PRACTISES IN OLD AGE ICT-EDUCATION

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ABSTRACT

A lifelong learning as an individual activity that spans over one's life is not a reality yet, despite the general guides of educational policy. Especially the elderly, those over 65 years, are in danger of lagging behind; the solid trust in one's own activity and learning skills is required; besides, many aged today, lack the learning culture (Tikkanen, 2003). In step with an increasing elderly population, more attention needs to be paid on proper old-age education technology, pedagocy, motivation and needs. This paper presents principles taken from literature on old age education based on cognitive ageing (compensating and supporting the deficiencies and strenghts) not forgetting the impact of empowerment by current ICTs in the life of elderly people. The experience gained from directing a computer club for the elderly is demonstrated, based on a WWW-questionnaire, as well as observations made during years 2007-2008 in Pieksämäki, Finland. The results show that the continuing education program for the elderly is strongly facilitated by peer-support which is experienced during informal club-based activities, as well as having a jointly planned content, which is tailored to their needs, motivation and ability. Learning in the club was evaluated according to the Chaffin-Harlow model of cognitive learning (Chaffin & Harlow, 2005), and found to reside on the "adjustment learning" level. Recommendations to achieve the "discovery level" are given.

KEYWORDS

Lifelong learning, elderly people, cognitive learning, ICT and elderly, computer clubs.

1. INTRODUCTION

Currently Europe has the highest proportion of elderly people in the world, standing at 16.7 % (82,7 million) of the population (496 million) of EU-27. Moreover, this percentage is expected to increase in the 2 to 4 decades to come. It is estimated that by 2050 approximately 30 % (141,6 million people) of the European population will be above 65 years of age, and especially the oldest of old (80 years +) is estimated to increase rapidly (Eurostat, 2008, pp. 23-31; 78-81). This demografic revolution will have its impact on national health care, social security and the general working conditions and innovations for continued survival becomes essential. Amongs others, innovations will be on the technological level: e-services (governmental portals, self care sites, e-banking, e-shopping, etc.), assistive technologies at home and care-units, more flexible provision for lifelong learning, for cognitive prostheses and for rehabilitation by means of computerized networks.

How well, and to what extent can, and will the elderly population adopt these services? The elderly user numbers are steadily growing, but are still relative low compared to overall figures. For example in year 2005, about 75 % of people over 65 years of age had no computer skills at all (Demunter, 2006). Furthermore, on average about 25 % of older people aged 55-74 used Internet regularly in EU-27. The spread in usage figures among the member countries, however, is quite extensive. For example in Finland, the number is 44 % (Smihily, 2007). The baby-boomers of 40's are soon to be our elderly. Today, about 76 % of the people aged 50-59, have used Internet during the past 3 months, while the number of those aged 60-74 only achieve 39 % (Statistics Finland, 2007). The population of Europe will be more ICT-literate in the future, as more and more citizens have been engaged in the use of computers and Internet during their working life. But, at present, there are still elderly people, for whom the digital world is new, which appears daunting to them and the benefits of which are not well known (see e.g. Morris et al., 2007).

Computer courses have been shown to have an effect on the computer attitudes and knowledge of the elderly (Morris, 1992); autonomy and communication skills can be improved (Chaffin & Harlow, 2005) and

there is a strong tendency of elderly using ICT, to sustain and support non-computer based hobbies and leisure activities, to fit the technology to their daily life (Selwyn, 2004). The advantages of continued participation in learning include, e.g., prevention of cognitive decline, interconnectedeness of elderly with family and friends, assistance on health related issues, enabling the elderly to remain safe and functionally independent, increased intergenerational interaction and enhanced self-esteem (Purdie & Boulton-Lewis, 2003; Rogers et al., 2004; Jones & Bayen, 1998).

However, it is not self evident that elderly people will adopt ICTs and use them. As Selwyn (2004) claims, "ICT is not universally attractive to, or universally needed by older users". In his study, the main reason for nonadoption of ICT, was simply not having an interest in using a computer and/or perceived lack of its usefulness; also the attribute of having once leant to use computer, does not automatically translate to later computer use in old age (see also Ng, 2008). One important option to improve this situation is to involve elderly in changing ICT, and ICT education to become more attractive and useful to them, not to expect the elderly to adjust the complexities and dullness of prevailing ICT (see also Tikkanen, 2003). By the elderly persons participation in design process, it helps in achieving the requirements formulated by Rogers & Fisk (2006): 1) to meet the needs of the elders, 2) to match their capacities and 3) to be acceptable for them.

