances, such as seasonal festivals and formal dinners (Finnish National Board of Education, 2004). In 2001, health education was introduced as a subject in its own right in secondary school. Previously, health education was a cross-subject thematic unit of basic education, whereas in secondary education it was incorporated into physical education. The objective of health education is to enhance skills among the pupils that increase their health, wellbeing and safety. Pupils learn to describe and assess key factors that promote health and cause disease and also to recognize and reflect on their personal choices relating to health and safety. Topics covered include nutritional needs, common food allergies, special diets and making nutritionally sound and balanced food choices in everyday life.

School meals are regarded as an important part of nutrition health education in Finland. They are pedagogical tools to teach healthy nutrition and eating habits as well as to increase consumption of vegetables, fruits and berries, whole meal bread and skimmed or low fat milk (Finnish National Board of Education, 2008). The tradition of offering schools meals has a long history in Finland. The state began subsidizing school meals in 1913 but, at this time, subsidized meals were usually offered to disadvantaged children only. However, in 1943, a law was passed requiring municipalities to arrange a free lunch for all pupils at elementary schools by 1948. According to the basics of the Basic Education plan that came into effect at the beginning of 2011, arranging a school lunch and implementing objectives requires the co-operation of various participants as well as their understanding of the operation as a whole. Also, the pupils' opportunity to participate in the planning and implementation of the school lunch is more focused than ever before (Finnish National Board of Education, 2010).

The Finnish school lunch is already an appreciated social innovation in the current operations model, but a directed, balanced and cost-free school meal arranged in a purposeful manner is just a part of the school meal and the school lunch environment (Finnish Basic Education Act, 628/1998). When creating and constructing a school lunch environment that promotes nutrition health learning, input from all the school staff is needed. In particular, input is essential from the professionally educated school lunch staff who will view their work on the school lunch as an educational task. Lintukangas's (2009) research indicated that intervention in inappropriate behaviour during school meals prevented bullying at school. By improving the interior of the school lunch room and increasing the choice of food, the pupils are influenced such that they enjoy themselves at school and do not leave to go to nearby kiosks or shops during breaks. Gradually, free school meals were introduced at all levels of primary and secondary education (Lintukangas, 2009). Currently, a well-balanced free school meal consisting of a hot meal, salad, bread and milk is served every school day to all pupils in primary and secondary schools as well as in vocational institutes. National guidelines on school meals, revised in 2008, emphasise the nutritional quality of school meals but also the need for meals to taste good, the importance of learning good eating habits together and the objectives of nutrition health education. According to the recommendations, the school meal should meet one third of a pupil's daily nutritional requirements (Finnish National Nutrition Council, 2008): fat 30% energy, protein 10 – 15% energy and carbohydrates 55 – 60% energy. The use of fish, vegetable fats, soft margarine and oil is recommended. The recommended main ingredients of a school meal are potatoes, rice or pasta, vegetables, fruits and berries, meat, fish or egg. In addition, a school meal should include a beverage, bread and spread. Earlier school surveys conducted from 1996 to 2006 in Finland found that about 90% of boys and 80% of girls ate school meals daily, although skipping some part of the meal was common (Raulio et al., 2007). A recent intervention study showed that 71% of seventh and eighth grade secondary school pupils (12 – 15 years of age) ate their school meal every day.

However, less than a third of pupils ate all of the components of the school meal, with only 20% of daily energy intake being derived from it, compared with the recommended level of one third. The school meal, however, was found to be the healthiest meal that children ate during the day (Hoppu et al., 2010).

Along with school meals, school health nurses play an integral part in nutrition health education. They have many opportunities to interact with pupils, for example, directly through health interviews and classroom counselling and also indirectly through planning and implementing health promotion programmes at schools together with other partners and more widely in the community (Tossavainen et al., 2004a). Furthermore, they are in a position to help pupils process health information and to assist them in the framing of health and wellbeing messages within the school (Tossavainen et al., 2004b). However, previous studies have indicated that a good deal of school health nurses' working hours were allocated to routine screening and monitoring with relatively little set aside for nutrition health activities in the school. Therefore, the school health nurses' role as health promoters within their school is often unclear and undefined. Ideally, because of their background in health sciences and expertise and skills in health education, school health nurses should work in the school to provide high quality nutrition health education. In addition, teachers claim that they are not experts in health knowledge, particularly because the Finnish comprehensive school curriculum has included health as a special subject. (Tossavainen et al., 2002).

Little is known about how confident school health nurses feel about using basic ICT and whether they feel competent to use it to access the information within the health literature and clinical information held on computerised systems. Therefore, school health nurses need two forms of ICT skill. They need to be able to access ICT guidelines and the evidence to support best practice. In addition, school health nurses will need to be able both to access and to record information about pupils from the computer medical record. (Pritchard et al., 2002.)

1.3 FROM PUIJO TO THE WORLD WITH HEALTH LUNCH AND THE BACKGROUND OF THIS STUDY

The study *"From Puijo to the World with Health Lunch"* was carried out as participatory action research in close co-operation with Kuopio University Department of Nursing Sciences and Kuopio City, as well as Kuopio City Education Unit, Social and Health Services from 2000 to 2004. The major aims of the project were 1) to develop and strengthen the healthy nutrition lifestyles and nutrition health learning skills of pupils; 2) to strengthen parental responsibility in promoting nutrition health; 3) to update nutrition health education contents and methods; 4) to create a working, synergic network of participants and 5) to support parents' and communities' responsibility and develop their nutrition health education.

The project was carried out in four schools, both rural and urban, in Eastern Finland. Two of the schools were experimental; the other two were controls. Both the experimental and control schools implemented their nutrition health education according to the objectives of the national curriculum for basic education. Furthermore, in the experimental schools, an ICT-based learning environment (WebCT, www.webct.com) was used to further develop a nutrition health learning environment from grade seven to grade nine (Figure 1). This ICT-based learning environment enabled studying in accordance with the learning objectives and also served as an educational backup tool for teachers, school health nurses and school catering managers for nutrition health education. It was a part of computer science, home economics, student counselling in the seventh grade, chemistry, health education and optional home economics in the eighth grade along with biology and

optional home economics in the ninth grade. Furthermore, it was used in school health care, school meal service and school-home co-operation.

The *From Puijo to the World with Health Lunch* project was a part of a wider European Network of Health Promoting Schools programme (ENHPS). Since 2008, the Schools for Health in Europe (SHE, <http://www.schoolsforhealth.eu>) network has extended and continued the previous work of ENHPS (Buijs, 2009b; Tang et al., 2009). Previously, under the name of ENHPS, this network was an international programme for the promotion of school health initiated by the WHO European regional office, the European Council and the European Commission, to which more than 40 countries belonged from 1991 to 2007 (Clift & Jensen, 2005). Finland joined the ENHPS programme in 1993 and a varied number of Finnish schools (30 – 70 schools) were involved in the ENHPS programme (Tossavainen et al., 2004a; 2004b).

SHE aims to assist organizations and professionals engaged in the development and maintenance of health promotion in schools by providing a European platform to support this activity. The SHE network provides information, encourages research, shares good practice, expertise, skills and promotes school health. The network is coordinated by the Netherlands Institute for Health Promotion (NIGZ), a WHO Collaborating Centre for School Health Promotion and is supported by the Council of Europe, the European Commission and the WHO Regional Office for Europe. Branches of SHE have been established in more than 40 European countries, involving several thousand schools and hundreds of thousands of pupils. The SHE network encourages each participating country to develop the concept of the “health promoting school” in the way that is most appropriate for their needs and specific cultural and social environment (Barnekow et al., 2006; Buij, 2009a; 2009b).

Nowadays, about 40 schools are involved in the SHE program in Finland. The program is coordinated by The Finnish Centre for Health Promotion (FCHP; since 2012, Finnish Society for Social and Health, (SOSTE)) and has an executive team that dictates the main themes of the health promotion activities conducted by the network. At the national level, the SHE network provides the opportunity for professionals to share experiences and good practices and to examine health improvement related questions at annual education events. At the local level, SHE network schools form local activity networks; local meetings and seminars are organized based on topics relevant to the needs of the area. The formation of local networks facilitates co-operation in the planning and evaluation of the promotion of health (Tossavainen et al. 2002; Turunen et al., 2000; 2006; 2010). It is recommended that each school develops a strategy that provides teachers, parents, students and other community members with a set of guidelines that should be followed and also actions that can be taken for the promotion of health. Strategies based on the “health promoting schools” concept have the potential to help school communities manage health and social issues, enhance student learning and improve school effectiveness (Gray et al., 2010).

The Healthy Eating and Physical Activity project (HEPS) is also a SHE initiative. It has been developed to support the SHE National Coordinators in the initiation and support of the development of a national school policy on healthy eating and physical activity. Across member states, there are many practical initiatives reducing the number of children and adolescents who are overweight. However, currently no member state has an effective national school policy in operation. HEPS aims to bridge this gap by being a policy development project on a national level across Europe. HEPS helps to implement these programmes in a sustainable way at the school level (Simovska et al., 2010).

In Finland, every school has a contact person and a health promotion working group. The SHE network provides education and consultation support for health promotion plans and practices in the schools. Each school defines its own health promoting practices and devises plans for the implementation of programmes adapted to local needs and circumstances (Tossavainen et al. 2002; Turunen et al. 2006; 2010). Thus, the SHE network

does not impose a uniform model or program on schools in terms of the provision of nutrition health education. Instead, schools are encouraged to develop nutrition health education programmes, projects and other interventions that are adapted to their own requirements and preferences.

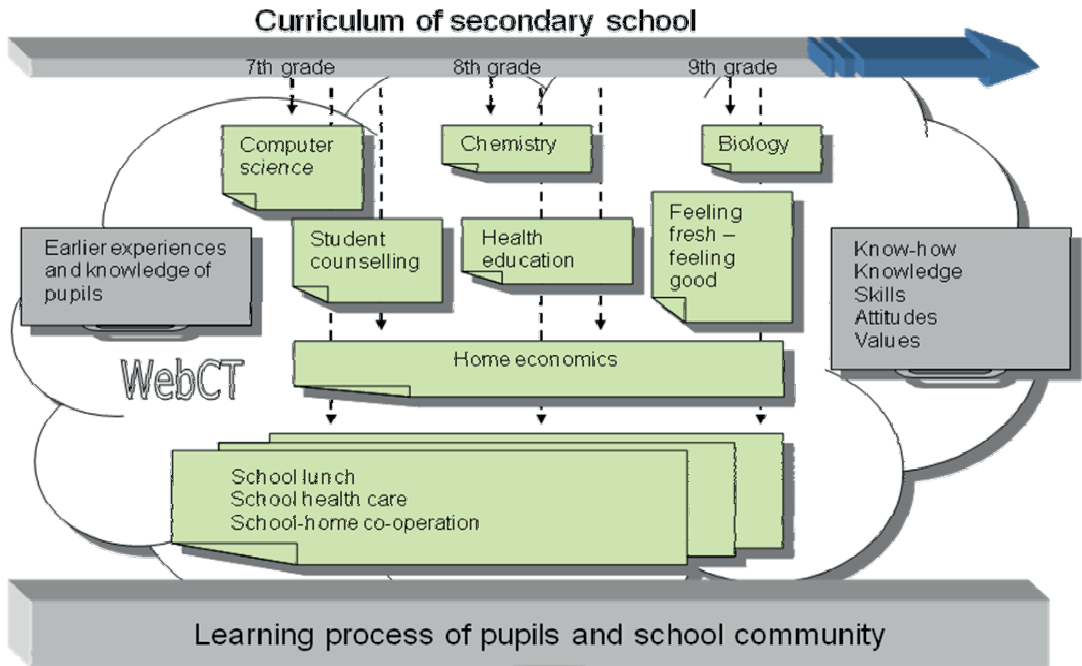


Figure 1. From Puijo to the World with Health Lunch – a project in the experimental schools from grade seven to grade nine

2 Theoretical model of the nutrition health project

Nutrition health projects have the potential to affect adolescents, especially when distributed through channels that reach the majority of adolescents, such as school. Designing a successful nutrition health program for adolescents requires a systematic approach that combines knowledge of determinants of behaviour with efficacious strategies and evaluation plan. Nutrition health programs with successful outcomes have tended to be behaviourally based on using theories for developmental framework; they have included an environmental component; delivered an adequate number of lessons; and emphasized developmentally appropriate strategies. The use of nutrition health intervention planning techniques, coordination of nutrition health interventions, utilization of technological advances such as ICT-based learning environments, incorporation of policy changes into intervention efforts, and dissemination of effective programs are all trends that will influence the development of effective nutrition health programs for adolescents (Hoelscher et al., 2002).

There are a number of significant theories and models that underpin the practice of nutrition health programs for adolescents. These include, for example, Social Cognitive Theory (Bandura, 1986; Rinderknecht & Smith, 2004), Health Belief Model (Janz & Becker, 1984; Abood et al., 2003), and Theory of Planned Behaviour (Ajzen, 1991; Hardeman et al., 2002). Hoelscher et al.'s (2002) review of nutrition interventions between 1994 and 2000 show that the Social Cognitive Theory has been the most dominant theory used in the development of nutrition health programs for adolescents. The Social Cognitive Theory provides a reciprocal model in which behaviour, personal factors, and environmental influences interact continuously. The Social Cognitive Theory has been particularly effective for developing nutrition health programs for children and adolescents. As children are often not completely in control of their behaviour, their environment needs to be taken into account as well. According to the Social Cognitive Theory, both individual behaviours and the environment are suggested to influence nutrition health behaviour (Bandura, 1986).

The Health Belief Model is by far the most commonly used theory in health education and health promotion (Glanz et al., 2002). It was developed in the 1950s as a way to explain why medical screening programs, particularly for tuberculosis, were not very successful (Hochbaum, 1958). The underlying concept of the original Health Belief Model is that health behaviour is determined by personal beliefs or perceptions about a disease and the strategies available to decrease its occurrence. Personal perception is influenced by the whole range of intrapersonal factors affecting health behaviour. The following four perceptions serve as the main constructs of the model: perceived seriousness, perceived susceptibility, perceived benefits, and perceived barriers. Each of these perceptions, individually or in combination, can be used to explain health behaviour. More recently, other constructs have been added to the Health Belief Model. Thus, the model has been expanded to include cues to action, motivating factors, and self-efficacy (Strecher & Rosenstock, 1997). Correspondingly, the Theory of Planned Behaviour predicts that planned behaviours are determined by behavioural intentions which are largely influenced by an individual's attitude towards behaviour, the subjective norms encasing the execution of the behaviour, and the individual's perception of their control over the behaviour (Ajzen, 1991; Rothman, 2004). Theory of Planned Behaviour has been used to predict an array of behaviours (Martin et al., 2010; Stone et al., 2010).

Furthermore, several methods have been proposed for planning nutrition health projects for adolescents. These include, for example, the process of Intervention Mapping, developed by Bartholomew et al. (1998) and the Precede-Proceed model developed by Green and Kreuter (1999). Moreover, these conceptual frameworks have been developed to

provide investigators with a structured process to improve the accuracy and ease with which theoretical concepts are used to address a practical problem (Rothman, 2004). Intervention mapping is a systematic process that combines behavioural theory and empirical data to develop nutrition health promotion programs. More specifically, it produces a framework that links nutrition health behaviour determinants and performance objectives with specific methods and strategies (Brug et al., 2005).

The Precede-Proceed model (Green & Kreuter, 1999) was selected to guide development, implementation, and evaluation of the *From Puijo to the World with Health Lunch* project, as it was a theoretically robust model that addresses all the phases of programme development. Furthermore, the Precede-Proceed Model is a participatory model that has also successfully created nutrition health intervention in schools (Howat et al., 1997; Tjomsland et al., 2009). It is based on the premise that nutrition health behaviour change is, by and large, voluntary; nutrition health interventions are more likely to be effective if they are planned and evaluated with the active participation of pupils and school staff. Thus, nutrition health intervention must be examined in the school context. Nutrition health intervention in schools is initiated by an evaluation of the objective's final results – nutrition health. The aim is to find the predisposing, enabling and reinforcing factors that precede and affect pupils' nutrition health. As reviewed by Green and Kreuter (2004), it has served as a successful model in several rigorously evaluated clinical and field trials, has been widely used by government and specialist health organizations and has been successfully applied across a range of preventive health promotion programmes (Chiang et al. 2003; Mirtz et al., 2005; Wright et al., 2006). Furthermore, an interactive computerized version of the model, called Empower, has been developed for community-level cancer prevention and control interventions (Green & Kreuter, 1999).

The Precede-Proceed Model involves nine phases (see Figure 2) and is based on the premise that a thorough assessment (Precede) should be made before planning a nutrition health intervention with evaluation (Proceed) built into the process to enable measurement of the effectiveness of that intervention. Primary targets for the nutrition health intervention are established through each phase of the assessment process (planning phases 1 – 5) on the basis of causal importance in the chain of nutrition health determinants, their prevalence, and their changeability. The results of this assessment process guide the development of the nutrition health intervention (implementation phase 6). The evaluation (evaluation phases 7–9) tracks the impact of the nutrition health intervention on factors identified as important targets in the assessment process.

2.1 PLANNING OF NUTRITION HEALTH INTERVENTION

Phases 1 & 2 – Social and epidemiological assessment

The application of the Precede-Proceed Model commences in phase 1 with the examination of the quality of nutrition health factors that are of prime importance to the school, followed by an examination of nutrition health issues connected to the realization of these nutrition health factors (phase 2). However, an outstanding issue that usually occurs as part of the social assessment process is the engagement of the pupils and school, which is vital to the long-term success and relevance of a nutrition health intervention. This is necessary for the stakeholders who may have an investment in the nutrition health of pupils, pupils and even pupils' families who themselves have been affected as well as those school services which take responsibility for the nutrition health education of these pupils.

Phase 3 – Behavioural and environmental assessment

The focus of the behavioural and environmental phase is the identification of the etiological factors, or determinants of nutrition health, in the behavioural patterns and environment of the pupils. Factors of particular interest are those associated with the early identification and receipt of promotion of nutrition health. The behavioural assessment requires a systematic analysis of behavioural links to the specific nutrition health target of early identification and promotion. Correspondingly, the environmental assessment process focuses on factors in the immediate social and physical environment that could be causally linked to the behavioural targets or directly linked to the outcome of interest. Nutrition health environmental factors, including accessibility and availability of services and the quality of promotion by health professionals, are important factors but are managed by external health and nutrition health services.

