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Finnish Kindergarten Student Teachers' Attitudes Towards Modern Information and Communication Technologies

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Abstract

The paper discusses the relation of the Finnish kindergarten student teachers to modern information and communication technologies, MICT. This relation is considered from three points of view: personal innovativeness, the emotional attitudes on technologies and the philosophical view of them. The students are classified according to Individual Innovativeness theory in adopter categories: the Innovators, the Early Majority, the Late Majority and the Laggards. The students' emotional attitudes on information technologies are considered: whether they love, like, dislike or even hate MICT, or if they are worried or scared of them. The paper also describes two opposing philosophical views of information and communication technologies: determinism and instrumentalism. Determinism sees the technologies as autonomous forces and instrumentalism as tools. The students are classified as utopian determinists, who trust positive evolution, or dystopian determinists, who believe in negative development or, further, as instrumentalists, who wait for a positive or negative development in information and communication technologies. It was discovered that the proportion of early categories of innovation adoption was considerably higher than could be assumed according to the theory. The difference was statistically significant. The students mostly had a positive attitude towards information and communication technologies. They became fond of it after having the possibility to try its applications. Many of them were also afraid of not having enough opportunity to learn and use it. The philosophical view of instrumentalism was common among students, only a minority were determinists. Many of the students believed in positive development in information and communication technologies, but not all had a clear opinion about it.

Keywords: attitude; determinism; innovation; instrumentalism; kindergarten teacher education, modern information and communication technologies.

1 GLOBAL, NETWORKING INFORMATION AND COMMUNICATION SOCIETY VS. KINDERGARTEN TEACHER EDUCATION

In the 1990s there was strong evolution in modern information and communication technologies (MICT) (Tella 1997). The development had three cores in the world: Europe, the United States of America and Japan. Very effective hardware and software

applications were developed, the most common of them being microcomputers with their programs and the Internet. These are now widely used especially in business but also in everyday life. With these applications we can interact with other people in different countries, without the limitations of place and time. We used to speak of the information society, whereas we nowadays speak of the global networking information and communication society. From 1995 Finland has had a well-developed national project entitled "Finland towards a first-class information society" (Developing a Finnish Information Society 1995).¹ It emphasised the importance of mastering MICT in all professions and at all ages.

The project had a good basis in Finland because we already use a wide range of MICT in everyday life. In 1998 half of our population, all age groups, had the possibility to use a microcomputer either at home, at work or at school (*Sähköisten palvelujen käyttö kotoa ja työ- tai opiskelupaikalta* 1999). In 1999 the Finns had 111 Internet hosts per 1,000 people, which is a world record (Network Wizards, s.a.). The situation is, of course, changing, but the trend has been the same for years. Another example of Finnish MICT innovativeness is the high number of mobile phones. In 1998, the number of mobile phones was higher than that of fixed lines, and the number of mobile phones per households was higher than in other countries (*Tiedolla tietoyhteiskuntaan* 1999). This idea of striving for a first-class information society had an impact on education at all levels, kindergarten teacher education included. This education has belonged to the university since 1995 and the students take a Bachelor of Education examination. It consists of 120 credits (one credit is 40 hours of work), and can be taken in three years. The education programme includes a course in MICT (one study credit).

Kindergarten teachers need MICT for several purposes (cf. Kankaanrinta 1999). First, they need good competence in its various applications for successful studies in education, e.g. word processing, spreadsheets and applications for music and the visual arts. Human communication and interaction are an ever-expanding field of MICT. Second, student teachers need to network with each other and with their teachers, in their work with parents, children and administrators. The levels range from local to global. Third, MICT is

¹ This study was conducted during the period of first national information strategy 1995–1999. After that, a second national strategy has been developed (Education, Training and Research in the Information Society: A National Strategy for 2000–2004, 1999). It emphasises the development towards a strong, high quality society where every citizen has information society skills, networks are used in versatile ways in studying and teaching, information capital is accumulated and information society structures are strengthened in education, training and research.

needed in the education of children. Educational CD-ROMs are already common in various subjects but the global trend is towards network-based learning (e.g. Tella 1997). In future, the earlier CD-ROMs will be delivered on the World Wide Web. That will enable flexible updating of material and interaction between the users, authors and possible outside commentators. Electronic entertainment games are everyday life for many children. The games are often underestimated: they are regarded as worthless or even harmful. The fact is, however, that they are in common use in cultures of high technology, children love to play them, and they can create very effective interactive worlds for children. Kindergarten teachers need competence in understanding how they function, they must be capable of analysing, evaluating and using them safely. They must know the world the children live in and the language they speak.