The attitude of elderly people towards computers and Internet is generally positive – unlike general false perception (Li & Perkins, 2007; Eaton & Salari, 2005; Xie, 2007; Morris, 1992; Rogers & Fisk, 2006). The actualization of the learning needs and possible benefits is, perhaps, as Lawton (1998) put: "to mobilize technology to enhance both fun and function of older people". This involves taking the age-related cognitive decline and psycho-motor functionality, and (ICT)literacy into account, as well as motivational and self-fulfillment factors. What motivates the elderly to learn the usage of ICT? We shall take a closer look at such issues in section 2 that follows.

In search of comprehensive lifelong learning, also people outside the statistics, those aged 65+, should be included in the policy and above all the practises of societies. From an individual point of view *lifelong learning* can be defined as an action that individual engages throughout his/her life, in many different situations and contexts (Tikkanen, 2003). From the side of official educational policy, there are guidelines that stating how the learning should be facilitated and targeted, so that all individuals would have equal possibility and facility to learn. In the rapid technologically changing Western society there is an actual on-going need for any individual to learn new or "sink", as stated by Tikkanen. Elderly people of today, who are on lower levels of education may not have the capabilities (skills) to engage in learning activities prominently (Willis, 2006). Goals of self-fulfillment, participatory influencing [on society] and taking responsibility for one's own future are important, at least in Finnish visions.

This paper focuses on the educational side of the elderly people. In this paper the term "elderly" (often referred as "older adults" in the UK and USA literature) is used to describe the heterogenous user group of people aged 60+, who are still active participants at societal level, and who are interested in self-fulfillment in diverse domains of the retired life which they are living (Laslett, 1991). However, the frail and those not-interested in technology, are also considered. Firstly we examine some motivational issues behind computer and Internet learning. As aging is accompanied by degrees of cognitive, sensory and visual impairment, these are revieved. Based on both, motivational facts and impairments, teaching and learning of elderly people are covered in *Section 2*. To show one succesful example of continuing education among elderly, *Section 3* describes the experiences gained from the Digital Cottage (computer club for the elderly): background, activities, participatory design of the courses, and analysis of learning in connection to Chaffin-Harlow (2005) model of cognitive learning. *Section 4* summarizes the issues covered in the paper, and presents some recommendations for starting cognitive learning for elderly.

2. OLD AGE ICT-EDUCATION

The natural process of aging affects the cognitive and sensory capabilities of the elderly people in progressive declining manner. What these impairments are, and how they should be taken into account in teaching and learning for the elderly, are considered in this section. In addition, the motivational issues in ICT-learning of the elderly are shortly reviewed. The data is collected from literature and previous study (Naumanen & Tukiainen, 2008).

2.1 Requisites for Old Age Learning

2.1.1 Age-related Cognitive Impairments

There exist natural impairments that accompany normal aging. Jones & Bayen (1998) divide these declines into four categories: 1) cognitive slowing (reasoning, memory, spatial abilities), 2) limited processing resourses (attention, Working Memory (WM)), 3) lack of inhibition (discrimination of information), and 4) sensory deficits (especially loss of vision and hearing). If these factors are taken into account in the design and conduct of teaching for the elderly, nearly equal level of performance compared to younger adults can be achieved by the elderly. Impairments, thus, do not render the elderly incapable of learning, although the learning may be slower, require more recap, time and support, and be different of content compared to younger adults.

Empirical findings have shown that changes in semantic, episodic, prosedural and perceptual representation system occur as a process of normal aging. Especially a loss of working memory occurs, which is much needed requirement for computer use. Besides, WM load is positively correlated with increasing task complexity. Losses take place also in long term memory (free recall and retrieval), and in episodic memory (store for events in past and future). The latter weakens slightly, but can be accommodated by reminders and external cues. Recognition, however, is not much affected by aging, and gains in chrystallized, semantic knowledge has been reported (life experience, accumulated knowledge). (Craik & Bosman, 1994; Mayhorn et al., 2004).