Phase 4 – Educational and ecological assessment

The focus of the educational and ecological assessment is on the factors influencing nutrition health-related behaviour and living conditions that require change in order for behavioural and environmental change to occur. The primary premise is that for nutrition health behaviour to change, one needs the cognitive and affective building blocks that provide the motivation to act (predisposing factors) as well as resources (enabling factors) and rewards (reinforcing factors). Predisposing factors are the nutrition knowledge, beliefs, values, attitudes, perceptions of diet and health, self-efficacy, as well as age and gender. The prime sources of reinforcement have been identified as positive feedback and social support of, primarily, family and friends followed by teachers, school health nurses and school catering workers. There are several enabling factors that facilitate nutrition health skills: information seeking skills, accessibility and availability of quality nutrition health services, school lunch and school health care are obvious ones and were raised in consultations with service providers.

Phase 5 – Administration and policy assessment

This phase requires an analysis of the policies, resources and circumstances in a school setting and context that either hinder or facilitate the development of a nutrition health intervention. To a large extent, administration and policy assessment is intrinsic to the establishment of the nutrition health intervention.

2.2 IMPLEMENTATION OF NUTRITION HEALTH INTERVENTION

Phase 6 – Implementation

In this phase, the predisposing, enabling and reinforcing factors that influence nutrition health and are conducive to recognition and early requests for help, became the factors that shaped the nutrition health intervention. The development and implementation of the nutrition health intervention occurred over a three academic year period, running from grade seven to grade nine in two secondary schools in Eastern Finland. The development of the overall strategy was undertaken largely through ongoing consultation with the *European Network of Health Promoting Schools (ENHPS)* research group. This helped to ensure that the nutrition health intervention complemented related nutrition health programmes and facilities liaisons within existing school programmes, so that they could assist in the delivery and promotion of the nutrition health project. As the *From Puijo to the World with*

Health Lunch project progressed, the research group also provided a means of feedback about how the nutrition health intervention was being received in the schools and suggestions for refinement. The nature of the target region was also examined to determine opportunities and limitations for nutrition health activities. For example, as the nutrition health intervention was restricted to two experimental schools, two other schools, used as controls, were studied to provide a region for comparison. Furthermore, pupils were further segmented according to gender and school status: rural or urban. The ICT-based learning environment for the experimental schools was designed to provide more nutrition health-related information and to address the target enabling factors of skills in recognition and information seeking for nutrition health. The ICT-based learning environment was developed in consultation with the school staff, to test out concepts and ensure synergy with school curricula and school policies and it was developed for its potential to address all predisposing, enabling and reinforcing factors. Wherever possible, all elements of the ICT-based learning environment were pre-tested with the pupils for functionality and ease of navigation.

2.3 EVALUATION OF NUTRITION HEALTH INTERVENTION

Phases 7, 8 & 9 – Process, impact and outcome evaluation

The evaluation process was developed at the same time as the nutrition health intervention. The primary goal was to track whether the nutrition health intervention was being implemented effectively and whether it was achieving the targets set during the assessment process. The evaluation structure followed the outline laid down in part of the Precede-Proceed Model. The development of the evaluation plan and review of its implementation was guided by a research group from *ENHPS*, studying the field of nutrition and health promotion, qualitative and quantitative research methodologies and population health promotion program evaluation. The evaluation results described in this doctoral thesis cover the three years of the project. The process evaluation of nutrition health intervention was examined by a recall interview with teachers, school health nurses and school catering managers. Correspondingly, the pupils' questionnaire given at the beginning, forming the baseline and at the end of the intervention in the two experimental schools and in the two control schools was the primary source for impact evaluation and outcome evaluation in this nutrition health intervention.

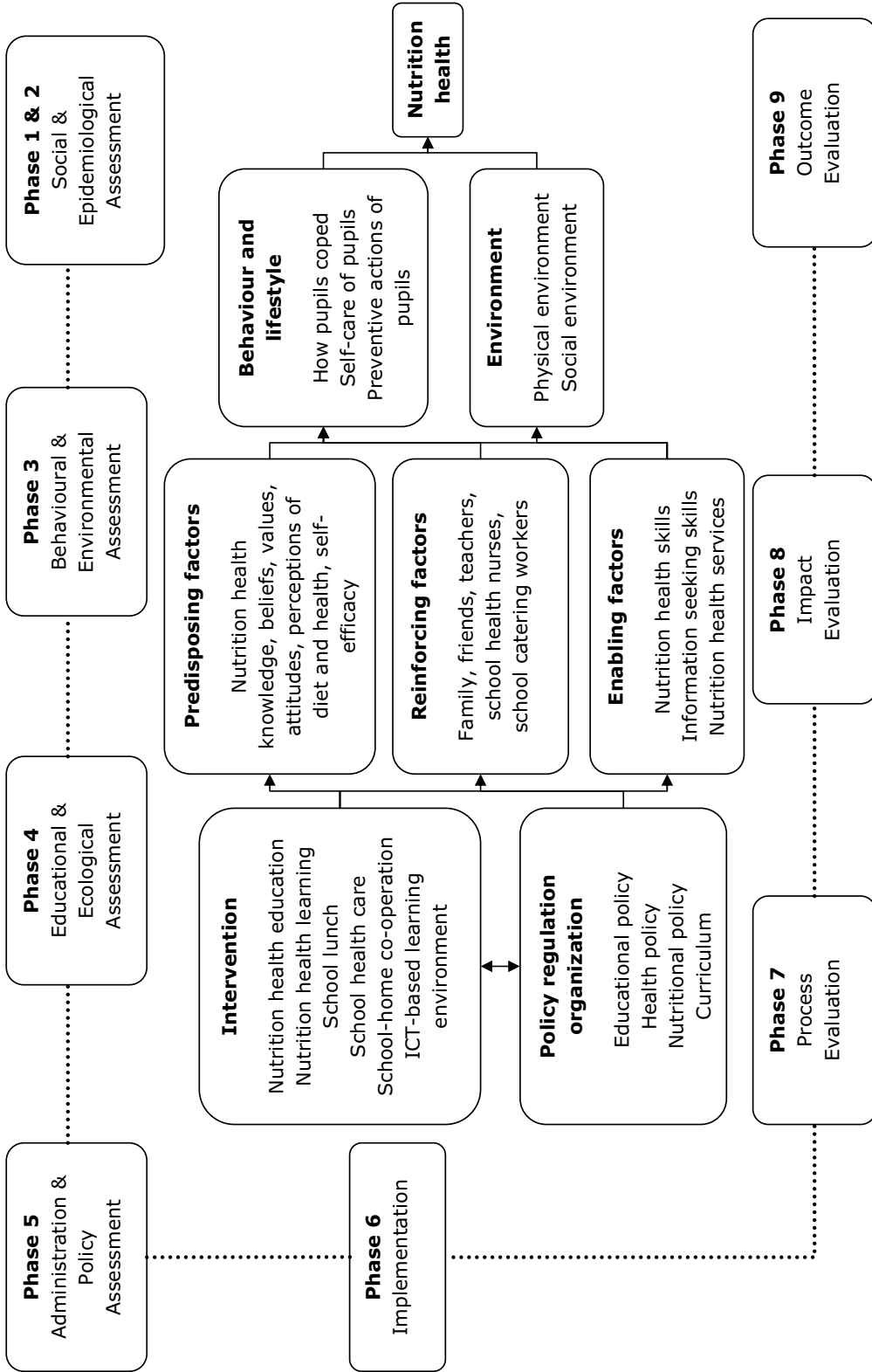


Figure 2. The application of the Precede-Proceed model in nutrition health intervention planning and evaluation (adapted from Green & Kreuter, 1999)

3 Purpose and objectives of the study

The purpose of this study was to design, develop and evaluate grade seven to grade nine pupils' nutrition health learning and nutrition health education using an ICT-based learning environment. The specific objectives of the study were:

1. To examine pupils' nutrition health attitudes, perceptions of skills, reported behaviour and perceptions of families' and friends' nutrition health-related behaviour in the baseline situation, in grade seven (Article I).
2. To evaluate and compare the effects of nutrition health intervention on pupils' nutrition knowledge and eating habits in experimental and in control schools using a follow-up design, from grade seven to grade nine (Article II).
3. To examine pupils' opinions of an ICT-based learning environment used as part of their health learning at the end of the project in grade nine and using a follow-up design from grade seven to grade nine (Article III).
4. To investigate the recall views about the implementation of nutrition health project and ICT-based learning environment in secondary school, from grade seven to grade nine of teachers, school health nurses and school catering managers (Article IV).

4 Methodological basis and the framework of the study

4.1 PARTICIPATORY ACTION RESEARCH

This study was a participatory action research (PAR) in the field of nursing science, in particular from the viewpoint of health promotion, where a nutrition health project played a key role in promoting pupils' nutrition health (Kelly, 2005; Tossavainen et al., 2005). The study was based on a participatory approach, in which development and research processes worked with co-operation between the researcher and the participants (Williamson et al., 2004; Khanlou & Peter, 2005; Baum et al., 2006). In practice, it was necessary for the researcher, together with the members of the school, to determine the problems of nutrition health issues, develop nutrition health activities and evaluate the results of nutrition health project (Kelly, 2005; Tossavainen et al., 2005).

Participatory action research is usually a kind of viewpoint research, where the researcher studies one or more people who are participating in the same action. The purpose is to change and develop something and to cause a real change in the circumstances of a person or a community (Huang & Wang, 2005; Kelly, 2005; Tossavainen et al., 2005). The central method in participatory action research is the discourse that aims to find commonly-held views. This discourse introduces different viewpoints for discussion and review by the whole project team. The researcher's task is to communicate scientific information on behalf of the other members of the project, structure the work and produce new ideas and problem-solving models. In this way, the researcher helps others involved to be aware of existing problems and solutions, as well as helping them manage unresolved issues. The researcher's role in the participatory action research is two-fold: the researcher studies, but on the other hand, uses the information received directly from the project.

The central idea of the participatory action research is the spiral progression through action and research phases (see Figure 3). An individual action research cycle consists of: 1) planning; 2) action; 3) observation and 4) reflection. One phase of the cycle is always the base for the next cycle and the purpose is to continuously develop operations and understanding of those operations.

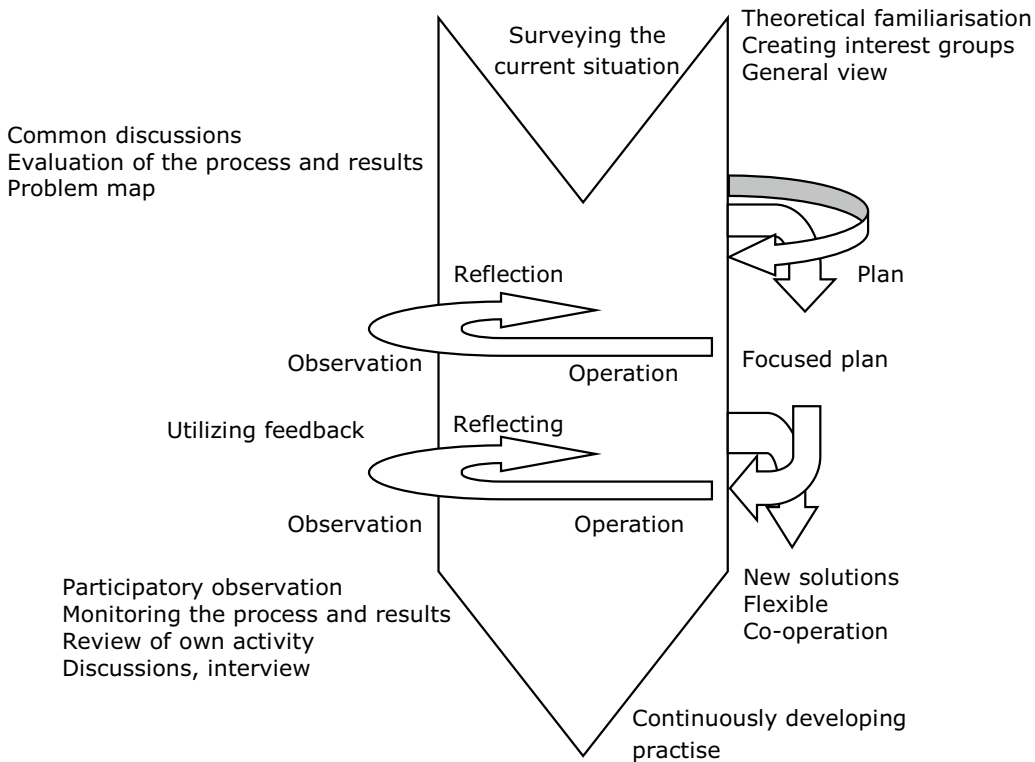


Figure 3. The cycle of participatory action research

In the planning phase of the cycle, the researcher co-operates with the participants to begin the research action. This specifies the theoretical starting points of the project and deepens the participants' own understanding of the current action models. In the planning phase, the theme of the research is specified as a defined action plan and also the objectives of the research are set. In comprehensive action research, it is desirable to express separately the immediate and more long-term objectives of the action cycle with action research that lasts several cycles. It is beneficial to plan the observation and reflection methods of the operation in the initial phase of the project. The preliminary plan of how the research is reported and how the research results will be utilized in the development of the operation can also be created. In order to evaluate the results and reliability of the action research, it is necessary to plan the observation and reflection phases. The action phase of the cycle is intended to be realized in accordance with the objective and compiled plan from the planning phase. The action phase involves looking for new solutions and aims to facilitate experimentation and flexibility where co-operation is emphasized. The nature of the action research means that the plan can be changed during the operation, in the event that the feedback received demands it. The action phase especially focuses on those items that were described by the participants in the initial phase as unsatisfactory and which have been chosen to be developed with the help of the research.

Observation is clearly a separate phase from the practical work. By observing the various phases of the research, information is collected for the action analysis and reflection afterwards. Analysis and reflection take place over the whole research process in the action research, but the final evaluation of that research takes place at the end of the operation. The researcher's task is to analyze and interpret the collected material, with which they can draw clear conclusions from the wealth of data. The preliminary analysis of the results continuously takes place in the participatory action research process, but the final analysis is made using logical reasoning and interpretation.

In the reflection phase of the cycle, it is determined whether the participatory action research has succeeded in developing both the research target as well as the participants. The result of the reflection is a new plan of how the operation should be developed in the future. The reflection phase is central to the participatory action research as it helps to evaluate the effectiveness of that research. The reflection on a technical aspect focuses on describing the operation and evaluating the applications of the action models shown above in figure 3. The practical level considers the nature of experiences and the arguments for choices. The reflection on the critical level examines the evaluation of the moral and ethical criteria of the operation. The purpose of the reflection of the action research phase is to consider the targets of the operation and critically re-evaluate and review the action methods.

Because the participatory action research is more of a research strategy, it cannot be reviewed as a defined research method. The material of the participatory action research is collected usually using both qualitative and quantitative methods. The methods used for collecting and analyzing information are mainly the same as those used with other research methods.

This study used a mixed methods (MM) approach (Morse, 2003; Pommier et al., 2010) and applied quantitative and qualitative methods in collecting and analysing data (Creswell & Plano Clark, 2007). The purpose of the quantitative research was to produce generalized information and the qualitative research helped in understanding the promotion of nutrition health as a part of the life of the pupils and the school community; in this way, the reliability of the research was increased. The quantitative part of study examined the pupils' nutrition health attitudes, nutrition health skills, perceptions of the nutrition health behaviour of families and friends, as well as the pupils' eating habits and nutrition knowledge. Furthermore, the quantitative study revealed the potential for using an ICT-based learning environment for pupils' nutrition health education. A quantitative study was carried out with the seventh grade in spring 2002 and with the ninth grade in spring 2004 in two experimental schools, using two other schools as controls. The qualitative part of the study analysed the views of the teachers, school health nurses and school catering managers about the implementation of a nutrition health project in secondary schools from the seventh grade to the ninth grade. In addition, the views of the school staff were obtained about the potential of using an ICT-based learning environment for implementing the nutrition health project throughout their secondary school. The qualitative study used recall interviews, after the nutrition health project ended in spring 2004.

The basis for the promotion of pupils' nutrition health was to develop it by means of nutrition health education throughout secondary school, from grade seven to grade nine. The planning was based on the Precede-Proceed model, but the action phases were capable of taking change into account. Active participation and co-operation between pupils, teachers, school health nurses and school catering managers increased the commitment of the schools to the nutrition health project and it may have had positive effects of pupils' nutrition health in the long-term.

The researcher's task was to help the pupils, pupils' families, teachers, school health nurses and school catering workers develop nutrition health education and guidance. In practice, the researcher collaborated with the school staff. The researcher participated in school work and regularly communicated with pupils and school staff using the ICT-based learning environment, email or telephone.

4.2 PROGRESSION OF THE STUDY AND NUTRITION HEALTH PROJECT

Reports about wellbeing from 1999 and 2001 (Wellbeing report on wellbeing of children and adolescents, 1999; Wellbeing report of children and adolescents, 2001) of children and

adolescents living in the Kuopio area concluded that the central factors threatening their wellbeing were: 1) weakened mental and economic resources of parents; 2) increased mental problems of children and adolescents; 3) increased psychosomatic symptoms in children and adolescents (e.g. fatigue, restlessness, headache) and 4) increased use of alcohol and drugs by children and adolescents.

The living conditions of families with small children as well as those of children and adolescents had been influenced by unemployment, financial problems of the families and the reduction of public services over this last decade. These problems are especially emphasized in the Kuopio area and they can cause an increase in the unhappiness of children, adolescents and families as well as increased social exclusion. Apart from the material factors, areas such as relationships, lifestyle of families and communities as well as attitudes are becoming more insecure. Parents show less and less responsibility for bringing up their children. According to these wellbeing reports (1999, 2001), the wellbeing of children and adolescents is threatened not only by economic difficulties but also by different conflicts within families, such as the parents' alcoholism.

The report about children's and adolescents' wellbeing (1999) was presented to the Kuopio City council in spring 1999 and, at the same time, it was pointed out that to improve the situation described earlier, the following definite actions should be taken: 1) the securing of the mental wellbeing and self-esteem of children and adolescents; 2) the timely discovery of problems of children and adolescents and an early intervention in order to prevent social exclusion and 3) supporting and strengthening parental responsibility. The need to broaden nutrition and health education was raised in the Health 2015 Public Health programme, according to which the mental health problems of adolescents, psychosomatic symptoms, smoking, alcohol abuse, experimenting and using drugs and problems connected with nutrition (anorexia nervosa, obesity) have increased in recent years among young Finnish people. To accomplish these actions, the *From Puijo to the World with Health Lunch* development and research project (Figure 4) was started at Kuopio University (since 2010, University of Eastern Finland) in the Department of Nursing Science in 2000.