Kindergarten teachers have an important position in the global, networking information and communication society. Besides parents, they are the first educators of children. That is why their attitudes towards modern information and communication technologies can also be a model for the child. In kindergarten teacher education it is important to know about these attitudes in order to organise the courses and to develop the curriculum in an optimal way. The aim should be the education of skilful professionals for the global networking information and communication society.

2 THEORETICAL FRAMEWORK

In this study we consider the attitudes of Finnish kindergarten student teachers to modern information and communication technologies. Three points of view are taken into account: personal innovativeness, emotional attitudes towards technologies and philosophical views about them.

2.1 Individual Innovativeness Theory

The adoption of modern information and communication technologies in personal use and in education is an innovation. The innovations are widely investigated in business (e.g. Moore 1998) but also in education (e.g. Rogers 1983; Holloway 1996). Tella & Tirri (1999) summarise educational innovations documented in 13 European Union countries. They state that the concept of educational innovation is different in various countries. There are at least six different types of educational innovations: innovation as a novelty, as a product, as a change, as an action, as a process and as an intention. In this study

innovation is understood to mean that the student adopts new hardware and software and ways to use them for different purposes in education and in personal life. The theoretical background of studying the innovativeness of students lies in the general theory of Innovation Diffusion (Rogers 1983). It consists of various subtheories, one of which is the Individual Innovativeness theory (Rogers 1983), namely that people can be divided into categories according to their innovativeness. The proportions of different categories in a population are supposed to be stable. The categories differ from each other concerning the rate of adoption, personal characteristics and the place of the social system (Table 1). The small group of innovators are pioneers in the adoption of new ideas. After them come the early adopters or the visionaries. The big group of the early majority or the deliberates (also called the pragmatists) begin to use the innovation at a rather early stage of its diffusion. The late majority or the conservatives (the scepticals) wait longer before they use innovations. The laggards want to become fully convinced of the benefits of the innovation before adopting it. What Rogers (1983) suggested were some very general innovation adopter categories. We would like to add some specifications to them when the innovation is an application of MICT. Some of these features are mentioned by Moore (1998), others are based on logical reasoning in the context of teacher education, but all of them need sufficient testing and verification.

Table 1. Adopter categories in innovation diffusion and their typical characteristics. Based on Rogers (1983) and further developed with MICT-related characteristics, some of the mentioned by Moore (1998).

The adopter category, proportion in the population	Central personal characteristics	Place in the social system	MICT-related characteristics
Innovators Enthusiasts about new ideas, 3%	The very first to adopt innovations. Hazardous, rash, daring, risky. High ability to withstand uncertainty.	Cosmopolitans. Act beyond the local circle. Effective in net-working. Gatekeepers in the flow of new ideas into a social system.	Skilful with hardware and software. Effective networking locally and globally via the Internet. Unrestricted by place and time. Homo ludens electronicus.

Early adopters The visionaries, 13%	Follow the innovators. Respected by peers.	Local missionaries, opinion leaders, role models for others.	Networking with innovators e.g. via the Internet. Networking nationally with MICTrelated centres or sources.
A chasm in the adoption (Moore 1998)			
Early majority The pragmatists, 34%	Deliberate. Evolution, not revolution. Improvements for existing operations.	Frequent interaction with local peers, no leadership.	Hard to understand and accept new hardware or software that enables operations that have not existed before.
Late majority The conservatives, 34%	Sceptical. Want to be quite sure of the advantages of an innovation.	Sensitive to the norms of the social system. Adoption after increasing network pressure.	Dependent on technical and mental support. Frustrated by the lack of standards.
Laggards , 16%	Traditional. Cannot tolerate the uncertainty of the innovation.	Localities, sometimes isolates.	Frustrated by the rapid and endless evolution of MICT. No concepts to speak of MICT.

The innovators can effectively be networked locally and globally via the Internet. In this way they become independent of time and place, at least to some extent. The ability to take risks is generally typical of an innovator. This is possible in many ways with the MICT: playing electronic games or communicating with people from other countries on the Net. The gameplayer can take different roles or even create a new personality for the communications on the Net. So among innovators *Homo ludens* (Huizinga 1984) evolves into a new variety or subspecies: *Homo ludens electronicus*.