2.1.2 Motivation for learning ICT

Adoption and use of technology among the elderly is influenced by many factors. There needs to be a real, perceived benefit for the use relative to the needs and interests of elderly people; a centrality of sociability (maintain social networks and communicate with family and friends) is also often mentioned in the literature. (Rogers et. al, 2004; Karavidas et al., 2005; Eaton & Salari, 2005; Morris et al., 2007).

In Australia, Purdie & Boulton-Lewis made a survey about the learning needs of elderly people. They interviewed a sample of elderly people, and based on the results, constructed a learning efficacy questionnaire. The results show that most important learning needs were related to transportation, health and safety issues and were least to do with technology *per se*. Biggest barriers found, were related to physical conditions (reduced mobility, degenerating sight and hearing) and cognition (memory deficit, learning difficulties, concentration). Elderly people on this study did not identify social learning needs as particularly important, neither support from friends and family, unlike in the study by Eaton & Salari (2005).

The needs, contexts and background of the elderly vary and are heterogenous. In UK, Morris et al. found out that the benefits of the computers and Internet are not well recogniced by many of the elderly. Additionally, 60 % of those who were not Internet users stated that nothing would encourage them to use it in the future, either. Barriers encountered include e.g. feelings of being too old, and lack of interest or access to Internet. In old age education, the creation of a positive first encounter is also important, to cultivate attitudes (Li & Perkins, 2007; Morris, 1992; Dickinson et al., 2005).

What motivates elderly can be deduced from activities the elderly people mostly engage in. These include Internet: information search about hobbies and local issues, e-mail, entertainment, internet transactions (Morris et al., 2007; Willis, 2006; Eaton & Salari, 2005; Karavidas et al., 2005). Keeping up with computerized technology and development of the society, was found to be among the main motivators to learn ICT skills among elderly (Selwyn, 2004; Naumanen & Tukiainen, 2008). Other motivations for learning include learning (to get knowledge) (Courtenay, 1998), peer support and sociability of learning experience (Xie, 2007; Naumanen & Tukiainen, 2008; Karavidas et al., 2005; Ito et al., 2001) and communication with friends and relatives (Morris et al., 2007). For example, good results were achieved for evolving motivation among elderly learners in Hong Kong, by using a participatory mode of learning and consistent support from different stakeholders (Ng, 2008). Thus, the motivation is both self-generated (instrinsic, the desire to know and develop) and facilitated by learning conditions, first of all by other people (extrinsic, learners, facilitators, family & friends).

2.2 Teaching for the Elderly

Experimental psychology is a good source of information, aplicable to old age aducation. To uncover the needs and interests of elderly people, teaching is required. Age-related changes in cognitive abilities are the result of cognitive slowing, limited processing recourses and failure to inhibit task-irrelevant information; also sensory deficits seems to accompany cognitive decline, as discussed in the previous section (Jones & Bayen, 1998). These factors are summarized in *Table 1*, with implications on teaching. Mayhorn et al. (2004) also suggest similar cognitive aging factors to be taken into account in system design for the elderly; these can as well, be applied to old age education. Guidelines for teaching are also given by Xie (2007) and Naumanen & Tukiainen, (2007b).

The key issue is to accommodate requirements of the elderly learners: to support their working memory by offering cues, reminders and navigational aids in systems and materials, to benefit from the accumulated experience and previous knowledge of elderly learners (use of analogs and real-life references), and to allow enough time and environmental support. In addition, structurizing of tasks, customizing interfaces and toolbars, and paying attention to the working environment and equipment (peace, large enough monitors, font-size, use of buttons), are advisable.

Table 1. Age-related changes in cognitive ability and the implications for teaching (summarized from Jones and Bayen, 1998)

Change Factor	Examples	Recommendations for teachers
Cognitive slowing	Slowing of reasoning, spatial abilities, long-term memory for verbal material and activities, reduction in processing speed	Allow sufficient time, room for questions, adjustment of control panel settings, minimize the amount of reading
Limited prosessing resources	impairments in attentional capacity and Working memory	Environment support: favor GUIs and toolbars, make online help known, break-up the instruction into small units and make goals explicit, provide enough instructors and hand-outs for reference, use of pictures in material, favor recognition rather than recall
Lack of inhibition	Irrelevant information is more likely to occupy the WM of the elderly	One task at time, eliminate noise and other environmental distractions, make learning objectives clear, as well as the status of learning/current state
Sensory deficits	Strong connection with cognitive tasks (their slowing); especially diminishing visual acuity and presbyopia (ability to focus on short distances); Difficulties in discerning colors in green-blue-violet range; Sensitivity to glare increases	Customize toolbars (larger buttons and font-size), use large monitors and position them correctly; use high contrast between background and text

3. CONTINUING EDUCATION FOR THE ELDERLY: COMPUTER CLUBS

The need for continuing education for elderly is apparent. Where courses can give an initial boost for computer skills, clubs and continuing learning of elderly people are needed to maintain and enhance the skills learnt (Xie, 2007; Naumanen & Tukiainen, 2008).