The *From Puijo to the World with Health Lunch* project was undertaken as a participation action research in close co-operation with Kuopio University's Department of Nursing Science, Kuopio City, Kuopio Education Unit, Social and Health Services from 2000 to 2004. The project started in 2000, with two secondary schools planning and delivering a nutrition health project that covered all school years, partly using curriculum subjects and activities. The project was part of the international *European Network of Health Promoting Schools* (ENHPS, since 2008; Schools for Health in Europe (SHE)) network.

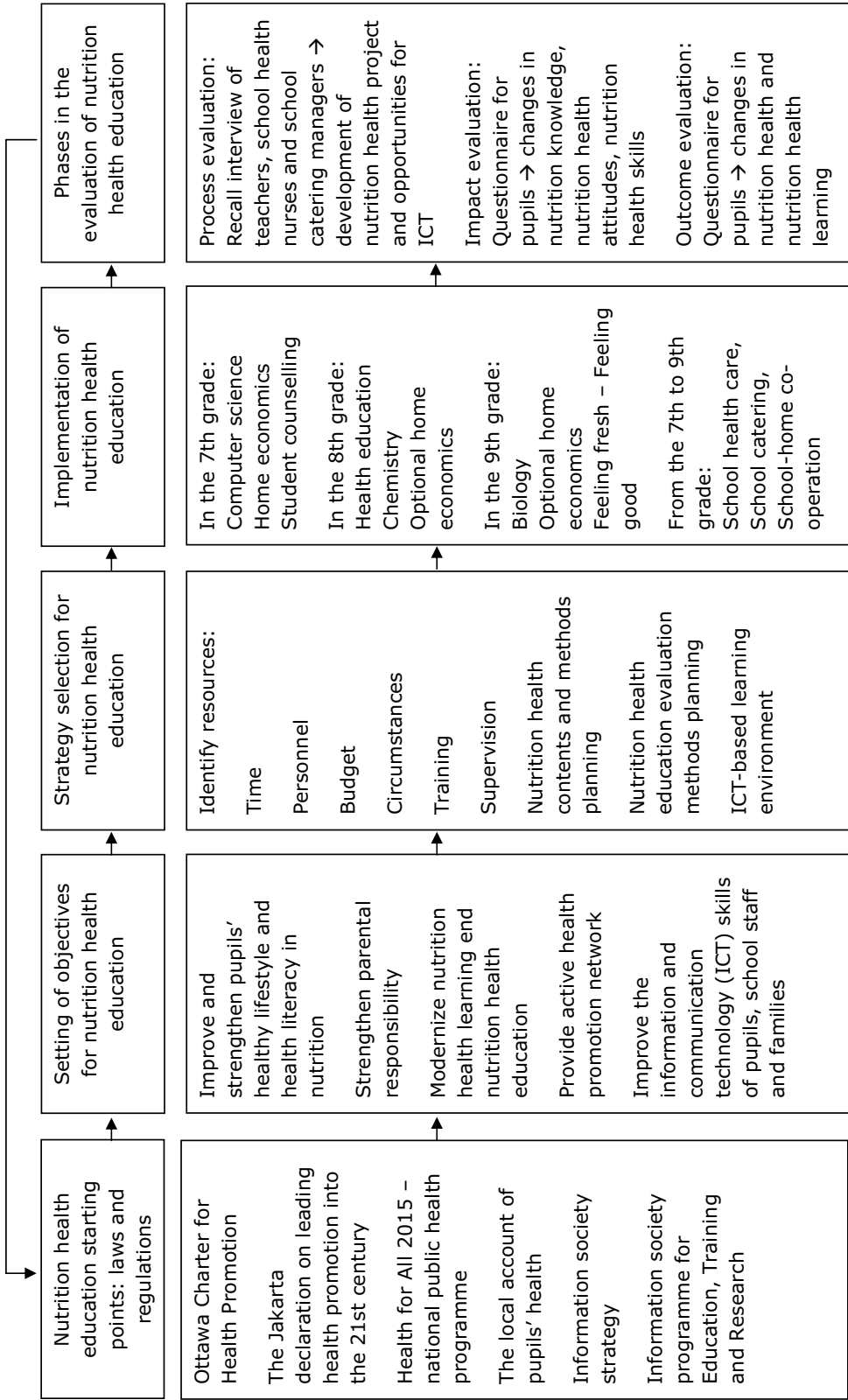


Figure 4. Framework for the From Puijo to the World with Health Lunch project

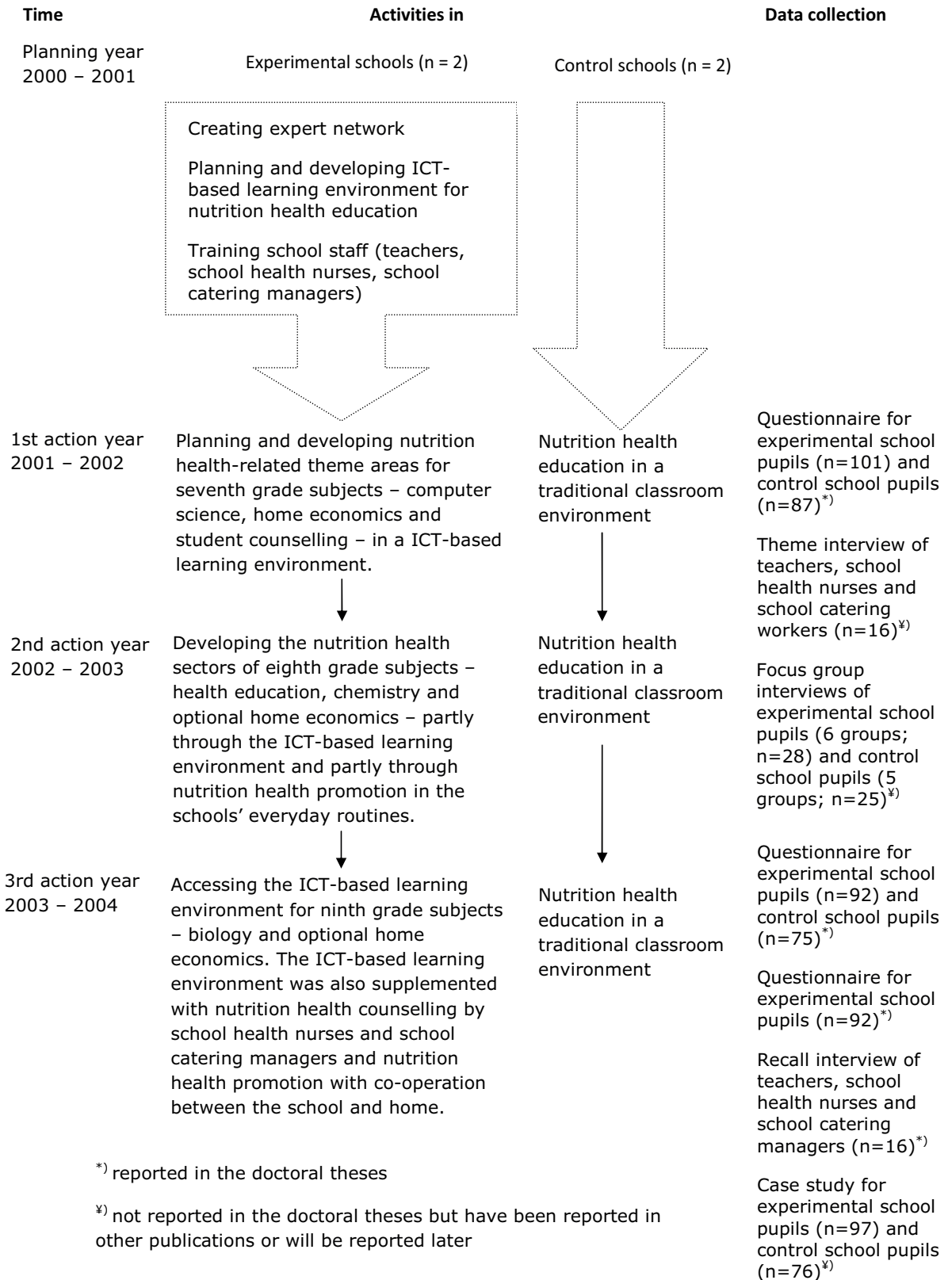
4.2.1 Functions of the project

In the planning year (academic year 2000 – 2001), two experimental schools and two control schools were selected for the project (Figure 5). In the experimental schools, an expert network was created in order to develop nutrition health education. The network consisted of the pupils and their family members, teachers, other school staff and researchers. In order to produce and forward the information on nutrition health education, an ICT-based learning environment was planned and developed by the expert network with the support of the researchers. Furthermore, the staff in the experimental schools were trained for the nutrition health project using an ICT-based learning environment.

In the first action year (academic year 2001 – 2002), health promotion issues (positive self-esteem, home life, school and free time, social skills, spontaneous health care, alcohol-free and non-smoking lifestyles) were integrated into the curricula of the schools. Pupils, parents, principles, teachers, school nurses and other members of the school community actively worked on the contents of the seventh and eighth grade theme issues about a health promoting ICT-based learning environment, through learning assignments and network discussions.

In the second action year (academic year 2002 – 2003), pupils, parents, principles, teachers, school nurses and other members of the school community continued to handle the health promoting themes placed in the curriculum using the ICT-based learning environment guided by expert tutors in health education for the seventh, eighth and ninth grades. Furthermore, they actively practised and carried out what they had learned e.g. social and life controlling skills, as a health promoting activity during schooldays. In order to support parental responsibility, theme discussions were created for the parents to participate in during parents' meetings and using the ICT-based learning environment. In order to handle issues regarding pupils and the factors affecting the flow of the school week (e.g. bedtimes, managing school assignments and supporting a non-smoking lifestyle), an ICT-based discussion forum for teachers and parents was created.

In the third action year (academic year 2003 – 2004), schools were using a health promoting unit, which covered the whole secondary school (from the seventh to the ninth grades). The ICT-based learning environment was heavily used during the implementation. Health promoting issues were the focus of the lessons in seventh grade computer science, home economics, student counselling, eighth grade health education, chemistry and optional home economics and ninth grade biology and optional home economics.



^{*)} reported in the doctoral theses

^{*)} not reported in the doctoral theses but have been reported in other publications or will be reported later

Figure 5. Progression of the study and the From Puijo to the World with Health Lunch project in the years 2001–2004

4.2.2 The objectives, contents and implementation in the seventh grade

The *From Puijo to the World with Health Lunch* project was presented to the seventh grade in computer science lessons and they familiarized themselves with the ICT-based learning environment (Table 2). The pupils used a computer during computer science lessons either independently, or in pairs, depending on the number of school computers available. Besides familiarizing themselves with the ICT-based learning environment, the pupils were also set tasks involving word processing, spreadsheets and information searching within the learning environment. During lessons, attention was also paid to the ethical questions of studying using the ICT-based learning environment and behaviour when using the internet. These lessons also practiced the idea of a discussion forum using the health themes given to the pupils. The teacher's task was to guide pupils in the use of computer, the ICT-based learning environment and the internet.

In home economics lessons, the pupils formed small groups of four or five that they worked in throughout the school year. In these groups, the pupils practiced preparing food, discussed nutrition health issues and used the computer in the home economics classroom for information searches and learning assignments. The most important subjects of the home economics lesson in the seventh grade were nutrition health and food culture. The teacher's task in these lessons was to promote and support the interaction between pupils and teachers as well as promote positive attitude towards healthy eating habits and food preparation. The teacher also gave their own examples to help pupils choose healthy food materials and prepare healthy and diverse food from those ingredients. Furthermore, in the home economics lessons, small groups of pupils solved issues connected to healthy and unhealthy eating and the meaning of healthy eating habits to the wellbeing and health of a developing adolescent. They also studied more detailed theoretical information about nutrition health and nutritional substances. Some issues were taught in small groups with the help of various exercises and crosswords. The conclusions of these small groups and the exercises were discussed in the home economics lessons, when the teacher clarified and supplemented the answers of pupils and emphasized the meaning of healthy and regular eating for the growth and management of the health of adolescents and adults. The teacher also gave the pupils some individual homework, which was meant to guide them to exploit the know-how and skills learned in home economics lessons, at home independently or together with their parents.

In student counselling lessons, the pupils answered questions about learning skills and learning techniques using the ICT-based learning environment. Optional subjects and further education opportunities were also taught during these lessons. Pupils used the ICT-based learning environment on their own or in pairs. The teacher's task was to motivate pupils to think and reflect on their own learning skills and learning techniques. The objective of the learning-style tests and learning-related exercises completed using the ICT-based learning environment was to encourage the pupils to evaluate their personal learning styles and possibly to help them find better and more effective learning techniques and styles.

4.2.3 The objectives, contents and implementation in the eighth grade

In the optional home economics lessons, the main issues presented to the eighth grade were repeated and the purpose of the *From Puijo to the World with Health Lunch* project was revisited: to develop, experiment and evaluate new and effective operation models and to promote the health and wellbeing of adolescents (Table 2). The main subjects of the home economics lessons were the importance of planning meals and special diets when choosing food products and preparing food. Pupils also formed small groups of four or five pupils in the eighth grade. The small groups did not have to be the same as those before. In these groups, pupils practised preparing food, discussed issues together connected to healthy and unhealthy eating habits and carried out various learning and repetitive exercises with

computers in the ICT-based learning environment. The answers and discussions of the small groups were then discussed together and the teacher clarified the concepts of healthy and unhealthy eating habits when needed.

In health education lessons, pupils, both independently and in small groups, considered the issues of values, alcohol-free lifestyle, dating and sexuality, physical education and health, first aid, the most common national health problems and traffic. Pupils searched for information within the ICT-based learning environment or on the internet and produced either an oral or a written report that was made available within the ICT-based learning environment. The repetitive exercises in the ICT-based learning environment were meant to help the pupils evaluate their own health skill levels and to pay more attention to those issues that were weaker than others.

In chemistry lessons, the pupils concentrated on the basics of chemistry, environmental chemistry and organic compounds. The issues included learning assignments, which pupils carried out either by themselves or in small groups during chemistry lessons or independently in their free time.

4.2.4 The objectives, contents and implementation in the ninth grade

The topics covered in biology lessons were human biology, alcohol and drugs, environment and health, micro and cell biology (Table 2). Pupils learnt about these issues, independently or in pairs then published a written report on the ICT-based learning environment's discussion forum or group work forums. After each lesson, pupils presented their own conclusions to the others. Further discussion of the issues continued in the ICT-based learning environment outside the lessons. The teacher's task was to motivate pupils to learn materials connected to health promotion and to research and discuss issues related to adolescents.

In the optional home economics lessons, the same issues were repeated as with the seventh and eighth grades. A new issue was a "health and nutrition" theme and food production information. In these lessons, the pupils formed small groups of four or five as in the seventh and eighth grades. The groups were not necessarily the same as those in the seventh and eighth grades. These groups practised preparing food, discussed questions connected to healthy and unhealthy food preparation, searched for information on the internet connected to healthy eating habits and carried out learning assignments in the ICT-based learning environment. The teacher's task was to motivate the pupils to prepare healthy food and search for health information on the internet.

As part of the project, a separate ICT-based learning environment was created for the health education of the ninth grade called "*Feeling fresh – Feeling good*". The objective of this learning environment was to raise questions and motivate teacher and pupils to discuss health-related issues together. The aims of "*Feeling fresh – Feeling good*" were that: 1) pupils participate actively in discussion and interaction within the network; 2) pupils are better prepared for working within the ICT-based learning environment; 3) pupils become interested in health and mental health issues and understand their connection to overall wellbeing; 4) pupils consider factors affecting health and mental health both independently and with others; 5) pupils learn to express themselves; 6) pupils learn new information about health and mental health; 7) pupils are able to work independently in the ICT-based learning environment; 8) pupils deduce new information based on their earlier knowledge and experiences and so their self-esteem and respect for others as individuals increases.

The "*Feeling fresh – Feeling good*" learning environment consisted of an introduction to the project, a health education pack, learning assignments, discussion forum and a group work area. The health pack covered the following issues: health, mental health, self-awareness, family, friends, school, physical education and hobbies, nutrition, social life, environment, alcohol-free, drug-free and tobacco-free lifestyle and sleep. The learning assignments were case assignments which were based on the issues found in the health education pack.

Pupils learnt in groups of three to five using the topics in the information pack and published a short report after the lesson on the issues discussed on the discussion forum or the group work forum. Small groups presented their reports to the other groups at the end of the lessons. The discussion of the issues continued in the discussion forum outside the lessons. Small groups also produced PowerPoint presentations about particular health issues (healthy nutrition, oral health, physical education, osteoporosis, sleep), which were given to the other groups at the end of the lessons and after that saved in the ICT-based learning environment to be learnt and commented on.

4.2.5 The contribution of school health care

The purpose of school health care was to continue the long-term follow-up of a child's health, which started in nursery as babies and continued through primary school to secondary school (Table 2). It focused on promoting a pupil's holistic development and health and also aspired to encourage the pupil to adopt a healthy lifestyle. The objective of school health care was to promote every pupil's healthy growth and development and also to create a basis for a healthy adulthood. School health care also promoted the health and security of the school community.

Another purpose of school health care was to act systematically and, in a pupil-oriented manner, holistically in order to promote health, health education, prevent health problems and promote co-operation within the whole school community and with the pupils, parents and carers. The idea of the school health care ICT-based learning environment was to teach pupils the meaning and objectives of school health care and also prevent and treat accidents at school. Furthermore, the ICT-based learning environment contained the contact information of the school nurses and school health care partners so that adolescents and their families could contact them when needed. Health nurses could also use a discussion forum where the adolescents could ask the nurses questions and receive answers in the discussion forum. School nurses also participated in lessons where the ninth grade were working on PowerPoint presentations about health issues.

4.2.6 The contribution of the school lunch

Within the school as a whole, the purpose of the school lunch was to be a diversified and balanced meal (Table 2). The intention was to guide the pupils to value the meaning of school lunch especially as it is free for everyone. In Finland, a free school lunch has been offered to all pupils for over 50 years. Nowhere else in the world does this. The school lunch covers a third of daily nutritional needs and meets nutrition recommendations if the meal is eaten according to the standard guidelines (main food, salad, warm side dishes, potato, rice or pasta, bread and drink). Good table manners are also learnt during school lunches and pupils can acquire new tastes. The quiet dinner hour brings a welcome break to the school day and the lunch gives energy for the afternoon studies.