The early adopters are also networked, but more locally than globally. Here the locality could mean national connections, in the native language. The early majority in general wants gradual evolution among existing operations or habits. That is why they may have difficulties in understanding new hardware or software with new operations: e.g. mobile phones that are connected to a video camera and can send movies to other mobile phones. The late majority waits for standards and support in the use of the new equipment. When this is lacking they can become frustrated and it is easy to postpone the adoption. The isolated laggards hardly know anything about MICT. At least they can

become quite depressed when facing the quick development of MICT, without having even concepts to speak of it. Some of them never adopt the innovation.

Recently it has been noticed (Moore 1998) that there is a chasm in adoption between the early adopters and the early majority. It is sometimes hard for an innovation to spread from a minor group of innovators and early adopters to mainstream customers. One reason could be in the locality of the early majority and the few contacts with opinion leaders who have a strong impact on the behaviour of consumers.

The diffusion of an innovation proceeds in the population over a period of time (Figure 1). The number of adopting persons is low in the beginning. Then there is a “take off” and the number of adopters increases rapidly. When the majority of potential adopters are using the innovation the rate of diffusion slows down. Some people in the population never adopt certain innovations.

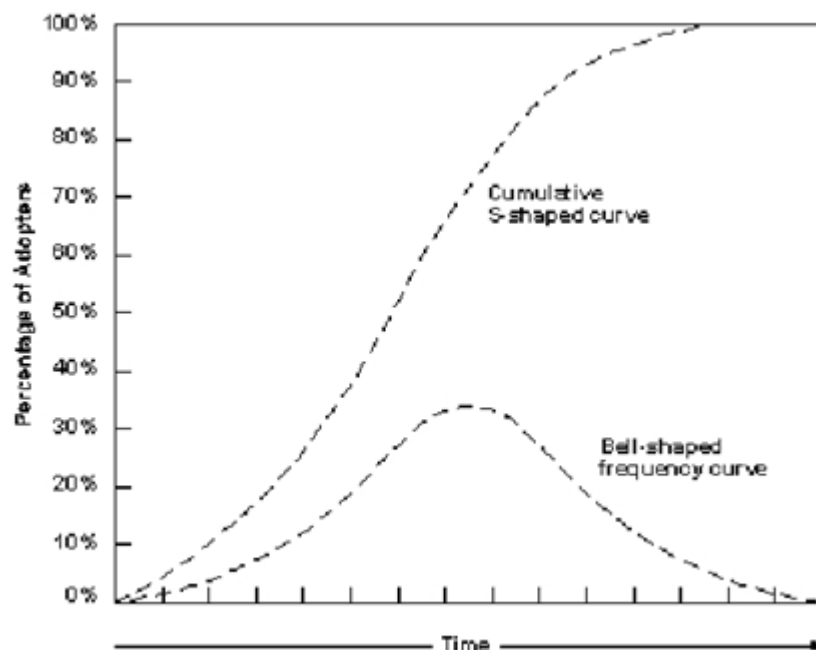


Figure 1. Diffusion of an innovation in time (Rogers 1983, 243). The bellshaped frequency curve is for individuals, the s-shaped curve is built on cumulative data.

2.2 Emotional Attitudes to MICT

In Finland, Tella (1995) categorised the end users' relation to MICT in general. This classification takes into account some emotional aspects of attitudes. The categories include the pioneers in the use of information technologies; those who hate it, or love it, at first sight; those who are skillful enough to be adept with MICT (hackers, or crackers); those who slowly become fond of the new technologies; those who imitate the others;

those with a superficial attitude towards technologies; those who are worried about or scared of it; those who dislike even the thought of using information technologies, and finally, those who are pushed outside: the dropouts.

These categories can be identified in the basic education of MICT. As Tella (1995) pointed out, the classification is introductory and needs testing in different groups. It has interesting parallels with innovation adoption categories, e.g. the similarities of Tella's category "pioneering, being enthusiastic about educational applications of MICT" and the innovator category are obvious (Table 2). Thus, attitudes to MICT can also be placed in the possible scale of time in the adoption of MICT.