Here we shall present one succesful case – a Digital Cottage – of teaching elderly the basics in computer and Internet use: background, participatory design of content, activities engaged in, motivation and learning are described. As methods were used participant observation, teaching diary, a focus group interview and WWW-questionnaires. We shortly summarize the results gained from end-questionnaire and reflect the learning against the Chaffin-Harlow model of cognitive learning (Chaffin & Harlow, 2005), and offer some suggestions for improvement.

3.1 Digital Cottage – a Computer Club for the Elderly People

Digital Cottage (DC) was founded at the end of 2006 on the initiative of a local bank, an enterpriser and a few active elderly people of the city of Pieksämäki, Finland. The challenge was addressed to the elderly to learn the basic skills of computer and Internet use, to aid them in their everyday lives. At first, some of the elderly took an introductory course in computers and Internet, and based on their enthusiasm and elementary computer experience they acted as peer-advisors at the club. It soon became apparent that more knowledge and skills were needed also by the peer-tutors. Thus, at the beginning of March 2007, a project "ICT to support the abilities of the aging people"[1] started, and took over the further planning and guiding the DC, as part of its activities. Experience gained from Seniors'Club was used as a model for Digital Cottage (Eronen et al., 2006; Naumanen & Tukiainen, 2007a).

The weekly 2 hour computer club meetings were attended, on average, by 10-15 elderly people aged 58-75 years old. Nearly all of them had some previous experience of using computer and Internet. Guidance was provided at the computer class of the local university of applied science, usually by the 1st author, or a student of the institution. There were also 1-3 student tutors to facilitate the learning, and to give hands-on support when needed. Students were paid a small fee from their services, via student co-op Tukeva.

At the beginning of each term (fall, spring), we collaborated in planning the program for the term, so that everybody could express his/her wishes and learning needs. The feedback was collected in observations made during the club-meetings. A diary about the meetings was also kept at the web-site of the Digital Cottage.[2] At the end of each term, additional feedback was obtained by filling in of WWW-questionnaires.

The subject matters learnt during the year were composed of different themes under which individual topics were provided. First, the topic was introduced and briefly discussed in the group, then skills to perform the particular task were practised together, each one using his/her own PC (with Windows XP in Finnish, Office 2003 package and some other basic software). Topics covered during the year varied from basic use of keyboard, mouse and folder-system to services of Internet (humor, travelling + ticket ordering, net banking), using e-mail, cleaning up the computer, image manipulation and music & movies. Image manipulation taught as a unit, took up 3 sessions.

Problems encountered during the activities can be divided into two categories: 1) hardware and software related and to 2) person-centered. In case of hardware and software, the institution had very limited user privileges to accommodate the system for the needs of the elderly (font-size, speed of the mouse, screen resolution and background) and there were many topics that we could not practice in reality (installation of software, getting access to music databases, using easy-to-access features). The problems related to persons mainly included a lack of motivation on part of some student tutors during the fall-term of 2007. It was also quite hard to comply with the wishes of every participant. In future, DC will continue its activity, supported by the local bank and university of applied science (Diak). The bank will give the venue and wireless broadband to the club, whereas Diak will include the guidance of elderly in its curriculum, together with its course in old age education.

3.2 Digital Cottage: Feedback from Elderly Participants

At the end of March, 2008, a WWW-questionnaire with open ended questions was filled out by 9 out of 15 seniors participated the DC activities (60 %). The questions asked included, e.g. how things were dealt during the club meetings, and what was covered too much/too little (Content of the teaching); for what purpose and to what extent they used computers and Internet (Computer use); What they have learnt, and how useful they saw the things learnt during the year (Things learnt); Some reflections on their learning (Self-Analysis of learning), and something about their expectations and future (Expectations vs. Reality and Future).