School lunch objectives change according to official recommendations. The 2001 survey of eating within the project indicated the development needs of the school lunch in an urban school. A school lunch development team was established and recommended the following actions to be carried out in order to achieve the objectives of the school meal: 1) specifying plans for school lunch, food portions and self-service; 2) emphasizing the importance of the accuracy of these plans; 3) dividing the dining area into class-specific areas so that there is more room for queues and the diners can have a quiet dining hour; 4) monitoring of nutritional intake and guidance; 5) adding more lunch buffet areas; 6) underlining the need for co-operation between teachers, pupils and lunch room personnel; 7) supporting the teachers' commitment to the school lunch; 8) creating sample meals; 9) emphasizing the importance of personal hygiene; 10) improving the ambience of the school

lunch room and the quiet atmosphere of the lunch hour and 11) paying attention to the taste and diversity of school food.

4.2.7 Co-operation between school and home

During the project, the parent meetings arranged at the schools were usually attended by a representative of the project, who presented the project's operation model, progress and the research results to the parents as well as project achievements regarding class tuition and accomplishments in lessons (Table 2). Parents had an opportunity to learn about the ICT-based learning environment during parents' meetings. Furthermore, parents had an opportunity to use the ICT-based learning environment in their free time, independently or together with their children.

Table 2. Structure of nutrition health project from grade seven to grade nine in experimental schools: grade, subjects, contents and activities

Grade	Subject	Contents	Activities
7th grade	Computer science	Familiarization with the nutrition health project and ICT-based learning environment Ethical issues and appropriate behaviour in ICT-based learning environment and on the internet	Independent assignments Assignments in pairs
	Home economics	Nutrition health Food culture	Food preparation Information search Group tasks Group exercises
	Student counselling	Learning skills Learning techniques Optional studies	Learning style assignments Independent assignments Assignments in pairs
8th grade	Health education	Health and nutrition values Alcohol-free and drug-free lifestyle Dating and sexuality Nutrition Physical exercise and health First aid National diseases (e.g. coronary heart diseases) Traffic safety	Independent assignments Group assignments Information search Oral report Written reports
	Chemistry	Safe environment Health Nutrition	Independent assignments Information search
	Optional home economics	In addition to the contents covered in the 7th grade: Meal planning Special diets	Group assignments Brush-up exercises Information search

Table 2. continued

Table 2. continued

Grade	Subject	Contents	Activities
9th grade	Biology	<p>People Drugs Alcohol Environment Microbiology Cell biology</p>	<p>Independent assignments Assignments in pairs Information search</p>
	Feeling fresh – Feeling good	<p>Health Mental health Self-image Family Friends School Physical exercise Hobbies Nutrition Dating Environment Drug-free and alcohol-free lifestyle (incl. tobacco) Sleep</p>	<p>Independent assignments Group assignments Information search Web discussion Elaboration of assignments in group work Use of case-based examples Observation of research results Making presentations</p>
	Optional home economics	<p>In addition to the 7th and 8th grades: Health and nutrition Nutrition facts</p>	<p>Group assignments Brush-up exercises Information search</p>
7th – 9th grade	School lunch	<p>Statutory and free Finnish school lunch</p>	<p>School lunch questionnaire (urban school) Information search Development of school cafeteria</p>
	School health care	<p>Objectives of school health care Prevention and treatment of accidents at school School health service co-operation partner connection information</p>	<p>Information search Web discussion</p>
	School-home co-operation	<p>Presentation of nutrition health project's operating model Advancements and research results Familiarize parents with nutrition health project and ICT-based learning environment</p>	<p>Parents' meetings Independent assignments Parent-pupil assignments</p>

4.3 DATA AND ANALYSIS

Quantitative data and analysis

The quantitative data for this study were collected from the pupils using a structured questionnaire (Table 3), which was developed by the research group based on the findings of previous studies (e.g. Puska, 1995; Gracey et al., 1996; Vartiainen et al., 1996; Rimpelä et al., 1997; Young & Fors, 2001). The questionnaire was suitable for this study because the aim was to follow the same adolescents from the seventh to the ninth grade. The questionnaire included a total of 132 structured questions and five-point Likert scale items measuring the pupils' background information, eating habits, nutrition health behaviour, skills, attitudes, knowledge and their opinions about the nutrition health habits of their families and friends along with the nutrition health education they had received. Furthermore, there were 88 Likert-type items related to the ICT-based learning environment and the internet. The questionnaire was piloted with a separate group of pupils ($n = 39$) to ensure that it was comprehensive and clear and it can therefore be considered to have sufficient and valid content.

The baseline data were collected from the pupils in two experimental and two control schools using a questionnaire first in grade seven (pupils aged approximately 13 – 14 years) with the follow-up data from grade nine (pupils aged approximately 15 – 16 years). Research data were collected at both measuring points during lessons which were supervised by a researcher or teacher. The target group for this study was 195 pupils (106 from the experimental schools and 88 from the control schools). The response rate in the baseline measure was 96% ($n=188$); 101 pupils from the experimental and 87 pupils from the control schools responded. The response for the follow-up measurement was 173 pupils (97 pupils from the experimental schools and 76 pupils from control schools), which was 89% of the total. In this study, we were interested in the changes in pupils' nutrition knowledge and eating habits and for that reason we needed the same pupils to respond both in the baseline and the follow-up questionnaires. The response rate of pupils who participated in both was 86% ($n=167$); 92 from the experimental and 75 from the control schools. The final sample from the follow-up study was thus 167 pupils.

The quantitative data were analysed using SPSS software (Table 3). Frequencies and percentages were calculated from the background data of the respondents and schools and genders were compared with cross-tabulation and Fisher's exact test. Factor analyses were performed separately using the Varimax rotation method for the questions that measured pupils' nutrition health skills and attitudes, the adolescents' opinions of the nutrition health habits of their families and friends as well as the ICT-based learning environment as an integral learning tool, health learning using the ICT-based learning environment and the usability of the ICT-based learning environment. Before the factor analysis, the relationships between variables were evaluated with Spearman's rank correlation coefficient. The variables correlated with at least one other variable ($r > .30$). The number of factors was restricted to factors with an eigenvalue greater than one and factors whose contents were meaningful. The internal consistency of the data included in the factors was evaluated using Cronbach's alpha coefficient. For logistic regression analysis, factor scores were dichotomized into two classes. This was done because of the restricted number of informants, in order to examine various interactions between the factors and background variables and to simplify the interpretation of the results. Logistic regression analysis was used to identify the factors and their interactions that best explained the daily healthy eating habits of pupils in relation to the food circle. In further analyses, separate models for the schools and genders were also constructed. Logistic regression analysis was performed following the backward selection procedure used in model fitting. The interpretation of the results of the logistic regression analysis was based on the odds ratios (OR) and their 95 per

cent confidence intervals. The non-standard factor scores were calculated for the factors using weighting coefficients, which were used in the two-way variance analysis, together with the background variables to describe and compare the pupils' experiences of the ICT-based learning environment in the schools and also to compare genders. The pupils' experiences of the ICT-based learning environment in the longitudinal study were analysed using the Wilcoxon test. Possible differences in the sum variables of nutrition knowledge and use of healthy and unhealthy food between pupils of the experimental and control schools in cross-sectional studies were obtained using the Mann Whitney U-test. Changes in sum scores from grade seven to grade nine were tested by the Wilcoxon test. The correlation between statistically significant changes in sum variables and school status variables was tested using the Mann Whitney U-test. Variables that describe consumption of daily meals were obtained using Fisher's exact test in a cross-sectional study. The significance of changes was tested with the McNemar test. A p-value of less than 0.05 was considered statistically significant (Burns & Grove, 2010).

Qualitative data and analysis

The qualitative data of this study were obtained by means of recall interviews with 16 school staff members – 12 teachers, two school health nurses and two school catering managers – after the three year project (see Table 3). The interviewees were asked to recall nutrition health education and the ICT-based learning environment at their schools. The themes of the interview included: curriculum, validation of nutrition health learning, school meal, ICT-based learning environment, development of nutrition health education and the school meal, expertise in nutrition health education and the *From Puijo to the World with Health Lunch* project. These themes were selected to illustrate nutrition health education and the use of an ICT-based learning environment in a secondary school as understood and practised by the school staff. The interviews varied from one to two hours and were recorded and transcribed verbatim.

The qualitative data were analysed by means of qualitative content analysis (Graneheim & Lundman, 2004; Berg, 2006) using Atlas.ti software (Lewis, 2004) (Table 3). The analysis consisted of simplification, grouping and conceptualising. The analysis units were similar to the original statements, which formed simplified classes that were grouped into sub-categories (Jansen, 2010). Conceptualisation was continued by combining the sub-categories into main categories, which were the descriptions by school staff of nutrition health education and the ICT-based learning environment.

Table 3. Research data, times and analyses of the study and the related articles

Data and times	Analyses	Article (I-IV)
Quantitative material in 2002: - questionnaire for experimental school pupils (n=101) and control school pupils (n=87)	Cross-tabulation, Fisher's exact test, factor analyses, logistic regression analysis	Article I
Quantitative material in 2002 and in 2004: - questionnaire for experimental school pupils (n=92) and control school pupils (n=75)	Mann-Whitney U-test, Wilcoxon test, Fisher's exact test, McNemar test	Article II
Quantitative material in 2004: - questionnaire for experimental school pupils (n=92)	Cross-tabulation, Fisher's exact test, Wilcoxon test, factor analyses, two-way analysis of variance	Article III
Qualitative material in 2004: - recall interview for teachers, school health nurses and school catering managers (n=16)	Content analysis using Atlas.ti software	Article IV

4.4 ETHICAL CONSIDERATIONS

The treatment of ethical issues in this thesis follows the guidelines for good ethical conduct based on the Helsinki declaration (World Medical Association, 2008). Whenever young people are involved in a study, ethical issues need to be carefully considered (Leadbetter et al., 2006). During this study, the researcher sent a letter to the parents or guardians of pupils in the experimental and control schools, describing the aims and methods of the study (Polit & Beck, 2004). Furthermore, the parents and custodians of experimental school pupils became involved in the nutrition health project (Kerzner, 2009). The schools staff were provided with written and oral information regarding voluntary participation and the confidentiality of their responses. They were also informed that the recorded interview would be transcribed and that their names would be given code numbers to ensure confidentiality. The participation of pupils and school staff in the study was voluntary and every pupil and member of staff could choose whether or not she/he wanted to participate. There were no pupils or members of staff in the schools who did not want to be involved.

The research data about pupils and school staff were collected during schools days, supervised by a researcher. At the beginning of the study, the researcher explained that she was interested in the experiences of pupils and school staff with nutrition health learning and nutrition health education as well as the ICT-based learning environment. The researcher analyzed the data and wrote the study reports in such a way that no individual pupils or school staff member could be identified. The data have been used only by the research group.

5 Results

5.1 PUPILS' NUTRITION HEALTH ATTITUDES, PERCEPTIONS OF SKILLS, REPORTED BEHAVIOUR AND PERCEPTION OF THE NUTRITION HEALTH-RELATED BEHAVIOUR OF FAMILIES AND FRIENDS (ARTICLE I)

The pupils' opinions of their own eating habits and the eating habits of their family members indicated that pupils ate healthy food in relation to the food circle daily, or once or twice a week. About half of the pupils reported that they ate together with their family on weekday evenings and 65% reported eating with their families at weekends. Nine percent of the pupils said they had a special diet. Boys estimated that they ate dinner on weekdays with their family members more regularly than girls (Article I; Table 2).

The pupils' nutrition health skills consisted of five factors: 1) *parental support for adolescents' nutrition health skills*; 2) *healthy and regular meals*; 3) *healthy food preparation and choice skills*; 4) *independent choice of meals* and 5) *healthy and health-conscious food choice skills*. Pupils' nutrition health attitudes were made up of three factors: 1) *significance of healthy nutrition for one's health*; 2) *positive attitude towards a healthy diet* and 3) *association of unhealthy nutrition with other aspects of behaviour* (Article I; Table 3). Furthermore, the nutrition health habits of their families consisted of three factors: 1) *family support for adolescents' healthy meals*; 2) *joint family meals and preparation of food* and 3) *family's healthy food choices*. Correspondingly, the nutrition health habits of their friends consisted of two factors: 1) *the healthy nutrition habits of friends and support for adolescents' healthy eating habits* and 2) *the significance of friends' unhealthy nutrition habits* (Article I; Table 4).

The findings highlighted that the pupils who exhibited healthy food preparation and choice skills or had family support for adolescents' healthy meals and those with parental support for adolescents' nutrition health skills showed a greater probability of eating healthy food compared with respondents whose families supported neither their desire for healthy meals nor their nutrition health skills. Furthermore, the pupils who appreciated the significance of healthy nutrition for one's health, healthy nutrition habits of friends and peer support for adolescents' healthy eating habits had a greater probability of following a healthy diet compared to pupils who did not appreciate the significance of healthy nutrition for health, friends with unhealthy nutrition habits and had no peer support for their healthy eating habits (Article I; Table 5).

5.2 THE EFFECTS OF NUTRITION HEALTH INTERVENTION ON PUPILS' NUTRITION KNOWLEDGE AND EATING HABITS (ARTICLE II)

The findings indicated that in the experimental schools, general nutrition knowledge increased significantly during nutrition health intervention from grade seven to grade nine (Article II; Table 2). The experimental school pupils' knowledge of carbohydrates was found to develop significantly during the intervention and the change was significantly better than that of the control school pupils. This was particularly true among the urban experimental school pupils, who had significantly weaker carbohydrate knowledge than the rural experimental school pupils in grade seven; the increase in their score was 48%. Furthermore, the experimental school pupils' knowledge of fats improved significantly during the intervention. This was particularly true among the urban experimental school pupils, who had less knowledge of fats in grade seven than did the rural experimental school pupils; a 19% increase in their score was found.

The results of the pupils' use of healthy food like vegetables, salads, fruits, berries, meat products, chicken, fish, rye bread/crisp bread, milk/sour milk, yoghurt/sour whole milk and

cheese appeared to be rather similar in both the experimental and control schools in grade seven (Article II; Figure 1). The experimental school pupils' use of healthy food increased significantly during the intervention. A positive change was found particularly in the urban experimental school. The change was more significant in the experimental schools than in the control schools. At the end of the intervention, the experimental school pupils used healthy food significantly more often than the control schools pupils.

The results of the pupils' use of unhealthy food, such as soft drinks, sweets, chocolate, French fries, potato chips, hamburgers, meat pies and pizza turned out to be rather similar in both the experimental and control schools in grade seven (Article II; Figure 2). The reduction in the use of unhealthy food by the experimental school pupils was statistically significant during the intervention. A positive change was found particularly among the urban experimental school pupils. The change in the urban experimental school was significant compared with both the rural experimental school and the urban control school.

The pupils had daily meals - breakfast, school lunch, dinner and an evening snack - at a similar frequency in both the experimental and control schools in grade seven (Article II; Table 3). As to the results concerning school lunch, the experimental school pupils' habit of eating regularly at school increased significantly during the intervention. A corresponding change was not observed in the control school pupils. At the end of the intervention, the rural experimental school pupils ate school lunch more often than the urban experimental school pupils.

5.3 THE USEFULNESS OF AN ICT-BASED LEARNING ENVIRONMENT IN PUPILS' HEALTH LEARNING (ARTICLE III)

The majority of the pupils (91%) had a computer at home. However, only 46% of the pupils reported using a computer daily. Approximately three-quarters (76%) of the pupils thought they had a computer with an internet connection at home. More than a third (38%) of the pupils reported using the internet daily. Pupils at the urban school were more likely to have a computer with an internet connection at home compared with the pupils at the rural school. Furthermore, the pupils at the urban school used a computer and the internet more often than the pupils at the rural school. Correspondingly, boys evaluated their computer skills as better than how the girls evaluated theirs (Article III).

The ICT-based learning environment as an integral learning tool consisted of eight factors: 1) *easy-to-use and cooperative learning environment*; 2) *the everyday tool in information seeking*; 3) *the learning environment of the family*; 4) *internet as an activating learning environment*; 5) *need of assistance*; 6) *the transferability of experiences*; 7) *studying independent of time and place* and 8) *the teacher's feedback and support* (Article III). The pupils who had an internet connection at home had a more positive attitude towards the ICT-based learning environment as an everyday tool for finding information compared with pupils who did not have an internet connection at home. The pupils who use the internet and did so in their free time found it of greater assistance compared with the pupils who could not or did not use the internet at home. Moreover, an internet connection at home and the pupils' use of the internet in their free time had a positive link to the transferability of experiences of the ICT-based learning environment. The rural school pupils had more positive experiences of an easy-to-use and co-operative learning environment compared with the urban school pupils. Furthermore, the pupils at the rural school had a more favourable impression of the internet as a stimulating learning environment compared with the pupils at the urban school. The interaction between school and gender was significant: boys from the rural school had more positive experiences of transferability compared to boys from the urban school. Furthermore, the rural school pupils were sympathetic to the transferability of experiences in the ICT-based learning environment. Correspondingly, the girls had better experiences of an easy-to-use and co-operative learning environment compared with the

boys. The pupils who had an internet connection at home had a more positive attitude towards the ICT-based learning environment as an everyday tool in information seeking compared with those who did not have an internet connection at home. Furthermore, it was easier for the pupils who could use the internet to ask for assistance compared with the pupils who could not use the internet. The pupils who used the internet in their free time asked for assistance more readily than the pupils who did not use the internet in their free time. An internet connection at home had a positive connection to the transferability of experiences in the ICT-based learning environment. The pupils' use of the internet in their free time also had a positive effect on the transferability of experiences in the ICT-based learning environment.

The health learning in the ICT-based learning environment was made up of five factors: 1) *networked health learning on demand*; 2) *transfer effect of health learning*; 3) *socialisation of health learning*; 4) *deepening and integration of health learning* and 5) *the meaning of peers for health learning* (Article III). Skills in using a computer and the internet had a positive link to pupils' opinions about deepening and integration of health learning. The pupils at the rural school had a positive attitude towards deepening and integration of health learning using the ICT-based learning environment. The rural school pupils also had a more favourable impression of the opinions of peers for health learning compared with the urban school pupils. Furthermore, the girls had a positive attitude towards deepening and integration of health learning using the ICT-based learning environment.