Attitudes	Innovation adopter categories				
	Innovators	Early adopters, visionaries	Early majority, pragmatists	Late majority, conservatists	Leggards
Pioneers	Pioneers				
Hackers	Hackers	Hackers			
Loves at once	Loves at ones	Loves at one			
Slowly becomes fond of			Slowly becomes fond of	(Slowly becomes fond of)	
Worried about			Worried about	Worried about	
Imitators				Imitators	
Superficials				Superficials	
Hates at once				Hates at once	Hates at once
Drop-outs					Drop-outs

Table 2. Attitudes towards MICT (Tella 1995) and innovation adopter categories (Rogers 1983), possible correlations.

In Tella's (1995) attitudes towards MICT, both the positive and the negative dimension can be seen. If this dimension is added to the timeline of the adoption process, which is indicated here by different adopter categories, we can view people in two dimensions (Figure 2).

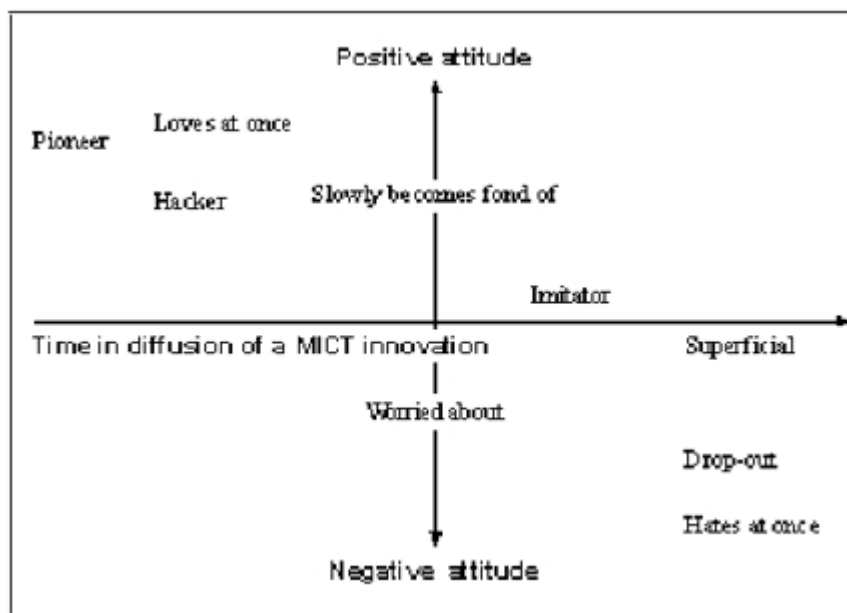


Figure 2. Attitudes to MICT (Tella 1995) and the adoption time.

2.3 Philosophical Views of MICT

Modern information and communication technologies may also be considered from a philosophical point of view. One of the classifications comes from Surry & Farquhar (1997). As this classification has existed for a long time in the field of technology, the authors originally refer to technology alone (Table 3). Theoretical viewpoints on MICT can be divided into technological determinism and technological instrumentalism. In fact, they form a continuum with many nuances. The determinists see technologies as autonomous forces which cannot be controlled by human beings. They are also the main reason for social changes. Determinists acknowledge that technological evolution has periods of marked changes instead of a smooth, continuous development. There are two varieties of technological determinism. One is for utopian (positive), the other for dystopian (negative) development.

Utopian determinists believe in the constant positive impact of MICT; it will lead mankind automatically to prosperity and will eliminate all ills from our world. Dystopian determinists can behave as destructive neo-Luddites, constantly fearing MICT. They think it will replace teachers, and they consequently behave as laggards in the adoption of MICT.

Instrumentalists believe that people can control MICT. They see technologies as tools, like an axe or a knife. Their role is optional, the user has the power to decide if they are used for good or bad purposes. Technological instrumentalists see human beings as agents for

change. Social conditions produce pressure which results in evolution towards good. This process is, from the instrumentalist point of view, gradual and peaceful. Natural evolution has sometimes been compared to evolution from the instrumentalist perspective. The correspondence is not identical, however.

Evolution in nature also has leaps: e.g. natural catastrophes can destroy whole phyla as with the extinction of dinosaurs

Table 3. Philosophical perspectives on MICT. Based on Surry and Farquhar (1997).