Selected results of feedback – about content, things learnt and self-analysis of learning and motivation – is collectively displayed in *Table 2.* Accordingly, most participants were content with activities engaged in DC. They acquired more confidence in use of computers and Internet, and learnt e-mailing, net business (banking, usage of timetables, net-TV), and felt that they could affect the framework of what was taught/learnt. They preferred learning by doing things by themselves, and by experimenting with additional

[1] joint project of the University of Applied Science, Diak East, and University of Joensuu, 1.1.2007 – 30.6.2008
[2] www.digitupa.fi (only in Finnish)

support of the group and tutors. The main motivation was to keep in touch with the modern times and desire to know/learn more. More detailed results can be found in Naumanen & Tukiainen, 2008.

Table 2. Feedback of Digital Cottage

Content of teaching	**Things learnt during the year**	**Analysis of learning and motivation**
Pace and content: suitable or pretty suitable (7/9) and too complex or wide (2/9) Felt to be able to affect the content: (6/9); content or not capable (3/9)	Confidence in usage (4/9), e-mailing (5/9), information search (4/9), net business (4/9)	Best method: Learning by doing and experimentation (8/9); support by the group as good treatment in case of problems (2/9); group is an important factor in learning new skills (9/9)
More: very basics in computer use (5/9) and technical issues (4/9) Less: technical structure of computer (2/9), image processing and complex software, content (4/9)	Usefulness of learnt things: strong or relatively strong (6/9), no clear view (3/9)	Motivation: Keep in touch with today and desire to know (5/9), computer as useful tool in everyday life (4/9), good company/relationships

3.3 Cognitive Learning at Chaffin-Harlow Model

Chaffin & Harlow (2005) have created a model for computer skills learning for elderly people. Its central idea is that "the fundamental interest of the learner can be discerned" and with skillful guidance the motivation will follow. Perception of control is important and once the basic skills have been learnt, autonomy and communication of elderly can be improved, and computer technology can provide them new ways of addressing life's problems. In the model, the older learner is an active actor. Learning is a change in user's cognition levels, which is greatly affected by his/her environment (art, culture, technology). In addition, older learners have a basic need for connecting to others, as well as sharing and expressing him/herself. Focal points in learning/teaching are experience of actors and life-centricity of activities. Older user involvement plays a significant role in all phases: planning, implementation and assessment.

By teaching, elderly people adopt new ways of communicating and doing things. Existing knowledge connected to that which is newly acquired, will create new combination of ideas, which afterwards are put into practise. At first drill and practise may be appropriate. Age-related problems (discussed earlier) needs to be identified, and working environment and content should be adjusted accordingly. Once the type of education and barriers to learning have been identified, it is time to act (teach and learn). With proper instructional design, learners will improve their learning skills by solving problems, challenging themselves and experience personal change. The levels of this dynamic learning process are demonstrated in *Figure 1*.

At DC-activities we reckoned with the issues in model for example by joint-planning of the content of learning (needs and interests covered), by adjusting the working environment (if possible) and making use of collaborative learning (peer-instructors and additional tutor guidance) and adjusting the appropriate pace (slow enough with recap).

From the observations and teaching-diary notes, it could be concluded that learning in DC currently is at the level of "adjustment learning". Outside instructions and control of learning were still greatly needed, import of skills to be applied at home is just about to start, and the courage to experiment was mostly missing. Questions were often made about the security issues and topics rose by media (newspapers, TV) about computers and Internet. At the end, however, a slight change in attitudes and knowledge were noticeable, and the worst fears were overcome. How does one attain a level of discovery learning, where sense of mastery and courage to experiement will arise? Some suggestions include:

- use of additional, *everyday life related computer problems to be solved at home* (to recap and enforce the things practised at club)
- even more *personalized touch* to teaching (some private sessions with 1:1 guidance)
- letting *elderly create content* by themselves (though some basic skills are first needed)
- use of well-designed, structured and guided *workshop activities* (see e,g, Naumanen & Tukiainen, 2007a)
- s*howing the potential of the application of technology in the everyday life* of elderly (to support and augment the activities they are already practising)