The usability of the ICT-based learning environment was made up of two factors: 1) *technological functionality* and 2) *the reliability of network connections* (Article III). The pupils in the rural school were more confident on the technological functionality in the ICT-based learning environment compared with the pupils at the urban school.

The pupils' experiences of the ICT-based learning environment were quite positive as a whole from grade seven to grade nine (Article III). However, the pupils found using the ICT-based learning environment to be less pleasant in grade nine than in grade seven. This was especially true among the urban school pupils, where a 24% decrease in the number of pupils who found using the ICT-based environment pleasant was found. However, the urban school pupils' skills in finding information about health nutrition on the internet increased during secondary school. Furthermore, the pupils' critical attitude towards information found on the internet improved statistically significantly during lower secondary school. An increase in this critical attitude was found, of 15% especially among girls, and of 20% with rural school pupils. The pupils' awareness of the accuracy of information found on the internet also improved statistically significantly during secondary school. An increase was found among the rural school pupils and girls.

5.4 THE IMPLEMENTATION OF THE NUTRITION HEALTH PROJECT AND THE ICT-BASED LEARNING ENVIRONMENT IN SECONDARY SCHOOLS (ARTICLE IV)

The findings relating to the implementation of an ICT-based learning environment in the nutrition health project are described from the viewpoints of the school staff – teachers, school health nurses and school catering managers – in accordance with the findings on the introduction and maintenance of the nutrition health project in the schools and the findings about the ICT-based learning environment in the nutrition health project.

The findings about the introduction and maintenance of the nutrition health project in the schools from the viewpoints of the school staff revealed three main categories: 1) *the basis of multidisciplinary education in nutrition health*; 2) *motivation to lifelong nutrition health learning* and 3) *school community support of nutrition health activities* (Article IV; Figure 1).

School-specific curricula, based on the national basic education curriculum, served as the foundation for basic education. In home economics lessons, the teachers taught the skills

needed for the preparation of healthy meals and good table manners. Besides practical home economics, nutrition health issues were integrated into other school subjects, for instance biology and health education, as well as health promotion activities, like health theme days that supported the school's rules of good conduct. At secondary school level, nutrition health is mainly taught by a few teachers of health education and home economics. Co-operation as a pedagogical activity was regarded as important for the management of departments, joint operating guidelines and the elimination of overlap. A lack of time for co-operation was pointed out as a problem. The combination of a small number of nutrition health project meetings and a large amount of work caused a large number of obstacles to co-operative working. The natural interface between the school and the home was the class supervisor. Parents' involvement in the project meant distributing information regarding the pupils' meals or state of health. The importance of parents' involvement in the project was also emphasised at parent-teacher meetings and by the parents' association.

The main aim of the nutrition health project was to encourage pupils' to prepare their own meals. In nutrition health education, this implied underlining how self-prepared healthy meals can taste good and be convenient and low priced. Healthy eating lifestyle focused on a regular daily routine and a healthy lifestyle. Many school staff members noticed that to actually change the pupils' way of life to make it healthy, the pupils themselves were considered to need, besides good manners, skills that they would be able to apply in practice in the future – recognition of healthy lifestyle choices and a healthy diet.

The statutory free school meal is based on nutrition recommendations, served as a healthy meal model and acts as a social situation that supports the pupils' participation in a healthy meal. The school meal consists of a main course, salad, a beverage and bread. Special diets required because of health problems or due to religious reasons have also been taken into consideration in the school meals. The lack of funds allocated for school meals has negatively affected the quality of the meals over the past few years. The most common reason that contributed to the pupils' refusal to eat the school meal was that their friends did not participate in the meal. The food kiosk in the school was counter to the health ideas and values of the school meal and its opening hours have therefore been reduced whilst healthier alternatives, such as fruit, have been added to the product range. On the other hand, the kiosks gave the pupils an opportunity to practice commercial activities and lowered the number of times pupils left the school area during the school day. The methods most commonly used by school health care to promote the nutrition health of pupils were individual health checkups, discussions and use of questionnaires as well as distribution of health promotion material. The impact of school health care on the nutrition health project was considered weak and therefore school health nurses needed further training. The example set by school staff was considered an important aspect of supporting the pupils' healthy meal practices and participation in school meals. Despite supervision of school meals, monitoring of the pupils' participation in school meals by the teachers was said to be insufficient and they only occasionally participated in school meals with their pupils.

The findings about the ICT-based learning environment in the nutrition health project as viewed by the school staff yielded two main categories: 1) *operational ICT culture in the nutrition health project* and 2) *ICT for the nutrition health project process* (Article IV; Figure 2).

Practical commitment to using the ICT-based learning environment required the school staff members to be motivated and have a change in their attitude; also, compared with traditional classroom education, more time for planning and co-operation between colleagues in charge of nutrition health education was needed. School staff members described the ICT-based learning environment as suitable for the nutrition health project, but the facilities were a weakness in the schools. The ICT-based learning environment was evaluated as requiring well-functioning classrooms with a sufficient number of computers with telephone lines. This being the case, access to only one computer in the classroom was

considered problematic. Adoption of the pedagogical principles of an ICT-based learning environment required the school staff to internalise the ICT-based learning environment and utilise alternative methods in the nutrition health project, for example by integrating teaching, learning activities and problem-based learning. Furthermore, the school staff realised that they would need to be competent at using the ICT-based learning environment in terms of the nutrition health project. This required some further training and advanced courses for the school staff. Training would give the school staff a better opportunity to develop the nutrition health project using an ICT-based learning environment.

A flexible and inquisitive nutrition health project was apparent in that illustration and the search for up-to-date information had become easier using the ICT-based learning environment. Apart from up-to-date information, the ICT-based learning environment supported the pupils' independent, spontaneous nutrition health learning process. ICT also increased pupils' motivation and interest in nutrition health, because learning was not tied to a place or time. Furthermore, the pupils' parents had an opportunity to familiarize themselves with the ICT-based learning environment and monitor the nutrition health learning of their children.

The interactive aspect of the nutrition health project was improved even further by establishing an interactive element to the project. For example, discussion forums and web-based chat offered the pupils an opportunity to present questions and exchange opinions with their classmates and the school staff. The pupils were not experienced in using discussion forums for nutrition health learning, however. The ability to search for information needed for the nutrition health project enabled development of the skills of the school staff and pupils to acquire information. This was considered an absolute prerequisite for forming a critical attitude towards information found through the ICT-based learning environment and the internet, as well as whether or not to use this information in the nutrition health project.

5.5 SYNTHESIS OF THE RESULTS

Table 4 presents the summary of the main results of the study and the related articles in this thesis. The results of this study indicated that the pupils had positive attitudes towards healthy eating. Most of the pupils were interested in a healthy diet and wanted to improve their own habits of eating healthy and diverse food. Over half of the pupils considered themselves able to make independent decisions and nutrition choices regardless of their friends' unhealthy nutrition habits. The nutrition health project carried out in experimental schools from grade seven to grade nine resulted in positive changes in the pupils' nutrition knowledge and healthy eating habits. The results showed that an ICT-based learning environment was a versatile tool for pupils' health education. Use of an ICT-based learning environment for health education supported pupils' independent and collaborative learning as well as increased their awareness of how to critically evaluate health information found on the internet. Development of the nutrition health project required the continuous co-operation of the entire school staff – teachers, school health nurses and school catering workers, pupils and pupils' families. It also enabled an update of the nutrition health curriculum. Implementation of the ICT-based learning environment for nutrition health education required that the school staff manage and update their knowledge and skills in ICT and create new action environments to promote pupils' nutrition health learning.

Table 4. Summary of the main results of the study and related articles

Evaluation phase	Material and time	Main results	Articles (I-IV)
Evaluation of the seventh-grade pupils' nutrition health attitudes, perceptions of skills, reported behaviour and perceptions of families' and friends' nutrition health-related behaviour	Quantitative material in 2002: questionnaire for experimental school pupils (n=101) and control school pupils (n=87)	<ul style="list-style-type: none"> -pupils had very or fairly good health -pupils reported eating healthy food in relation to the food circle daily or once or twice a week -about half of pupils ate together with their family on weekday evening and over half of pupils did so during the weekends -only nine percent of the pupils had a special diet -boys had a higher estimation than girls of their health and boys reported eating dinner on weekdays with their family members more often than girls -the seventh-grade girls had a greater probability of following healthy eating habits compared to seventh-grade boys -parental support played an important role in seventh-grade adolescents' healthy eating habits and food choices -adolescents' own healthy food preparation and choice skills were associated with healthy and diverse eating amongst seventh-graders. -no significant differences between the experimental and control schools were found in this baseline situation 	Article I
Evaluation of the effects of nutrition health intervention on pupils' nutrition knowledge and eating habits	Quantitative material in 2002 and in 2004: questionnaire for experimental school pupils (n=92) and control school pupils (n=75)	<ul style="list-style-type: none"> -the experimental school pupils' knowledge of nutrition, carbohydrates and fats improved significantly during the nutrition health intervention -the pupils who participated in the nutrition health intervention increased their intake of healthy food such as vegetables, salads, fruits, berries, meat products, chicken, fish, rye bread/crisp bread, milk/sour milk, yoghurt/sour whole milk and cheese -at the end of the intervention the experimental school pupils' use of healthy food was significantly greater than that in the control schools -the experimental school pupils reduced their intake of unhealthy food, such as soft drinks, sweets, chocolate, French fries, potato chips, hamburgers, meat pies and pizza, during the nutrition health intervention -the pupils who participated in the intervention began to have their school lunch more regularly 	Article II

Table 4. continued

Table 4. continued

Evaluation phase	Material and time	Main results	Articles (I-IV)
Evaluation of pupils' views about an ICT-based learning environment for health learning	Quantitative material in 2004: questionnaire for experimental school pupils (n=92)	<p>-the ICT-based learning environment as an integral learning tool consisted of eight factors: 1) easy-to-use and cooperative learning environment; 2) an everyday tool in information seeking 3) a learning environment for the family; 4) the internet as an activating learning environment; 5) need for assistance; 6) the transferability of experiences; 7) studying independent of time and place; and 8) the teacher's feedback and support</p> <p>-health learning in the ICT-based learning environment was made up of five factors: 1) networked health learning on demand; 2) transfer effect of health learning; 3) socialisation of health learning; 4) deepening and integration of health learning and 5) the meaning of peers for health learning</p> <p>-the usability of the ICT-based learning environment was made up of two factors: 1) technological functionality and 2) the reliability of network connections</p> <p>-the pupils' critical attitude towards information found on the internet improved</p> <p>-the pupils' awareness of the accuracy of information found on the internet improved</p>	Article III
Evaluation of the views of teachers, school health nurses and school catering managers about a nutrition health project implemented using an ICT-based learning environment	Qualitative material in 2004: recall interview for teachers, school health nurses and school catering managers (n=16)	<p>-the nutrition health project in the schools was implemented in accordance with the basis of multidisciplinary education in nutrition health i.e. the curriculum in basic education – towards goals of teaching and acting, co-operation as a pedagogical activity and parents' involvement in the project; motivation to lifelong nutrition health learning i.e. preparation of healthy meals and a healthy eating lifestyle; school community support of nutrition health activities i.e. statutory free school meals based on nutrition recommendations, statutory school health care and the example of the school staff</p> <p>-the ICT-based learning environment consisted of an operational ICT culture in the nutrition health project i.e. practical commitment to using the ICT-based learning environment and adoption of the pedagogical principles of an ICT-based learning environment; ICT for the nutrition health project process i.e. a flexible and inquisitive nutrition health project, the interactive aspect of the nutrition health project and media literacy</p>	Article IV

6 Discussion

6.1 EXAMINATION OF THE RESULTS

This doctoral thesis presents the results of the *From Puijo to the World with Health Lunch* project. The results provide an overview of experiences and evaluations by school staff and pupils from secondary schools regarding factors that promote nutrition health. The researcher has reviewed the learning and teaching of nutrition health from the viewpoints of pupils and teachers, school health nurses, and school catering managers. In addition, the researcher has studied the central factors of the ICT-based learning environment using both quantitative and qualitative research methods.

Several significant theories and models support the practice of nutrition health projects (Hoelscher et al., 2002). Among others, these include the Social Cognitive Theory (Bandura, 1986), the Health Belief Model (Janz & Becker, 1984), Theory of Planned Behaviour (Ajzen, 1991), Intervention Mapping (Bartholomew et al., 1998), and the Precede-Proceed model (Green & Kreuter, 1999). Precede-Proceed model was selected for frame development, implementation, and evaluation of the *From Puijo to the World with Health Lunch* project. Precede-Proceed model is a widely used planning model that has guided the design of programmes in a varied array of setting and for numerous health problems (Horacek et al., 2000; Zimmerman et al., 2001; Chiang et al., 2003; Gary et al., 2003; Wright et al., 2006). Precede-Proceed model is founded on the notion that social context greatly influences knowledge transfer and uptake (Green & Kreuter, 1999). Green and Kreuter (1999) do not explicitly define the socio-cognitive framework underpinning their model. They refer to a number of specific models and theories in their text such as the Health Belief Model and the Social Cognitive Theory that support the principles underpinning the Precede-Proceed framework. These theories and models, although shown to be fruitful for the purpose of facilitating individual health-related behaviour change, may also have value in the development of theoretical models to improve researcher's understanding regarding what factors and conditions are necessary to facilitate behaviour change or other desired changes in the context of nutrition health.

When the Precede-Proceed model was applied in the *From Puijo to the World with Health Lunch* project, the education of nutrition health in the school community was started by evaluating the objective final result (nutrition health) (see Figure 2). The aim was to find the predisposing, reinforcing, and enabling factors that precede and affect the final results. The predisposing factors consisted of pupils' nutrition health knowledge, attitudes, values, beliefs, and concepts. The reinforcing factors consisted of the nutrition health attitudes of the parties influencing nutrition health, such as family members, friends, and school staff, and of the school meals and school health care. The enabling factors, in turn, included material and physical facilities for the education of nutrition health, which included pupils' nutrition health skills and services allocated to nutrition health education.

The nutrition health of Finnish adolescents has been studied since the 1970s in the North Karelia Project (Puska et al., 1981; Puska et al., 1982). Furthermore, the nutrition health has been monitored in the school context since the 1990s as part of European Network of Health Promoting Schools programme (ENHPS; since 2008 the School for Health in Europe (SHE)) (Rasmussen & Rivett, 2000). However, these studies have not considered the opportunities provided by the information society. In addition, there have been significant changes in the use of ICT during this decade, in both technical hardware and the use and applications of ICT in realizing nutrition health projects and teaching and learning processes of schools. Therefore, it is important to bring forward newer studies and

experiences from them, and, in the future, to utilize the possibilities of the internet as well as ICT that were introduced in earlier studies. They have also had a central role in the planning, realization and evaluation of this research intervention.

The results in the baseline situation indicated that most seventh-graders said they eat breakfast, school lunch, dinner, and evening snacks daily. However, less than half of the adolescents said that their family members eat dinner together on weekdays. The boys reported eating dinner with their family members more regularly on weekday evenings than girls. The results showed that girls had a greater probability of having healthy eating habits compared to boys. During the weekends, 65 per cent of the children ate meals with their family members. This is in line with previous findings (Haapalahti et al., 2003). The results of the baseline study indicated that most adolescents were interested in healthy diets and wanted to improve their own eating habits to incorporate healthy and versatile food. Over half of the informants considered themselves able to make independent decisions and nutrition choices regardless of their friends' unhealthy nutrition habits. However, the present results showed that friends' healthy nutrition habits and support for adolescents' healthy eating habits would seem to especially positively affect seventh-grade girls' eating habits. Furthermore, parental support for healthy meals and nutrition health skills of adolescents was associated with seventh-grade girls' and boys' healthy food choices and their healthy eating habits.

The results of this study indicated that, at the school level, the nutrition health project can have a positive effect on pupils' habit of eating daily meals that follow nutrition recommendations. The changes in the foods pupils eat could be a result of their active participation in carrying out the project, which may have helped the pupils to practise choosing and preparing healthy meals both at school and at home. Finnish pupils are in a special position in international comparison due to receiving free school lunch (Finnish National Board of Education, 2008). The statutory free school lunch is an important key to improve and promote a healthy and diverse diet among pupils, as it is based on nutrition recommendations and accounts for one third of a pupil's daily nutrition (Roos et al., 2002). From an international perspective, the Finnish free school lunch is a unique example of well-organized nutrition health policy (Roos et al., 2002; Prättälä, 2003). A school lunch based on nutrition recommendations guides pupils towards healthy nutrition and simultaneously improves their healthy eating habits. Furthermore, pupils learn about social eating habits and the consideration of others during the communal meals as well as learn about other countries' food culture (Mikkelsen et al., 2005; Young et al., 2005; Sarlio-Lähteenkorva & Manninen, 2010).

Based on the results, it can be presumed that the improvement in the nutrition knowledge of the pupils in the experimental schools could also have influenced the reduction of unhealthy foodstuffs in the pupils' diets. Some earlier studies (Oenema et al., 2005; Powers et al., 2005; Kroeze et al., 2006; De Bourdeaudhuij et al., 2007; Ghorbani & Heidari, 2011) have observed similar effects. For example, improving knowledge about the energy and fats contained in food could have been the reason why pupils reduced the use of foods that contained large proportions of carbohydrates and fat during the project. This involvement may have partially increased the pupils' intake of healthy foodstuffs. Furthermore, the increase in pupils' nutrition knowledge may have had an effect on their positive eating habits. This is why education that promotes nutrition knowledge and good eating habits is needed in schools: it helps pupils practise making healthy eating choices (Graham & Zidenberg-Cherr, 2005; Story et al., 2009; Fančovičová et al., 2010). However, the results of this study do not answer the question on what the pupils' nutrition knowledge or eating habits will be like in the future and whether it is typical to eat unhealthy foods while also eating healthy foods.