Philosophy of technology	Philosophical premises			Notable advocates	Examples from MICT
	Role of technology	Role of man	Characteristics of technical evolution		
Utopian determinism	Technology is an inevitable force that will lead mankind to prosperity and be the salvation of humanity.	Passive: technology is beyond direct human control.	Technical evolution is a series of revolutionary leaps forward.	Karl Marx, Marshall McLuhan, Alvin Toffler	
Dystopian determinism	Technology is an inevitable force that is morally corrupt and will lead to the destruction of humanity.			George Orwell, Aldous Huxley, Unabomber	Educational neo-Luddites, laggards
Instrumentalism	Technology is under human control and its use can lead either to beneficial or disastrous consequences.	Active: human aspirations and social changes are primary causes of improvement and development.		Technical evolution is a slow, gradual process.	Yoneji Masuda, Nicholas Negroponte, Jacques Attali, Bill Clinton, Al Gore, Bill Gates

When these philosophical views are applied to MICT, instrumentalism in particular needs some specifying. The main idea of instrumentalism is using MICT as tools. Tools are often seen as very concrete things like scissors or a pen. Tella (e.g. Tella 1997; Tella & Mononen-Aaltonen 1998) has discussed the problems of different kinds of tools. Basing his views on the literature, he takes the concept of “artefact” as a higher hierarchical concept. Everydaylife tools are primary artefacts with very concrete purposes, like axes and needles. Secondary artefacts include both primary artefacts and the ways to use them. Tertiary artefacts are ones which enable people to create autonomous worlds, such as artefacts used to create virtual reality games. From the artefact point of view we can no

longer minimise the value of MICT by speaking of them as “only tools”. They are extremely strong tools with which we can do many such things that have been impossible before.

3 EMPIRICAL STUDY

The study reported below was carried out in Finland, at the University of Helsinki Department of Teacher Education, in the autumn of 1998. The students had a course of MICT for one study credit. The material of this study was collected at the beginning of the course. So the attitudes of the students were those which they had before studying at our department.

The 130 students in the study were of two categories. Most of them (97 students) were studying for their first year to be kindergarten teachers. A smaller part (33 students) were in-service kindergarten teachers who were making complementary studies for their Bachelor’s degree. The first-year students were young adults: they had matriculated recently or a couple of years ago. Half of all the students belonged to the 19–22-year age group and two thirds were under 30 years of age. The in-service teachers were mostly in early middle age, i.e. around 31–49 years old. The oldest student was 53 years old. The vast majority of the students were women, only five of the first-year students were men. The data were collected using a questionnaire. It consisted of statements of attitudes to MICT and the answers were given in a Likert scale “applies to me very well”, “doesn’t apply to me at all”. The 5-step scale was used, from 5 to 1, so the informant could also choose the neutral answer of 3. The statements were conducted from theories and models: that of innovation adopter categories (Rogers 1983), Tella’s (1995) attitudes towards MICT and the philosophical views of MICT (Surry & Farquhar 1997). There were three statements for each adopter category in the theory on innovation diffusion and the philosophical relationship to MICT. For the emotional attitudes there were 1–2 statements in each category.

Examples of the statements

Innovation adopter categories:

I am very eager to try even the newest applications of MICT. (Innovators)

I have to give a good example to the others by using applications of MICT. (Early adopters)

If my boss or my teacher encourages me to use MICT applications, I will do that. (Early majority)

If all the others begin to use some application of MICT, I will use it myself, too. (Late majority)

I hope I will never have to use MICT applications. (Laggards)

Attitudes towards MICT:

I quite simply hate MICT. (Hates)

I fell in love with MICT from the very first moment. (Loves)

I am worried about the rapid development of MICT. (Is worried)

Philosophical views on MICT:

MICT lead mankind to prosperity. (Utopian determinist)

MICT lead mankind into moral degeneration. (Dystopian determinist)

MICT are splendid tools in education. (Instrumentalist)

A personal innovativeness index was counted for the classification of the innovation adopter categories. This index was the average of the statements belonging to the same adopter category. When all the indexes of a student were known it was judged into which adopter category the student belonged. In the scale of 5–1 the index of the judged category was always over 3 and the index of the judged adopter category was higher than those of the others. No discrepancy, of course, could be accepted between the indexes of different categories, e.g. high indexes both to early adopter and to late majority for the same person. The few students to which this applied were left out of the classification.

In the same way, the indexes for philosophical views to MICT were counted. The index consisted of the average (scale 5–1) of three statements. The minimum index for a certain philosophical category was always 3.7, and was in fact 4.0 or more in many cases.