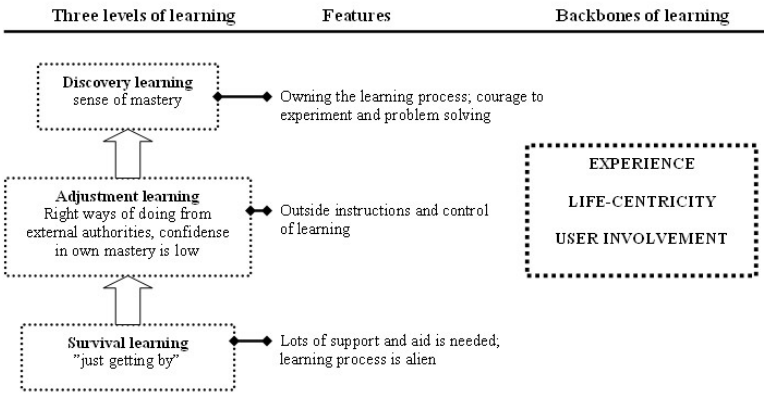

Figure 1. Levels of Chaffin-Harlow model for cognitive learning for the elderly

4. DISCUSSION

This paper contibutes to the general knowledge of old age ICT-education. The results support the enhanced activities of daily life (EADLs) of elderly people (Rogers & Fisk, 2006) by technological means – in the field of learning, communication, leisure activities – which require great deal of cognitive capabilities from the elderly user. Experiences from Digital Cottage – computer club for the elderly – were presented. Club-form activities build on the principles on continuing education and enable elders to maintain and improve their computer skills over a longer period of time (Naumanen & Tukiainen, 2008; Xie, 2007). The learning resides at "adjustement" level, which requires outside instruction and control of learning, and where the learner is insecure about his/her skills and more rehearsal is needed. To reach the "discovery" level, more everyday related computer problems could be tackled. Also, by involving the elderly more deeply in the content creation (beyond content planning), and enforcing more structurized approaches (e.g. Workshops) may help in this process. Motivation for learn among the DCs, however, was relatively high, due to the support of group and peer-tutors, possibilities to affect the content, and activity of the learners (to learn and to keep up with the progress of time). As DC activities in future are tied to the curriculum of an educative institution and its funding is facilitated by a local bank, the continuation is secure and can be used as an example for the creation of more clubs.

In evaluation of e-learning environments and software, a TUP-model has been used (Bednarik et al., 2004). To attain usability (learning, user satisfaction, effectiveness, motivation), the technology needs to match both the user requirements and capabilities, and the pedagogy (teaching method, materials) needs to be deliberate. Model can be further augmented to fit for user centred design of learning for eldelry people (see *Figure 2, below*).

In the centre, there is an older learner with his/her characteristics and needs. If technology and pedagogy are in order, i.e. accommodate the needs and characteristics of the user, usability will follow (and thus also motivation and acceptability; see Chaffin & Harlow, 2005; Rogers & Fisk, 2006). It is notable, however, that use of technology and learning occurs in different contexts. Then, also the user's requirements, own activity in the learning process and interactions vary, and methods should adjust to each individual and requirement separately. Frail bedridden elderdy persons do have different needs from active 3rd agers covered in this paper. Pedagogy and technology also account for complex interactions between learners, instructors, peers and the particular technology in use. In case of elderly users, sociability: support from family and friends and from peers – that are experiencing the same difficulties and are representors of same social generation – was also found important in this study. In club form activities especially among the learners, the evolving sense of a community has a great impact on learning – if not at skills level, at least at the level of user satisfaction, which may be more crucial.

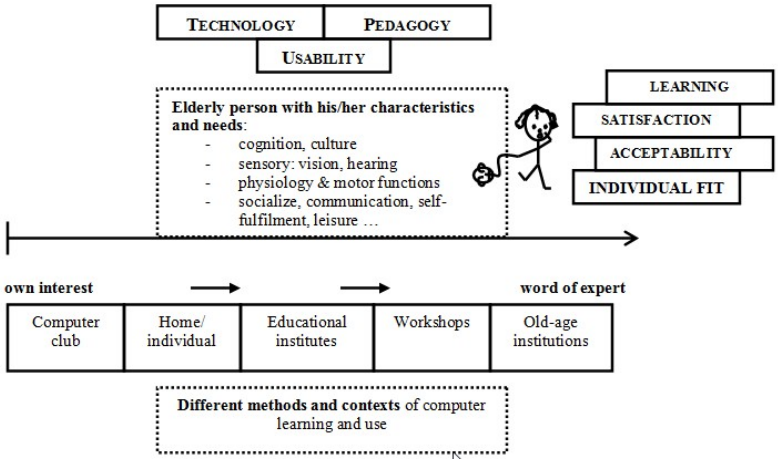

Figure 2. Different contexts of user centered design of learning for elderly people