The results of this study showed that the pupils' views on an ICT-based learning environment reflected fairly positive and user-friendly experiences. This is in line with

earlier studies (Kamel Boulos & Wheeler, 2007; Stretcher, 2007; Crutzen et al, 2008; Livingstone, 2008; O'Hara, 2008) that suggested that the networks of social media and the internet have become a popular tool for seeking health information among young people. Based on the results of this study, one might assume that the pupils' positive experiences may result in an outcome of improved health learning methods in the ICT-based learning environment. For example, cooperative assignments in the ICT-based learning environment caused pupils to discuss and solve practical, health-related problems together with their fellow pupils and teachers. It is also possible that the same pupils who used the internet in their free time also used the ICT-based learning environment outside school hours, or that the pupils' computing skills that they have acquired at home affected their positive experiences of the ICT-based learning environment. When utilizing ICT at school, attention should be paid to issues such as committing pupils' parents to nutrition and health education and promoting health learning within the entire school community. Furthermore, special attention should be paid to planning health tasks, so that they are reasonable and motivating to pupils and support the pupils' broad health learning. For example, we should plan learning exercises that involve both schoolmates and parents, as this would support and develop health learning situations independent of time or place, and also improve the use of technology by pupils' families (cf. Geiger et al., 2002). Thus, health learning is also possible and flexible outside the classroom and schools will promote both pupils' and their family members' know-how of ICT. However, this requires more time and more diversified and continuing education on ICT for teachers (Räihä & Tervonen, 2003).

The results indicated that the ICT-based learning environment was well-suited to deepening and integrating health learning, and that it also fitted learning-on-demand. In particular, the pupils in the rural school had positive attitudes, as learning and understanding this topic also required combining and structuring previously learnt knowledge with the ICT-based learning environment. Based on the results, it can be stated that the ICT-based learning environment can be a very effective and functioning learning method for nutrition health. However, it does not constitute a revolution in nutrition health learning, because technology does not automatically lead to broad nutrition and health education for all pupils (Mimirinis & Bhattacharya, 2007). The ICT-based learning environment is not capable, like any other learning methods, to engage different pupils on different levels of the same type of nutrition health learning and learning tasks. On the other hand, an ICT-based learning environment provides an opportunity to create health learning situations and materials independent of time or place (Finnish Ministry of Education and Culture, 2010). Thus, health learning outside the classroom is possible. Neither should it be forgotten that it is easier for health promotion experts, for example those in school health care, to use an ICT-based learning environment to participate in health learning situations or for planning in co-operation with the teachers and pupils (Tossavainen et al., 2004a; 2004b; Whitehead, 2006). Furthermore, ICT can open up opportunities for dialogue and exchange amongst diverse communities, giving youth access to different networks, perspectives and experiences (Kamel Boulos & Wheeler 2007). In an ICT-based learning environment, pupils have an opportunity to learn the same material as taught in the classroom, with the difference that more diverse health learning material with pictures and animations and collaborative group tasks can be created within an ICT-based learning environment (Voogt, 2010). Additionally, Kamel Boulos and Wheeler (2007) have suggested that ICT, with embedded collaborative activities, can effectively foster rich health learning experiences that result in positive outcomes. Therefore, it is clear that an ICT-based learning environment does not replace personal contact and that health learning in co-operative groups that actively discuss and solve practical, health-related problems together with the teacher, family members and fellow pupils (Contento et al., 2002; Pérez-Rodrigo & Aranceta, 2003) are still needed. Furthermore, ICT can bring

individuals into a collective that helps to inspire, support, and sustain their enthusiasm. High quality health learning is based on both individual and communal development. Pupils identify their own nutrition health skills and nutrition knowledge, and share these by performing a variety of health learning tasks. Health learning involves new knowledge and everyday phenomena, testing, questioning, and looking at alternatives and critical appraisal. A pedagogical challenge for schools is to support pupils' health learning in a rapidly changing world (Finnish Ministry of Education and Culture, 2010). Therefore, it is necessary to study the effects of ICT on the health learning and health behaviour of pupils.

The results of this showed that the rural school pupils felt the technological functionality of the ICT-based learning environment to be more significant for their health learning than the urban school pupils did. Based on the results of this study, one may presume that the positive outcomes in technological functionality may have resulted from the pupils' active participation in health education, which helped pupils to get experience in learning about health in the ICT-based learning environment. Furthermore, the ICT-based learning environment was new for the pupils in the rural school, and they had not previously used a computer at school every day. In the secondary school, rural school pupils were made motivated in using the ICT-based learning environment, and also learned to use computers in their health learning. Therefore, they did not have technological problems with the ICT-based learning environment. Additionally, the rural school pupils did not consider themselves lonely or feel separated from other pupils. With the help of their ICT skills, they utilized what they had learned in after school classes or on weekends on their free time, whereas urban school pupils had other complementary means of gathering health information, for example, visiting a library.

An interesting result of this study was that the pupils increased their awareness on the fact that information on the internet is not always reliable and must therefore be considered with certain reservation. An increase in awareness was found especially among rural school pupils and girls. A reason for this could be that the parents of girls in rural areas are more active in warning their children of the dangers of the internet than before. When ICT becomes a part of our everyday life, media literacy has to become an important part of health learning (Kickbush, 2001; Wade et al., 2003; Kellner & Share, 2005; Bergsma & Carney, 2008). This means pupils have to know how to use different ICT tools and media (Cox & Marshall, 2007). Meanwhile, it already includes the skills of reading and writing i.e. pupils have sufficient skills to understand media articles and acquire information; they can use, apply and evaluate ICT according to their own requirements for health literacy (Papastergiou & Solomonidou, 2005). This means that pupils learn to differentiate between important and less important information, find the most essential information from the mass of information they can find and form their own opinions. The conclusion that can be drawn is that it can be established that health literacy involves pupils' independent ability to recognize their own nutritional health-related requirements and to acquire, understand, and adopt nutrition, health knowledge and skills.

The results of the study indicated that the nutrition health project was implemented in the experimental schools in accordance with the objectives defined in the curricula. This required development of curricular work, the atmosphere and operational culture in the school, and co-operation between teachers and other school staff. The main objective of the nutrition health project was to motivate the pupils to promote healthy meal habits and learn to prepare healthy meals. In addition to motivation, the adoption of nutrition knowledge as a taught subject was also considered important. The idea was to improve pupils' nutrition health through predisposing factors: nutrition knowledge, attitudes, and values of nutrition health (see Figure 2). According to the results, school catering and home economics as a school subject were the most important factors reinforcing nutrition health. The school meal, following nutrition recommendations, is also a social situation in which teachers teach the pupils good table manners together with the school catering workers.

Unfortunately, the results indicated that teachers were not motivated to participate in school lunch in addition to supervising it. However, the example set by the school staff was considered important in supporting the pupils' participation in school lunch and pupils' nutrition health habits in general. Therefore, schools should aim to have their teachers and other school staff eat together with their pupils, thus teaching them good table manners. Attention should also be paid to providing sufficient funds for school meals, so that all pupils are offered an equal opportunity to receive a free and full school meal during their school day. The inclusion of home economics in the curriculum was designed to support pupils' individual growth and development, and to improve their abilities to prepare healthy and diverse meals, either independently or together with their schoolmates and family members. The nutrition health project also focused on the importance of teaching pupils to identify the factors that influence their nutritional health. The home economics lessons and the skills learnt from nutrition health education were also estimated to have an influence on the pupils' healthy meal habits and the preparation of meals during adulthood. Based on the research results, among the enabling factors, these skills would seem to best promote pupils' nutritional health. Although the meaning of the project is talked about a good deal, there is only a little research data available about what can be achieved through the project for the promotion of pupils' nutrition health in the long-term (Hyland et al., 2006; De Bourdeaudhuij et al., 2011). The results of this study do not provide a clear view of how stable the activities in nutrition health project planning and implementation will become in schools. This requires development of the project, which helps the school staff use innovative activities to replace current ones in implementing and planning the nutrition health education project (Neumark-Sztainer et al., 2003b; Pérez-Rodrigo & Aranceta, 2003).

The important point in implementing nutrition health education is the role of the school staff (Contento et al., 2002; Tossavainen et al., 2004a; 2004b; Whitehead, 2006). Nutrition health education will always require human interaction and teaching, and the need for them will not diminish in the future. When reviewing the implementation of nutrition health education, the interaction between the pupils, the learning material and the school staff needs to be considered. ICT-based learning environments should be considered more as good forms of support and aids for nutrition health education, not as replacements for school staff. School staffs play an important role as developers and constructors of ICT-based learning environments (Chen et al., 2009; Giavrimis et al., 2011). However, school staffs will change their nutrition health education to become more pupil-centred and they will utilize technology more than at present in the development of their nutrition health education (Voogt, 2010). The role of school staff should be channelled into supporting and encouraging pupils' nutrition health education. In order to implement pupils' self-directed and co-operative health education, school staffs will need to encourage pupils to discuss and evaluate their own ideas and the ideas of their peers. The aforementioned pressures of change cause new challenges for teacher education where, in addition to developing the working methods, the use of technology should also be more focused on nutrition health education. It is possible to steer the learning environments in a direction that utilizes technology through teacher education.

According to the participants, the use of the ICT-based learning environment required the staff to be motivated and committed, and also demanded careful planning and close co-operation between the staff compared to traditional classroom nutrition health education. This is in line with previous studies (Chen et al., 2009; Giavrimis et al., 2011). The interviewees recognised the limited time, space, and equipment resources, as well as the inadequacy of their personal know-how in pedagogic ICT as obstacles to using the ICT-based learning environment. The results indicated that more computers with information network connections should be acquired for the classrooms to make ICT-based education more prevalent in nutrition health education. Earlier studies (Räihä et al., 2003a; 2003b;

Räihä et al., 2004) have obtained similar results. This would offer school staff better opportunities to utilise ICT for nutrition health education. At the same time, the networking possibilities of schools and evaluation of the quality of nutrition health education would also be rendered more efficient (cf. Linder, 2004). Therefore, training related to the educational use of ICT in general should be increased for school staff (Räihä & Tervonen, 2003). In addition to technology, attention should also be paid to the development of the contents and methods of ICT-based education during training. Furthermore, in the case of the ICT-based operating culture, it would be essential that school staff have an opportunity to participate more in the implementation of projects within the school community (Räihä et al., 2005). This would also require developing new support methods to aid school staffs that are developing their teaching for an ICT-based supply. This is in line with the Finnish National Information Society Strategy for 2007 – 2015 (Prime minister's office, 2006), which emphasises the need to share information society know-how and experiences and to further encourage schools to harness innovative methods of health learning (Papastergiou, 2009).

An interesting result from the point of view of this project was that the ICT-based learning environment was needed in order to develop nutrition health education. The use of ICT required the school staffs to update the curriculum of nutrition health education and its contents. Based on the results, it can be assumed that the use of ICT had a definite influence on the development of co-operation of the entire school in nutrition health project. Earlier studies (Woolfe & Stockley, 2005; Shepherd et al., 2006) have obtained similar results. In the future, the objective should be that pupils and parents participate more in the development and implementation of nutrition health projects at school, together with teachers and other staff (Hyland et al., 2006; Vanhala, 2012). However, the results of this study do not provide a clear view of how stable the activities in nutrition health project planning and implementation will become in schools. This requires development of the project, which helps the school staff to use innovative activities to replace current ones in implementing and planning the nutrition health education project (Neumark-Sztainer et al., 2003b; Pérez-Rodrigo & Aranceta, 2003). However, it is important to remember that the technology in itself does not guarantee nutrition health education, but the central aspect is to develop learning environments that promote pupils' active, intensive and co-operative education in nutrition health with the help of reasonable, motivating learning tasks (cf. Blatchford et al., 2006). Nutrition health education is affected by the pedagogy used in teaching, whereas the use of technology has only a small effect. However, the use of different technologies is an essential part of the development of nutrition health education at secondary schools in the future (Räihä et al., 2004). Based on the results, it can be seen that the ICT-based learning environment had an important impact on the practices and implementation of the nutrition health project.

To sum up, the increasing number of overweight young people is a growing public health concern, which requires the development of nutrition health education (Story et al., 2009). Prevention of these public health-related risks requires development of curricular work regarding nutrition health education in schools, improvement of the schools' atmosphere and operating culture as well as co-operation with pupils, their families, and other interest groups (Matvienko, 2007; McGarr, 2009). Support for families' everyday meals, interactive skills and parenthood form the basis for the promotion of pupils' nutrition health habits (Hyland et al., 2006). In addition, positive nutrition health practices should also be supported in schools (Bere et al., 2006; Bere et al., 2007; Buijs, 2009a; De Bourdeaudhuij et al., 2011). The measures of nutrition health education should be developed to support pupils' healthy eating habits in schools. The most important instruments in nutrition health are school lunches and home economics as well as school health care (Kubik et al., 2003; Tossavainen et al., 2004a; 2004b; Whitehead, 2006). Apart from them, nutrition health education should also be integrated into all school activities

and co-operation between the school and home (Cho & Zbell Nadow, 2004). This requires development of nutrition health education materials and practical teaching methods as well as training school staff to integrate information about nutrition and health into a meaningful and interesting learning package for pupils. Furthermore, in the future, it will be important to find out what factors promote pupils' healthy nutrition habits and how school communities can support pupils' nutrition health learning with novel teaching and learning methods, such as the use of interactive ICT in pupils' homes.

6.2 RELIABILITY AND VALIDITY OF THE STUDY

The reliability of the research is linked to the researcher, the material and research methods as well as the presentation of the research results. The evaluation of the reliability of this research was carried out during the quantitative research stage by evaluating the validity and reliability of the research and at the qualitative research stage using criteria suitable for qualitative research (Creswell, 2003; Burns & Grove, 2010).

Reliability and validity of quantitative research

The reliability of the quantitative research is based primarily on the success of the measurement of the researched phenomenon, which means the selection of a reliable metric, suitable research methods and a selection of handling methods for the data (Bruns & Grove, 2010). The metrics and analysis methods chosen for this research provided consistently good answers to the research problems, therefore the reliability regarding this stage can be considered good. The researcher has also considered the requirements set by the statistical methods when choosing analysis methods e.g. in the form of distributions as well as the measurement levels of variables. A nonparametric Wilcoxon test was used as the longitudinal research array in reviewing the changes of the pupils' eating habits and nutrition health learning from the seventh to the ninth grade. The Wilcoxon test used for the follow-up of the change is suitable, because it is based on the monitoring of the changes of points that involve every participant in the research, instead of just averages.

In the evaluation of the reliability of the pupils' eating habits and nutrition health learning, along with user experiences of the ICT-based learning environment, the internal and external validity, the reliability of the data and its collection were all reviewed in relation to the validity of the content and structure of the pupils' questionnaire. The research specifically evaluated whether the questionnaire measured the pupils' eating habits and nutrition health learning as well as the user experiences of the ICT-based learning environment and what kind of influence the various parts of the questionnaire had on earlier research information. The research also considered the effect of friends and families on the pupils' nutrition health learning and the use of the ICT-based learning environment.

The questionnaire was pre-tested with 39 seventh grade pupils outside the research area. After the pre-testing, the internal logic of the questionnaire was decided and the questions regarding the use of the ICT-based learning environment were added to it. Questions about the ICT-based learning environment along with pupils' eating habits and nutrition health learning were based on data and experiences from previous research. The external validity was linked to the generalisation of the results. Due to the research material from the experimental schools, as well as the methodological solutions, the interpretation of the results and their generalization included some limitations. Politics may play a part in the selection of experimental schools, increasing the opportunity to collect new data.

A new metric was developed to measure the pupils' eating habits and nutrition health learning and the ICT-based learning environment. This metric is very suitable for this

research because of several features. Regarding its contents, it covers changes in pupils' eating habits and nutrition health learning as well as the user experience of the ICT-based learning environment from the seventh to the ninth grade. The pre-testing of the questionnaire outside the research area increases the reliability of the research results. The validity of the contents of the metric in this research can be considered good. The evaluation of the apparent validity was only carried out by the researcher.

The reliability can be reviewed from three points of view: reliability as the consistency of the measurements, reliability as the internal strength or consistency of the metric components, or reliability measured by the consistency of the results (Burns & Grove, 2010). The internal consistency of the questionnaire, represented by the Cronbach alpha reliability factors, exceed the acceptable value of 0.60, so the questionnaire can be considered reliable when measuring the pupils' eating habits and nutrition health learning and the user experience of the ICT-based learning environment. The validity of the questionnaire was evaluated from the viewpoint of the validity of the structure and contents. When describing the pupils' eating habits and nutrition health learning and the ICT-based learning environment, a factor analysis was used to describe the users' experiences, which is considered the most reliable form of testing of the validity of an abstract concept. If the factors formed with the help of the factor analysis match the earlier theory and research information, the structure validity is considered to be good. The structure validity indicates how well an abstract concept can be changed into a measurable form i.e. operationalized. The evaluation of the validity of the contents was based on the content evaluation of the questionnaire. The Cronbach's alpha reliability test was used in order to evaluate the reliability of the internal consistency of the different parts of the questionnaire.

Reliability and validity of qualitative research

This research evaluated the nutrition health education and the implementation of the ICT-based learning environment using recall interviews of the school staff (teachers, school nurses, school lunch staff). The reliability of this qualitative research part was evaluated by using the following criteria - credibility, transferability, stability, and neutrality (Burns & Grove, 2010). Credibility as an evaluation criterion reflects how close to the original objectives the research has actually come. The evaluation of credibility is strengthened by the fact that the researcher herself knows the research context very well, for example through repeated field contacts and observations (Lindlof & Taylor, 2002). In this research, reaching the reality of the targets of the research required knowing the nutrition health education and the ICT-based learning environment of the school. The credibility of the results is strongly connected to the description of the progress of the research material analysis, as the reader may follow it and draw their own conclusions of the material and the results. The direct quotes and short statements by the school staff were presented in this research as there is only a little information available about the nutrition health education and the use of the ICT-based learning environment in nutrition health education in Finland. Factors that endanger the credibility of the research may be the holistic bias and elitist bias. With holistic bias, individual descriptions of the phenomenon being researched are valued disproportionately and are generalised to describe all the data. An elitist bias may result from treating the information provider as the best and only source of information with the researcher without considering all the data. With material-based analysis of the research material, the researcher concentrates on keeping records of how they use the statements of staff, their direct and abbreviated quotes. The purpose of this recording is to help the researcher to use all the qualitative material in all the reporting phases of the research analysis.

Transferability as a criterion of qualitative research is linked to the applicability of the research and transferability of the research from one context to another. Transferability is

emphasized in qualitative research as the sample methods do not enable a statistical generalization of the baseline dataset or the transferability of the research results as such to a different research project. The strengths of qualitative research are, therefore, the context sensitivity and subjectivity. The transferability can be evaluated in qualitative research by comparing the results with earlier research information. In order to carry out this comparison, the researcher should carefully describe the research participants, the methods used for collecting material and the method of analysis. In this research, the transferability was started to be evaluated from the point of view that all research participants should have similar experiences of nutrition health education and the ICT-based learning environment. A complete overview from the school staff was achieved through this convergent experience of the development operations and their transferability to practical procedures at the school.