The emotional attitudes had many varieties in this study, and consequently only one statement was given for most categories. The attitude which clearly had two dimensions also had two statements, namely “From the very first moment either loves or hates MICT”. Unlike the categories of innovativeness and philosophical views the attitudes were not necessarily exclusive: the student could belong to several categories.

4 FOCUS OF THE STUDY

The main idea of the study was the importance of the modern information and communication technologies in kindergarten teacher education. The aim was to find out the attitude of kindergarten student teachers to MICT, especially:

1. To which innovation adopter categories of MICT do the students belong?
2. What kind of emotional attitudes do the students have towards MICT?
3. What kind of philosophical views do the students have towards MICT?

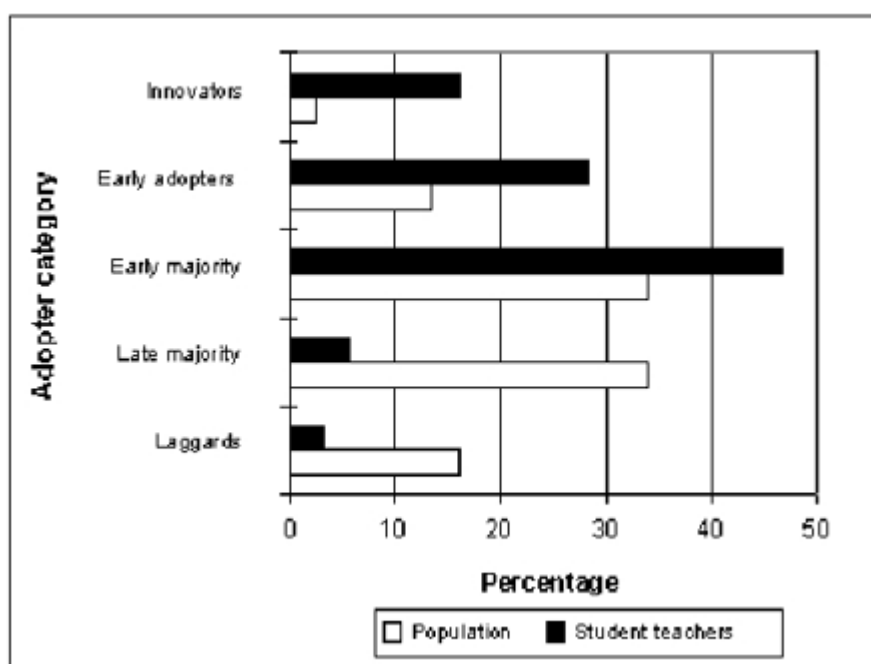
5 RESULTS

5.1 Individual Innovativeness

The MICT innovation adopter categories of the students are presented in Figure 3. The students in kindergarten teacher education belonged to early adopter categories more clearly than could be assumed according to the theory. This was the case for the group of innovators, early adopters and early majority. Correspondingly, the proportions of the last extremes: late majority and laggards, were much smaller than could be expected from the theory. The Chi-square test result was statistically significant; $\chi^2 = 57$; $p < 0,001$.

Out of the 129 answers to the adopter questions, 124 students could be classified into some of the categories, and 5 were left excluded from the classification because of discrepancy in the answers. The classification of the students was mostly easy: they clearly had higher averages with certain statements than with others. However, it was typical of early adopters that they also had rather high scores for the early majority category.

Figure 3. MICT innovation adopter categories among student teachers and general population.



5.2 Emotional Attitudes to MICT

Out of the 130 kindergarten teacher students, 124 could be classified into the MICT attitude categories of Tella (1995), Table 4.

About half of the students belonged to two or more categories, with a maximum of five categories.

The students supported positive statements more frequently than negative ones, but they also often gave neutral or critical attitudes to MICT. Of the classified students, about half wanted first to familiarise themselves with MICT and then slowly begin to like it. Many students wished they were skilful enough to feel comfortable with MICT (hackers). A considerable number of students were worried about their possibilities to use the applications. Some were worried about the uncertain development of technologies.

Table 4. Students belonging to attitude categories of MICT, Tella's (1995) classification. One student may belong to 1–5 categories.