Limitations of this study are the small and non-representative sample of elderly people, and limited methods used. In-depth interviews may have revealed more than did the www-questionnaire, which, however, was backed up by observations. Questionnaires are better used as the initial approach of a means to gather more information later on (Goodman et al., 2003). The use of focus group discussion at the beginning of terms was successful, even if it should be taken with a grain, as in the study of Lines & Hone (2004). Focus groups, however, can be recommended to be used in the learning contexts where 1) the participants know each others and 2) they have some knowledge of the domain of mutual interest (computers and Internet in this case). Without that knowledge, familiarizing is needed and goal is first to make technologies and possibilities they can offer known for the elderly users. As people learn, they can provide more versatile topics, as happened in case of Digital cottage.

Evolving motivation can be seen as a natural consequence of appropriate content & context of learning. Situated learning (Lave, 1994; Ng, 2008) prevailing in clubs and courses, creates a learner community where apprentice ideals for learning are realized: with peer-support, evolving skills and motivation lead towards the owning of one's learning, when the learner becomes an explorer and can surpass him/herself – despite the age and limitations.

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REFERENCES

Bednarik, R., et al., 2004. Development of the TUP Model - Evaluating Educational Software. *In Proceedings of the 4th IEEE International Conference on Advanced Learning Technologies (ICALT 2004)*, Joensuu, Finland, pp. 699-701.

Chaffin, A.J. and Harlow, S.D., 2005. Cognitive Learning Applied to Older Adult Learners and Technology. *Educational Gerontology*, Vol. 31, No. 4, pp. 301-329.

Courtenay, B.C., 1989. Education for Older Adults. *In Handbook of Adult and Continuing Education.* S.B. Merriam and P.M. Cunningham (Eds), Jossey-Bass Publishers, San Francisco, pp. 525-534.

Craik, F.I.M. & Bosman, E.A., (1994). Age related changes in memory and learning. In *Course Book on Gerontechnology: Normal and Pathological Ageing and the Impact of Technology*, S.L. Kivelä , K. Koski ja J. Rietsema (Eds.). COST A5 Series: Ageing and Technology. Eindhoven University of Technology, Netherlands, pp. 42-55.

Demunter, C., 2006. How skilled are Europeans in using computers and Internet? *Statistics in focus*, 17/2006. Eurostat. URL: http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-NP-06-017/EN/KS-NP-06-017-EN.PDF (accessed: 2nd of July, 2008)

Dickinson, A. et al., 2005. Strategies for teaching older people to use the World Wide Web. *Universal Access in the Information Society*, Vol. 4, No. 1, pp. 3-15.

Eaton, J. and Salari, S., 2005. Environments for lifelong learning in senior centers. *Educational Gerontology*, Vol. 31, No. 4, pp 461-480.

Eronen et al., 2006. Senior's Club – Technology Club and Research Laboratory. *In Frontiers of Educations*. San Diego, CA, USA, S3H-7-S3H8 (cd-rom). URL: http://fie.engrng.pitt.edu/fie2006/.

Eurostat, 2008. Europe in Figures – Eurostat yearbook 2008, URL: http://epp.eurostat.ec.europa.eu/portal/page?_pageid=2693,70381876,2693_70592044&_dad=portal&_schema=PORTAL (accessed: 3rd of July, 2008)

Goodman et al., 2003. Age-old Question(naire)s. *Inclusive design for the whole population*, London, UK. URL: http://www.hhc.rca.ac.uk/archive/hhrc/programmes/include/2003/index.html (accessed 11th of July, 2008).

Ito, M. et al., 2001. Making a place for seniors on the net: SeniorNet, senior identity, and the digital divide. *SIGCAS Compt. Soc.*, Vol. 31, No. 3, pp. 15-21.

Jones, B.D. & Bayen, U.J. (1998). Teaching older adults to use computers: recommendations based on cognitive aging research. *Educational Gerontology*, 24 (7), pp. 675-689.