The stability of qualitative research is evaluated through the confirmability of results. The confirmability is linked to the presentation of the research results such that the reader may follow the deductive path of the research material to the conclusions. The confirmability also includes the idea that the reader may evaluate the consistency of the research process, the clarity of the research problem and relevance in relation to methodological selections and sampling. Burns and Grove (2010) stated that the requirement for stability is that all the research should follow methodological consistency and accuracy over the whole research process. In this research, the school staff interviews were conducted at their own schools. These staff were willing to recall their experiences of nutrition health education and the implementation of the ICT-based learning environment. The interviews were recorded with the interviewees' consent and they were transcribed verbatim after the interviews. The interview tapes made it possible to return to the original material throughout the whole research process. Also, the notes from the interviews helped when reviewing the original interview. The stability of the content analysis was evaluated by categorizing the research material twice. However, two classifiers were not used in the analysis because in-depth understanding of the material required knowledge of the context i.e. the exact implementation of the nutrition health project.

Neutrality, when confirming the validity of the results, ensures that the research can be repeated with similar outcomes. This confirmation process focuses on the description of the research process, the collection of the data and the analysis as well as whether the conclusions have been drawn from the data collected. The influence of the researcher on the research process, the way they saved the data and the potential for repeating the research were all evaluated. When evaluating how repeatable the research results are, the content analysis is reviewed. The material-based content analysis emphasizes objectivity and consistency. The researcher showed clear deductive reasoning linking the simplified statements to the final results as part of the research process. This was augmented by the fact that the research will ultimately lead to the development of other processes. It is important to evaluate whether the results can be used in the development of the operation and whether they can be used in practice. This research evaluated nutrition health education implemented in an ICT-based learning environment from the point of view of the school staff. These views have been little researched in the field of Finnish pedagogy and health science. The results increased the understanding by the school staff of the potential of using the ICT-based learning environment for nutrition health education. Therefore, the results can be used for the development of nutrition health education and the ICT-based learning environments in secondary schools and when developing co-operation between the school staff.

6.3 CONCLUSIONS, RECOMMENDATIONS AND IMPLICATIONS FOR FURTHER RESEARCH

Based on the results of this study, the following conclusions and recommendations are suggested:

1. Nutrition health education was a multidisciplinary school subject, which demanded co-operation of school staff and commitment of parents.

The practises of nutrition health education and the responsibility need to be clarified. Every member of the school staff has an obligation to intervene when pupils exhibit abnormal behaviour regardless of their job description and title.

Nutrition health education is a comprehensive subject and teaching nutrition health should be integrated into several subjects, such as home economics, health science, biology, computer science, student counselling and chemistry. It can also be taught as a stand-alone topic within the previously mentioned subjects. A good atmosphere at school and a safe learning environment are based on the seamless co-operation of pupils, parents and school staff. Also, the co-operation between the teaching staff, school health care and school lunch staff is key. This co-operation directly influences nutrition health education and the development of the school lunch to become more diverse than before. The school staff of every school should participate in promoting the nutrition health of the pupils, the curriculum work of the school and other development functions of nutrition health education. Common procedures should be drawn up to guide the co-operation between the school and pupils' families. Parent associations play an important role in this. However, development is also needed regarding those homes that do not actively participate in parents' meetings or other events for the whole family. The school should utilise the parents' know-how and knowledge of nutrition health education in a more effective manner and encourage the parents to participate in the curriculum work and nutrition health education.

In the future there should be research into how to broaden parents' nutrition health knowledge and increase their knowledge of factors that promote a child's nutrition health. As nutrition health problems of children and adolescents, such as obesity, increase parents should be encouraged to take responsibility for their children's nutrition health when taking their children to wellbeing clinics or school health care.

2. Intervention school pupils began to have their school lunch more regularly.

School lunch should become a school subject or it should be defined as part of nutrition health education.

School lunch is a happy event. The school lunch is the highlight of the day for many pupils. A beautiful array of delicious meals and a comfortable environment ensure that a pupil will be looking forward to lunch hour before it starts. The school lunch should be a common event for the whole school. The school staff should participate in the school lunch with the pupils and guide them through example. The school lunch should be part of the school curriculum so that every member of the school internalises and understands the objectives as part of their nutrition health education.

Moreover, in further qualitative and quantitative research, it will be important to study the factors that influence children and adolescents to choose healthy or unhealthy food, and to participate in the school lunch.

3. The pupils' views on the ICT-based learning environment in health learning reflected fairly positive and user-friendly experiences.

ICT for pupils' nutrition health education needs to be created to respond to the interest shown by pupils and the challenges of new innovations in health learning.

ICT, at its best, supports communal nutrition health education, broadening existing knowledge and encourages interaction amongst pupils. Pupils should not only be reading text on a computer screen because that does not provide any added value compared to traditional classroom teaching. In addition to text, images, videos and other multimedia, the opportunities for nutrition health education include interactive exercises and games as well as individual and joint tasks. Exercises that guide the pupils accelerate their nutrition health education whilst at the same time reducing the teacher's work. Real-life situations can be used in nutrition health education with the help of ICT, by inviting, for example, an expert in health promotion to talk about specific issues being taught. Pupils can easily access topical sources of data on the internet, although searching for information requires guidance and practise as well as skills in critically appraising the information acquired.

Longer nutrition health interventions are needed in the future, which start in primary school and continue until the end of secondary school. The intervention research should be at a community level with its starting points where the targets of development are: children, adolescents, parents, siblings, the school community, school lunch, school health care and other factors that involve young people, including their friends and hobbies. Long-lasting and comparative intervention surveys could produce information regarding the nutrition health changes of children and adolescents and the factors influencing those changes across different age groups. At the same time, we would obtain more information of how long the nutrition health behaviours models learnt in the childhood and youth persist into adulthood and whether there are also changes when moving on to working life e.g. due to the influence of standard of living and educational background.

4. The use of the ICT-based learning environment in nutrition health education required the school staff to be motivated and committed.

School staffs need to be educated and provided ICT in order to be able to teach nutrition health.

Implementing ICT is challenging and school staffs need to be encouraged and supported to use ICT for nutrition health education. This active implementation should be assisted by the introduction of new courses of actions and their opportunities and through the support offered. It is important to create new pedagogic models and practices to respond to the challenges and opportunities for future nutrition health education. The skills of school staff can be improved with basic and updated training for teachers and other school staff as well as with practical training and development operations. The updated training should broaden the school staff's knowledge of the potential of ICT. ICT can be used to foster co-operation between home and school particularly as a tool for social interaction. Regarding the development of ICT, it is important that the pupils' parents have an equal opportunity

to participate in the development work, so that the desires and needs of different parties can be better represented. Developing the ICT for nutrition health education does not necessarily require development of a new innovation but it does mean a new kind of use of an existing ICT method. ICT can genuinely offer new opportunities for the traditional teaching methods of the school. The needs and ideas of the school staff should be taken into consideration in the development work in addition to previous research information. School staff should take an active role in realising the actual procedures used for nutrition health education. It is essential to regard the school staff as the users and developers of the ICT.

The use of ICT-based learning environments and social media will increase in the future. This requires, in addition to the management of computer equipment, ICT skills of the teaching staff that promote new teaching methods and new forms of interactive, collaborative learning. Therefore, it is important for future research to study the types of ICT skills that school staff will need in order to cope with different ICT-based learning environments and new social media and which factors will influence the development of new ICT-based teacher roles within education.

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Appendices

Questionnaire for adolescents

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BACKGROUND INFORMATION

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The following questions (1 – 26) deal with the background information of adolescents. Circle the opinion that best describes your opinion about each question or write down the answer below. Answer every statement.

1. My gender

1 boy

2 girl

2. Date of birth _____

3. My family has _____ people in it

4. My health

1 very good

2 fairly good

3 moderate

4 fairly poor

5 very poor

5. I follow a special diet

1 yes

2 no

6. I eat healthy food according to the food circle

- 1 daily
- 2 once or twice a week, generally at weekends
- 3 one or twice a month
- 4 more rarely than once a month
- 5 not at all

7. I eat with my family on weekday evening

- 1 by having a joint dinner, when everybody eats at the same time
- 2 by having dinner, but not everybody eat at the same time
- 3 by having dinner, when everybody takes something to eat
- 4 we do not eat dinner at home

8. I eat with my family during weekends

- 1 by having a joint meal, when everybody eats at the same time
- 2 by having a meal when not everybody eats at the same time
- 3 by having a meal when everybody takes something to eat
- 4 we do not have meals during the weekend at my home

9. Which of the following products have you eaten or drunk during the past week (seven days)? Answer by circling the best alternative on each row.

	1 – 2 days	3 – 4 days	5 – 7 days	not at all
Coffee / tea	1	2	3	4
Soft drinks	1	2	3	4
Sweets	1	2	3	4

Chocolate	1	2	3	4
Vegetables	1	2	3	4
Salad	1	2	3	4

Fruits	1	2	3	4
Berries	1	2	3	4
French fries	1	2	3	4

Crisps	1	2	3	4
Hamburgers	1	2	3	4
Meat doughnut	1	2	3	4

Rye bread and crisp bread	1	2	3	4
Pastries	1	2	3	4
Sausages	1	2	3	4

Pizza	1	2	3	4
Meat / meat dishes	1	2	3	4
Chicken	1	2	3	4

Fish / fish dishes	1	2	3	4
Milk / Sour milk	1	2	3	4
Yoghurt / Sour whole milk	1	2	3	4

Cheese	1	2	3	4
Ice cream	1	2	3	4
Something else, what?				

10. Usually I drink ... with food (Circle only one alternative)

- 1 water
- 2 juice
- 3 milk
- 4 sour milk
- 5 something else, what? _____

11. How many glasses of milk do you normally drink per day?

- | | |
|------------------------------|--------------------------------|
| At home | At school |
| 1 milk _____ glasses | 1 milk _____ glasses |
| 2 I don't drink milk at home | 2 I don't drink milk at school |

12. How many glasses of sour milk do you usually drink per day?

- | | |
|-----------------------------------|-------------------------------------|
| At home | At school |
| 1 sour milk _____ glasses | 1 sour milk _____ glasses |
| 2 I don't drink sour milk at home | 2 I don't drink sour milk at school |

13. Which milk do you usually drink? (Circle only one alternative)

- | | |
|----------------------|----------------------|
| At home | At school |
| 1 fat-free milk | 1 fat-free milk |
| 2 light milk | 2 light milk |
| 3 full-cream milk | 3 full-cream milk |
| 4 whole milk | 4 whole milk |
| 5 I don't drink milk | 5 I don't drink milk |

14. What sour milk do you usually drink? (Circle only one alternative)

- | | |
|---------------------------|---------------------------|
| At home | At school |
| 1 fat-free sour milk | 1 fat-free sour milk |
| 2 light sour milk | 2 light sour milk |
| 3 acidophilus sour milk | 3 acidophilus sour milk |
| 4 full-cream sour milk | 4 full-cream sour milk |
| 5 I don't drink sour milk | 5 I don't drink sour milk |

15. I add salt to my food

- 1 hardly ever
- 2 usually when the food is not salty enough
- 3 always before I taste the food

16. When I eat outside my home, the food compared to my home food is

At school	Somewhere else
1 saltier	1 saltier
2 less salty	2 less salty
3 less salty	3 less salty
4 cannot say	4 cannot say

17. I think my school work is

- 1 very good
- 2 quite good
- 3 moderate
- 4 quite bad
- 5 very bad

18. I like school

- 1 very much
- 2 quite a lot
- 3 moderately
- 4 not so much
- 5 not at all

19. I have very good friends

At school	Outside school
1 _____ friends	1 _____ friends
2 none	2 none

20. I have friends with whom I spend my free time

- 1 a lot
- 2 some
- 3 few

21. We have a computer at home

- 1 yes
- 2 no

22. We have a computer with an internet connection at home

- 1 yes
- 2 no

23. I can use the computer

- 1 well
- 2 moderately
- 3 poorly
- 4 I can't use the computer at all

24. I use the computer in my free time

- 1 daily
- 2 once or twice a week
- 3 monthly
- 4 I don't use it at all

25. I can use the internet

- 1 well
- 2 moderately
- 3 poorly
- 4 I can't use the internet at all

26. I use the internet in my free time

1 daily

2 once or more a week

3 monthly

4 I don't use the internet at all

NUTRITION KNOWLEDGE

The following questions (27 – 67) deal with the nutrition knowledge of adolescents. Circle an option on each row that best describes your opinion. Answer every statement.

	Totally agree	Somewhat agree	I don't know	Somewhat disagree	Totally disagree
27. Unhealthy nutrition is hazardous to health even early in life.	1	2	3	4	5
28. Adolescents' unhealthy eating habits become more common in secondary school	1	2	3	4	5
29. Adolescents who eat unhealthy food also use intoxicants.	1	2	3	4	5
30. Adolescents who eat unhealthy food have difficulties to concentrate at school.	1	2	3	4	5

31. The girls at the secondary school follow a healthier diet than the boys of same age.	1	2	3	4	5
32. Following a healthy diet is typical in Finnish culture.	1	2	3	4	5
33. A person who has a healthy diet manages better at school.	1	2	3	4	5
34. Adolescents at secondary school eat fast food meals weekly.	1	2	3	4	5

35. The teeth of adolescents who eat unhealthy food are in a poorer condition than the teeth of those who eat healthy food.	1	2	3	4	5
36. The purpose of the food circle, pyramid and plate models is to guide towards healthy and varied eating.	1	2	3	4	5
37. Organic means organically produced foods.	1	2	3	4	5
38. The purpose of nutrition is to produce energy, regulate vital functionc, prevent infections and deficiencies and build cells.	1	2	3	4	5

Appendix 1 (9/26)

	Totally agree	Somewhat agree	I don't know	Somewhat disagree	Totally disagree
39. Energy-producing nutrients are carbohydrates, fats and proteins.	1	2	3	4	5
40. Protective nutrients are vitamins, minerals and proteins.	1	2	3	4	5
41. Cell-building nutrients are proteins, minerals and water.	1	2	3	4	5
42. Carbohydrates are divided into three main groups: sugars, starches and nutrition fibres.	1	2	3	4	5

43. Starch is found in vegetable products, e.g. corn and potatoes.	1	2	3	4	5
44. Nutrition fibres promote bowel function, prevent constipation and give a feeling of fullness.	1	2	3	4	5
45. Proteins are formed from amino acids.	1	2	3	4	5
46. A lack of protein causes growth problems and slowing of mental growth.	1	2	3	4	5

47. Proteins are cell-building nutrients.	1	2	3	4	5
48. Proteins are necessary for the growth and development of the human system.	1	2	3	4	5
49. Proteins regulate the vital functions of a human.	1	2	3	4	5
50. Milk and milk products are the most important sources of protein.	1	2	3	4	5
51. Fats include fat-dissolvent vitamins A and D.	1	2	3	4	5

52. Fats include vitamin-like vital fatty acids.	1	2	3	4	5
53. Extra fat collects as spare energy, i.e. overweight.	1	2	3	4	5
54. Fat usage should be reduced by choosing low-fat food and cooking methods.	1	2	3	4	5
55. Fats are divided into animal and vegetable fats.		2	3	4	5
56. Fats from animal sources are usually hard fats.	1	2	3	4	5

Appendix 1 (10/26)

	Totally agree	Somewhat agree	I don't know	Somewhat disagree	Totally disagree
57. Vegetable fats are soft fats.	1	2	3	4	5
58. Vitamin A is needed to see in the dark and to form new skin.	1	2	3	4	5
59. A lack of vitamin D causes osteomalacia in children and osteoporosis in adults.	1	2	3	4	5
60. Vitamin C aids in the absorption of iron.	1	2	3	4	5
<hr style="border-top: 1px dashed black;"/>					
61. A lack of vitamin C is seen as general weakening of condition, tissue defects and anaemia.	1	2	3	4	5
62. Group B vitamins are needed for the brain, nervous system, food digestion functions and building of red blood cells.	1	2	3	4	5
63. Mineral nutrients are needed to form tissue in the human system and to regulate vital functions.	1	2	3	4	5
<hr style="border-top: 1px dashed black;"/>					
64. Excessive use of salt raises blood pressure and increases the risk of cardiovascular diseases.	1	2	3	4	5
65. A person needs 2–3 litres of water a day.	1	2	3	4	5
66. Water is needed for transportation of nutrients, temperature regulation and food digestion.	1	2	3	4	5
67. A lack of water results in drying or swelling.	1	2	3	4	5

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NUTRITION SKILLS
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The following statements (68 – 77) deal with the nutrition skills of adolescents. Circle an option on each row that best describes your opinion. Answer every statement.

	Totally agree	Somewhat agree	I don't know	Somewhat disagree	Totally disagree
68. It is easy for me to refuse unhealthy food offered by friends.	1	2	3	4	5
69. It is easy for me to eat healthy food, although my friends eat unhealthy food.	1	2	3	4	5
70. I can make food-related healthy choices independently, even when there is unhealthy food available.	1	2	3	4	5
<hr/>					
71. It is easy for me to discuss the health hazards of an unhealthy diet with my mother.	1	2	3	4	5
72. It is easy for me to discuss the health hazards of an unhealthy diet with my father.	1	2	3	4	5
73. I have discussed the benefits of a healthy diet with my mother.	1	2	3	4	5
74. I have discussed the benefits of a healthy diet with my father.	1	2	3	4	5
<hr/>					
75. I am open-minded towards new types of food and I will at least taste them.	1	2	3	4	5
76. While shopping for groceries, I pay attention to the low fat content of foods and choose the products with the lowest fat content.	1	2	3	4	5
77. While shopping for groceries, I pay attention to the low salt content of foods and choose the products with the lowest salt content.	1	2	3	4	5

Appendix 1 (12/26)

NUTRITION ATTITUDES

The following statements (78 – 87) deal with the nutrition attitudes of adolescents. Circle an option on each row that best describes your opinion. Answer every statement.