Type of category	Number of remarks	Total of remarks
Positive attitude categories		
Pioneer	0	
Loves from the very first moment	10	
Gets fond of slowly	58	

Imitator	4	
Hacker	42	
Total of positive categories		114
Neutral or critical categories		
Worried about	16	
Superficial	5	
Fear of dropout	33	
Total of neutral or critical categories		54
Negative categories		
Hates from the very first moment	11	
Dislikes even the thought of using it	2	
Total of negative categories		13
Total of all categories		181

5.3 Philosophical Views: Determinism and Instrumentalism

The students gave 126 answers to philosophical views on MICT. From these 109 could be classified as either the determinist or instrumentalist type (Table 5).

Table 5. Philosophical views on MICT.

Philosophical views on MICT	Number of student teachers			
	Utopian positive	Utopian or dystopian	Dystopian	Total
Determinist	9	3	1	13
Instrumentalist	43	52	1	96
Total	52	55	2	109

The instrumentalists (96 students) were clearly a dominant group. About half of them saw the evolution of MICT as positive or “utopian”. Many of the students could not be classified into either of the instrumentalist sub-types. Of the 13 determinists most were also in favour of positive development. Only one person from the two opposite philosophical views was of the dystopian type.

6 DISCUSSION

The results of the study concerning the kindergarten student teachers and modern information and communication technologies were in brief as follows:

The first three innovation adopter categories which according to the theory of innovation diffusion should compose 50% of the population, accounted for 91% of our students. Correspondingly, the late adopters: the late majority and the laggards made up only 9% of the students. The attitudes of the students towards MICT were positive. The most frequently recorded category was that they “slowly got fond of MICT”. The students wished they had more skills, and they also feared being pushed aside by developments in MICT. The instrumentalist point of view was clearly dominant over the determinist one, and most students believed in the positive development of MICT.

The results give a positive impression of the relationship of the kindergarten student teachers towards MICT. Generally, most of our students are willing to try and use the applications of MICT, and after personal experience they begin to like them. They see the applications of MICT as useful tools that are beneficial in education and personal life. There are also critical aspects in their relationship to MICT: they want to try and see the possibilities of applications for themselves. They are also afraid of being unable to keep up with developments.

The questionnaire was delivered to the students before the course in MICT. The students were briefly interviewed about their earlier experiences before the course, and many of them reported a minimum experience of MICT, except for word processing. Thus, the majority of the students were unfamiliar with the many and useful applications of MICT. That is why it is probable that after the course the results of the study would have been even more positive.

The large proportion of early adopter categories in this study can be explained by several factors. The questionnaire was new and it had not been standardised. So the quality of the questions and their accuracy in classifying the categories was not foolproof. Also, it is not certain if the three questions are sufficient in themselves. The questionnaire needs further development and testing. It would be useful to have complementary methods, e.g., qualitative ones: an essay or an interview. But it is possible, of course, that the students selected in kindergarten teacher education were, in fact, of the innovative kind. One could ask if this is a common feature among those who want to be teachers. At least the same trend has been noticed among Finnish biology and geography teachers (Kankaanrinta, forthcoming). In the cited study, the MICT innovation was specified as the educational use of the Internet. Since, on the basis of their education, these biology and geography

teachers know about the theory of innovation diffusion, they could themselves define into which adopter category they belonged. The teachers in that survey research were progressive ones, so the proportions of innovators, early adopters and early majority were much bigger than one would expect according to the theory, 84% (cf. 91% in this kindergarten student teacher study). The difference was that among biology teachers the proportion of innovators was near to the theory, 4%, but considerably higher, 16%, among our kindergarten student teachers. The method of self-classification, instead of answering to statements, cannot be strictly judged to be a better or worse one. Even if the biology teachers know the theory of innovation diffusion they may give a more positive impression of themselves than the truth warrants. Answering the statements such as those in the present study could be more reliable, especially when there are several statements for each category. A combination of both methods would give greater reliability to the study. The theory of innovation diffusion could be explained to the students, and after that they would classify themselves and answer the statements given in the questionnaire.

There is evidence that the proportion of early adopter categories among Finnish people could be large. This is indicated by the high number of microcomputers, computers with Internet access and mobile phones, cited at the beginning of this paper. If students are selected from this kind of population it is no wonder that the number of early adopting categories is really high.

According to this study there is evidence that students in kindergarten teacher education have a favourable relationship to MICT. Thus they have a good starting point to be active professionals in the global networking information and communication society.

Furthermore, they deserve the best and most versatile kindergarten teacher education in the applications of MICT. That means the development of the existing curriculum.

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