Karavidas et al., 2005. The effects of computers on older adult users. *Computers in Human Behavior*, Vol. 21, No. 5, pp. 697-711.

Laslett, P., 1991. *A Fresh Map of Life: The Emergence of the Third Age*. Harward University Press, Cambridge, MA.

Lawton, M.P., 1998. Future Society and Technology. *In Gerontechnology, A Sustainable Investment in the Future.* J. Graafmans et al. (Eds.). IOS Press, Amsterdam, pp. 12-22.

Lave, J. and Wenger, E., 1991. *Situated learning: Legitimate peripheral participation.* Cambridge University Press, Cambridge, MA.

Li, Y. and Perkins, A., 2007. The impact of technological developments on the daily life of the elderly. *Technology in Society*,Vol. 29, No. 3, pp. 361-368.

Lines, L. and Hone, K., 2004. Eliciting user requirements with older adults: lessons from the design of an interactive domestic alarm system. *Universal Access in the Information Society*, Vol. 3, No. 2, pp. 141-148.

Mayhorn et al., 2004. Designing Technology Based on Cognitive Aging Principles. *In Gerotechnology: Research and Practice in Technology and Aging.* D. Burdick and S. Kwon (Eds.), pp. 42-53.

Morris, M., 1992. The effects of an introductory computer course on the attitudes of older adults towards computers. *ACM SIGCSE Bulletin,* Vol. 24, No. 1, pp. 72-75.

Morris et al., 2007. Internet use and non-use: views of older adults. *Universal Access in the Information Society*,Vol. 6, No. 1, pp. 43-57.

Naumanen, M. & Tukiainen, M., 2007a. Seniors' Club – Learning and Blogging Together. *In Web Based Communities (WBC 2007)*. IADIS, Salamanca, Spain, pp. 312-316.

Naumanen, M. & Tukiainen, M., 2007b. Guiding the elderly into the use of computers and Internet – Lessons taught and learnt. *Cognition and Exploratory Learning in Digital Age, 2007,* IADIS, Algarve, Portugal, pp. 19-27.

Naumanen, M. & Tukiainen, M., 2008. K-60 Access to ICT granted but not taken for granted. *In World Conference on E-Learning in Corporate, Government, Healthcare, & Higher Education.* November 17-21, 2008 in Las Vegas, Nevada, USA. (accepted for publication).

Ng, C., 2008. Motivaton among older adults in learning computing technologies: A grounded model. *Educational Gerontology,* Vol. 34, No. 1, pp. 1-14.

Purdie, N. and Boulton-Lewis, G., 2003. The Learning needs of older adults. *Educational Gerontology.* Vol. 29, No. 2, pp. 129-149.

Rogers, W.A. et al., 2004. Technology in Everyday Life for Older Adults. *In Gerotechnology: Research and Practice in Technology and Aging.* D. Burdick and S. Kwon (Eds.), pp. 3-17.

Rogers, W.A. and Fisk, A.D., 2006. Cognitive Support for Elders Through Technology. *Generations*, Vol. 30, No. 2, pp. 38-43.

Selwyn, N., 2004. The information aged: A qualitative study of older adults' use of information and communications technology. *Journal of Aging Studies*. No, 18, pp. 369-384.

Smihily, M., 2007. Internet usage in 2007 – Households and individuals. *Eurostat DATA in focus*, 23/2007. Eurostat. URL: http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-QA-07-023/EN/KS-QA-07-023-EN.PDF (accessed: 3rd of July, 2008)

Statistics Finland, 2007. *Statistical Yearbook of Finland 2007*. Multiprint Oy, Helsinki.

Tikkanen, T., 2003. Elinikäinen opiminen – elämänhallintaa ja ihmisenä kasvua (Lifelong learning – life control and growing as a person). *In Gerontologia.* E. Heikkinen and T. Rantanen (Eds). Duodecim, Helsinki, pp. 408-417 (in Finnish)

Willis, S.L., 2006. Technology and Learning in Current and Future Generations of Elders. *Generations*, Vol. 30, No. 2, pp. 44-48.

Xie, B. (2007). Information technology education for older adults as a continuing peer-learning process: a chinese case study. *Educational Gerontology*, Vol. 33, No. 5, pp. 429-450.