	Totally agree	Somewhat agree	I don't know	Somewhat disagree	Totally disagree
78. I am interested in a healthy diet.	1	2	3	4	5
79. Many of the adolescents in secondary school think that an unhealthy diet eases stress and distress but in reality it does not remove any problems.	1	2	3	4	5
80. I think it is good that there is a school lunch at school.	1	2	3	4	5
81. I have a bad conscience if I eat unhealthy food.	1	2	3	4	5
82. Unhealthy eating is connected to the free-time of secondary school pupils.	1	2	3	4	5
83. A healthy diet has a big impact on my health and wellbeing.	1	2	3	4	5
84. I want to influence my health by eating healthy and versatile food.	1	2	3	4	5
85. I always choose milk or sour milk with a meal.	1	2	3	4	5
86. I always choose the lighter alternative instead of a fattier milk or sour milk.	1	2	3	4	5
87. I am happy with my diet.	1	2	3	4	5

Appendix 1 (13/26)

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NUTRITION BEHAVIOUR
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The following statements (88 – 97) deal with the nutrition behaviour of adolescents. Circle an option on each row that best describes your opinion. Answer every statement.

	Totally agree	Somewhat agree	I don't know	Somewhat disagree	Totally disagree
88. I prepare food independently according to the food circle at home at least once a week.	1	2	3	4	5
89. I want to learn more about the preparation of healthy food.	1	2	3	4	5
90. I eat breakfast every day.	1	2	3	4	5
91. I eat school lunch every day.	1	2	3	4	5
92. I eat dinner every day.	1	2	3	4	5
93. I eat an evening snack very day.	1	2	3	4	5
94. I eat vegetables, fruits and berries every day.	1	2	3	4	5
95. I eat sweets when I'm hungry.	1	2	3	4	5
96. I go grocery shopping for my family on my own.	1	2	3	4	5
97. I go grocery shopping with my parents.	1	2	3	4	5

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THE NUTRITION BEHAVIOUR OF FRIENDS

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The following statements (98 – 104) deal with the nutrition behaviour of the adolescents’ friends. Circle an option on each row that best describes your opinion. Answer every statement.

	Totally agree	Somewhat agree	I don't know	Somewhat disagree	Totally disagree
98. My best friends follow a healthy diet.	1	2	3	4	5
99. My friends have a negative attitude towards "fast food".	1	2	3	4	5
100. My friends' unhealthy nutrition habits affect my nutrition health behaviour in such a way that I also eat unhealthy food.	1	2	3	4	5

101. For me, it is important to belong to a group of friends who avoid eating animal products.	1	2	3	4	5
102. My friends encourage me to have a diet by following a healthy diet.	1	2	3	4	5
103. I am willing to be without "fast food" if my best friends also are.	1	2	3	4	5
104. My friends use to eat in a unhealthy manner during their free time.	1	2	3	4	5

THE NUTRITION BEHAVIOUR OF FAMILY

The following statements (105 – 117) deal with the nutrition behaviour of the adolescents' families.
Circle an option on each row that best describes your opinion. Answer every statement.

	Totally agree	Somewhat agree	I don't know	Somewhat disagree	Totally disagree
105. My mother does not like me to eat unhealthy food.	1	2	3	4	5
106. My father does not like me to eat unhealthy food.	1	2	3	4	5
107. My parents support my healthy meals by telling about the health benefits of a healthy diet.	1	2	3	4	5
<hr/>					
108. My parents support my healthy meals by selecting and preparing healthy and versatile home-made food.	1	2	3	4	5
109. We have agreed about meal times with my parents.	1	2	3	4	5
110. We stick to the meal times agreed with my parents.	1	2	3	4	5
111. My parents prepare a warm meal at home.	1	2	3	4	5
<hr/>					
112. I make food with my parents at home.	1	2	3	4	5
113. My parents pay attention to the low fat content of food and choose the products with the lowest salt content.	1	2	3	4	5
114. My parents pay attention to the low salt content of food and choose the products with the lowest salt content.	1	2	3	4	5
115. I have a warm meal waiting for me when I go home from school.	1	2	3	4	5

Appendix 1 (16/26)

	Totally agree	Somewhat agree	I don't know	Somewhat disagree	Totally disagree
116. At home we use organically produced raw materials.	1	2	3	4	5
117. At home we usually use semi-finished foods (soups, casseroles), so that preparing food is quick and easy.	1	2	3	4	5

TEACHING AND LEARNING METHODS IN HOME ECONOMICS AND HEALTH EDUCATION

The following statements (118 – 152) deal with the teaching and learning methods used in home economics and health education. Circle an option on each row that best describes your opinion. Answer every statement.

	Totally agree	Somewhat agree	I don't know	Somewhat disagree	Totally disagree
118. In home economics and health education classes we have team work where I have learned that an unhealthy diet is not a part of someone's life at my age.	1	2	3	4	5
119. In home economics and health education classes I have given presentations with friends about healthy diet.	1	2	3	4	5
120. In home economics and health education classes we have watched educational videos that have helped me to follow a healthy diet.	1	2	3	4	5

121. In home economics and health education classes we have practiced preparing healthy food.	1	2	3	4	5
122. The teachers of home economics and health education have talked about a healthy diet.	1	2	3	4	5
123. There have been guests and visitors talking about a healthy diet in the home economics and health education classes.	1	2	3	4	5
124. At school we have had theme days connected to healthy nutrition and eating.	1	2	3	4	5

125. I have got to influence the teaching and learning methods used in the home economics and health education classes.	1	2	3	4	5
126. My opinion has been asked on the contents of the home economics and health education classes.	1	2	3	4	5

Appendix 1 (18/26)

	Totally agree	Somewhat agree	I don't know	Somewhat disagree	Totally disagree
127. I have received sufficient information about the benefits of a healthy diet in home economics and health education classes.	1	2	3	4	5
128. I have been made more confident to prepare healthy food in the home economics and health education classes.	1	2	3	4	5
129. I have been made more confident for eating healthily in home economics and health education classes.	1	2	3	4	5
130. I have searched for information related to healthy nutrition on the internet.	1	2	3	4	5
<hr style="border-top: 1px dashed black;"/>					
131. It is easy to find information about healthy nutrition on the internet.	1	2	3	4	5
132. Nutrition information on the internet must be considered with certain reservations.	1	2	3	4	5
133. Nutrition information obtained through the internet is not always reliable.	1	2	3	4	5
134. I have sufficient skills to evaluate the reliability of the health-related information found on the internet.	1	2	3	4	5
<hr style="border-top: 1px dashed black;"/>					
135. We have used the computer in home economics and health education lessons.	1	2	3	4	5
136. We have used the internet in home economics and health education lessons.	1	2	3	4	5
137. We have used the ICT-based learning environment in home economics and health education lessons.	1	2	3	4	5
138. I have used the computer in learning health-related facts together with my parents.	1	2	3	4	5
139. I have used the computer in learning health-related facts together with my siblings.	1	2	3	4	5

Appendix 1 (19/26)

	Totally agree	Somewhat agree	I don't know	Somewhat disagree	Totally disagree
140. I have searched for health-related information on the internet together with my parents.	1	2	3	4	5
141. I have searched for health-related information on the internet together with my siblings.	1	2	3	4	5
142. I have searched for health-related information on the internet together with my friends.	1	2	3	4	5
143. I have done health-related assignments using the computer at school.	1	2	3	4	5

144. I have done health-related assignments using the computer together with my parents.	1	2	3	4	5
145. I have done health-related assignments using the computer together with my siblings.	1	2	3	4	5
146. We have done health-related assignments in groups using the computer at school.	1	2	3	4	5
147. I have discussed health-related issues with youth of my own age on the internet.	1	2	3	4	5
148. I have discussed health-related issues with experts on the internet.	1	2	3	4	5

149. The computer is a suitable tool for young people of my age to support their health education.	1	2	3	4	5
150. The internet is a suitable tool to support the education of young people of my own age.	1	2	3	4	5
151. I recommend the use of computer as a part of health education.	1	2	3	4	5
152. I recommend the use of the internet as a part of health education.	1	2	3	4	5

ICT-BASED LEARNING ENVIRONMENT (only for experimental schools)

The following statements (153 – 225) deal with the ICT-based learning environment, which is used in lessons (From Puijo to the World with Health Lunch project and Feeling Fresh – Feeling Good). Circle an option on each row that best describes your opinion. Answer every statement.

	Totally agree	Somewhat agree	I don't know	Somewhat disagree	Totally disagree
153. In my opinion, studying in the ICT-based learning environment has been pleasant.	1	2	3	4	5
154. I think studying in the ICT-based learning environment has been more interesting than traditional studying.	1	2	3	4	5
155. I think ICT-based studying is stimulating.	1	2	3	4	5

156. I think that ICT-based studying is motivating.	1	2	3	4	5
157. The ICT-based learning environment facilitates understanding.	1	2	3	4	5
158. In the ICT-based learning environment I can progress at my own pace.	1	2	3	4	5

159. Learning in the ICT-based learning environment has been easier than traditional learning.	1	2	3	4	5
160. I was able to search for health information independently in the ICT-based learning environment.	1	2	3	4	5
161. The health issues introduced in the ICT-based learning environment were connected to health information that I had studied before.	1	2	3	4	5

Appendix 1 (21/26)

	Totally agree	Somewhat agree	I don't know	Somewhat disagree	Totally disagree
162. I was able to exploit my earlier health knowledge in the ICT-based learning environment while I studied in the ICT-based learning environment.	1	2	3	4	5
163. The links in the ICT-based learning environment promoted my health learning.	1	2	3	4	5
164. Small group discussions in the ICT-based learning environment helped me with health learning.	1	2	3	4	5
165. Learning assignments done in small groups in the ICT-based learning environment promoted health learning.	1	2	3	4	5
166. I could study health-related issues in the ICT-based learning environment freely at home.	1	2	3	4	5
167. I could health-related issues in the ICT-based learning environment freely outside of school and home.	1	2	3	4	5
168. Studying in the ICT-based learning environment activated me to independently seek health information.	1	2	3	4	5
169. I participated actively in the discussion in the ICT-based learning environment.	1	2	3	4	5
170. We did learning assignments in groups in the ICT-based learning environment.	1	2	3	4	5
171. The teacher supported and activated my studies in the ICT-based learning environment.	1	2	3	4	5
172. The health-related issues that I have learnt in the ICT-based learning environment have been useful.	1	2	3	4	5
173. I got to solve real-life health problem situations in the ICT-based learning environment.	1	2	3	4	5
174. Real-life health education situations introduced in the ICT-based learning environment promoted health learning.	1	2	3	4	5

Appendix 1 (22/26)

	Totally agree	Somewhat agree	I don't know	Somewhat disagree	Totally disagree
175. The ICT-based learning environment introduced several different opinions about the health issues covered.	1	2	3	4	5
176. Learning health-related issues in the ICT-based learning environment has helped me in real life.	1	2	3	4	5
177. Learning in the ICT-based learning environment has helped me solve health-related situations better than before in my everyday life.	1	2	3	4	5
178. Studying in the ICT-based learning environment improved my understanding of health-related issues.	1	2	3	4	5
<hr style="border-top: 1px dashed black;"/>					
179. The ICT-based learning environment had tangible examples of health-related every-day situations	1	2	3	4	5
180. Studying in the ICT-based learning environment helped me evaluate my earlier views on health-related issues.	1	2	3	4	5
181. Health-related issues that I learnt in the ICT-based learning environment have helped me when studying new things.	1	2	3	4	5
182. Studying in the ICT-based learning environment developed my health-related problem-solving skills.	1	2	3	4	5
183. The ICT-based learning environment has been easy to perceive as an entity.	1	2	3	4	5
<hr style="border-top: 1px dashed black;"/>					
184. The ICT-based learning environment has been clear.	1	2	3	4	5
185. The ICT-based learning environment has been easy to use.	1	2	3	4	5
186. Navigation in the ICT-based learning environment has been smooth.	1	2	3	4	5
187. The ICT-based learning environment has functioned without technical problems during lessons.	1	2	3	4	5
188. The ICT-based learning environment has functioned without technical problems at home.	1	2	3	4	5

Appendix 1 (23/26)

	Totally agree	Somewhat agree	I don't know	Somewhat disagree	Totally disagree
189. The ICT-based learning environment has functioned without technical problems elsewhere outside of school and home.	1	2	3	4	5
190. I think the contents of the ICT-based learning environment have been important in health learning.	1	2	3	4	5
191. The contents of the ICT-based learning environment have been topical to me in health learning.	1	2	3	4	5
192. I think the health-related issues in the ICT-based learning environment have been interesting.	1	2	3	4	5
193. The references of the ICT-based learning environment have been useful, so that I can use them to explore health-related issues when needed.	1	2	3	4	5
194. I think the links in the ICT-based learning environment have been useful in health learning, so that I can use them to search for more health-related information when needed.	1	2	3	4	5
195. Studying in the ICT-based learning environment has been easy.	1	2	3	4	5
196. I think studying in the ICT-based learning environment has been flexible.	1	2	3	4	5
197. I browsed the links while I studied in the ICT-based learning environment.	1	2	3	4	5
198. The ICT-based learning environment motivated me to discuss with others in the discussion area.	1	2	3	4	5
199. I communicated with others in the discussion area of the ICT-based learning environment.	1	2	3	4	5
200. I got some new ideas from the texts which were written by others in the discussion area of the ICT-based learning environment.	1	2	3	4	5
201. Studying in the ICT-based learning environment has been cooperative and not lonely work.	1	2	3	4	5

Appendix 1 (24/26)

	Totally agree	Somewhat agree	I don't know	Somewhat disagree	Totally disagree
202. My computing skills developed while I studied in the ICT-based learning environment.	1	2	3	4	5
203. My information-seeking skills developed while I studied in the ICT-based learning environment.	1	2	3	4	5
204. I have needed assistance from fellow pupils while I was studying in the ICT-based learning environment.	1	2	3	4	5
205. I have needed the teacher's assistance while I was studying in the ICT-based learning environment.	1	2	3	4	5
206. I got interested in health-related issues while I studied in the ICT-based learning environment.	1	2	3	4	5
207. The ICT-based learning environment has encouraged me in my health learning.	1	2	3	4	5
208. The ICT-based learning environment got me thinking about questions connected to my health.	1	2	3	4	5
209. It has been easy to find health-related information in the ICT-based learning environment.	1	2	3	4	5
210. Searching for health information from the ICT-based learning environment has been more fun than reading it in books.	1	2	3	4	5
211. The ICT-based learning environment has diversified my health learning.	1	2	3	4	5
212. The introduced research information of the ICT-based learning environment concerning pupils my own age has been useful in health learning.	1	2	3	4	5
213. The ICT-based learning environment has promoted my health learning.	1	2	3	4	5
214. I have studied health-related issues in the ICT-based learning environment at home.	1	2	3	4	5

Appendix 1 (25/26)

	Totally agree	Somewhat agree	I don't know	Somewhat disagree	Totally disagree
215. I have studied health-related issues in the ICT-based learning environment outside of school and home.	1	2	3	4	5
216. My parents have explored the ICT-based learning environment and the introduced health-related issues.	1	2	3	4	5
217. My siblings have explored the ICT-based learning environment and the introduced health-related issues.	1	2	3	4	5
218. I have used the ICT-based learning environment together with my parents.	1	2	3	4	5
219. I have used the ICT-based learning environment together with my siblings.	1	2	3	4	5
220. I have searched for health information from the ICT-based learning environment together with my parents.	1	2	3	4	5
221. I have searched for health information from the ICT-based learning environment together with my siblings.	1	2	3	4	5

222. I have done health-related assignments in the ICT-based learning environment together with my parents.	1	2	3	4	5
223. I have done health-related assignments in together with my siblings in the ICT-based learning environment.	1	2	3	4	5
224. The ICT-based learning environment is a suitable tool for supporting health learning in my age group.	1	2	3	4	5
225. I recommend the use of the ICT-based learning environment as a part of health education.	1	2	3	4	5

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OPTIONAL SUBJECT CHOICES

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The following questions are connected to the optional subject choices of adolescents. Circle the answer that best describes your opinion and write the reasons for your choice below.

226. I chose home economics as an optional subject for the 8th grade

1 yes

2 no

Reason for your choice:

227. I chose home economics as an optional subject for the 9th grade

1 yes

2 no

Reason for your choice:

THANK YOU FOR YOUR ANSWERS!

Appendix 2

Interview themes (for teachers, school health nurses and school catering managers in recall interviews)

1. How have the nutrition health education/nutrition health guidance/school meal been included in the school curriculum and operations?
2. How have teachers/school health nurses/school catering managers supported adolescents' and their families' nutrition health learning?
3. How has the school meal supported adolescents' and their families' nutrition health learning?
4. How have teachers/school health nurses/school catering managers experienced nutrition health guidance and education using the ICT-based learning environment?
5. What is the impact that the ICT-based learning environment has had on the nutrition health education of the adolescents and their families?
6. How would teachers/school health nurses/school catering managers develop nutrition health education and the school meal at school, based on this experience?
7. What is teachers'/school health nurses'/school catering managers' expertise regarding nutrition health education and guidance?
8. How has the *From Puijo to the World with Health Lunch* project affected development of the school meal, nutrition health education and guidance?

Examples of forming the categories using content analysis of the recall interviews

Example theme 1: Nutrition health education/nutrition health guidance/school meal in the school curriculum and operations (Article IV; Figure 1)

Examples	Classes	Sub-categories	Main categories
Nutrition health education is naturally included in the curriculum...	School-specific curricula National basic education curriculum	Curriculum in basic education – towards the goals of teaching and acting	The basis of multidisciplinary education in nutrition health
Naturally, home economics, biology, chemistry...	Home economics Biology Chemistry		
Usually in practice it is the responsibility of one or two persons...	Teacher-centred instruction	Co-operation as a pedagogical activity	
I believe our co-operation with each other has been quite scarce, actually.	Inadequate co-operation		
As a class supervisor sometimes there are situations where I have to contact the pupils' home...	Class supervisor		
...if the pupil is too tired to do something, the pupil is continuously tired or there is something else where you have to think about nutrition.	Pupils' meals and state of health	Parents' involvement in the project	
This co-operation is at pretty good level through the parents' association, in that the parents' associations arranges...	Parents' meetings Parents associations		

TEIJA RÄIHÄ
*Nutrition Health Project
Using an ICT-based
Learning Environment
– Participatory Action
Research in Eastern Finland*



This dissertation investigated the opportunities offered by an ICT-based learning environment for providing nutrition health education in two Finnish secondary schools. The results of the three-year nutrition health education intervention indicated a marked increase in the nutrition knowledge and healthier eating habits of pupils. Furthermore, the intervention had positive effects on pupils' opinions about their critical reading skills relating to nutrition health information. In nutrition health education, the utilisation of an ICT-based learning environment required the participation of all school staff.



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