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Motivation of computer based learning across adulthood

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ABSTRACT

This research investigates learning motivation of young and old adults. In detail, we explore motives of young and old adults to participate in two ICT-course settings: e-learning and face-to-face courses. In a first study young (n = 53, M = 26.0 years) and old (n = 55, M = 69.8 years) participants of e-learning courses completed an online questionnaire on learning motivation and personality. In a second study young (n = 46, M = 26.7 years) and old (n = 57, M = 69.5 years) participants of face-to-face ICT courses completed the same learning motivation questionnaire and questions about personality, subjective age and life satisfaction. Exploratory factor analysis revealed four factors of learning motivation: belonging, instrumentality, personal growth, and competition. As expected, older adults expressed stronger motives of belonging and personal growth, and thus expressed a stronger interest in self-determined and intrinsic learning. Young adults, in contrast, strongly endorsed competitive-related motives of learning. Instrumentality was influenced by the interaction of age and subjective age; older participants showed higher instrumentality when the difference between chronological age and subjective age is big. Findings of this study shed new light on assumptions of socioemotional selectivity theory.

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1. Introduction

Older adults more often engage in activities of informal voluntarily learning courses that do not require formal qualification. Not surprisingly, educational institutions (e.g. adult education centers) extended their programs to include informal learning courses for older adults. For example, adult education centers in Germany recently reported that 29.6% of their learners are older adults (Reichart & Huntemann, 2008) and many of them are taking courses to learn information and communication technology (ICT) skills in face-to-face courses. As the use of ICT might have a positive effect on well-being in older persons (Shapira, Barak, & Gal, 2007), this is a development which should be empowered and studied. Furthermore, the use of online based ICT-trainings for older adults seems to increase as there is a variety of different e-learning and blended learning ICT-projects for older learners (European Commission, 2012).

Not much is known, though, about the age-related reasons for participating in ICT-learning courses and even less is known about online based learning for older adults of 60 years and older. Extending on assumptions of socioemotional selectivity theory (Carstensen, 1991, 1992, 1995), this study explores the association of chronological age, learning motivation, subjective age and personality across adulthood. More precisely, we focus on the learning motivation of taking part in ICT-learning courses in virtual internet platforms as a new and promising learning context and in ICT-courses which offer face-to-face learning.

2. Theory

2.1. Theoretical assumptions about learning motivation in older adult learners

Research on learning motivation in psychology often relies on student samples of adolescents or young adults. Few studies have included middle-aged and older adults (Huang, Lee, & Chang, 2007; Kolland, 2000; Kolland & Ahmadi, 2010; Staudinger & Baumert, 2007). Consequently, age-associated changes of learning motivation across the adult life span are not yet well understood. In the following, we elaborate lifespan theoretical assumptions as they pertain to age-associated differences in learning motivation. To begin with, we submit that learning motivation involves an array of four classes of age-associated motives that all involve or combine motives of knowledge acquisition with socio-emotional needs in distinct ways, that is, the motives of belonging, the striving for personal growth, instrumentality as well as competitiveness.

This is not to say that there are no other relevant classes of motives. However, we believe that these four types of motives are relevant for understanding age-related changes in learning motivation.
A well-known theory that explicitly addresses age-related change in motivation across the life span is socioemotional selectivity theory (Carstensen, 1995; Carstensen, Isaacowitz, & Charles, 1999; Carstensen & Lang, 2007). According to this theory there are two fundamental age-associated dimensions of goals across adulthood: One goal dimension pertains to the acquisition of knowledge and a second goal dimension is the regulation of emotion. The salience and strength of both motives differently change across the life span depending on how much time individuals believe to have left in their lives. When time is perceived as open-ended, knowledge-related goals are more salient and stronger as compared to emotion-regulatory goals. When time is perceived as limited, emotion-related goals that promise short-term benefits are preferred. Generally, older adults appear to perceive the remaining time in their life to be more limited than younger adults (Carstensen & Lang, 2007). This implies that short-term goals will be pursued more strongly in later life than in early adulthood. Thus, the two goal dimensions of knowledge acquisition and of emotion regulation partly overlap as learning always involves some affective components (Abe, 2011; Ryan, Connell, & Plant, 1990). Consequently, we argue that there are four specific classes of motives that may help to better disentangle emotional and information-seeking goals.

A first type of such learning motives relates to personal growth, and to the ego-centrality of the learning contexts (Kropp, 1999, 2001). Such intrinsic motivation may characterize young adult learners as much as older adult learners. But studies with older employees suggest that intrinsic motivation and personal growth increases with age (Feldmann, Doerpinghaus, & Turnley, 1995; Grube & Hertel, 2008). Personal growth of learning also applies to self-improvement and adjusting oneself to new situations, resulting in boosts of self-efficacy when learning is successful (Bandura, 1997). Thus, learning may contribute to personal growth strongly in later adulthood.

In addition, and secondly, learning motivation often involves social and emotional purposes related to the motive of belonging (Baumeister & Leary, 2000). Consequently, spending time with emotionally meaningful social partners may be perceived as part and parcel of the learning activity. One implication is that emotional goals of learning become more salient for older adult learners. Accordingly, learners may well be motivated to build up meaningful contacts with other learners while learning.

Third, motivation of learning may be associated with social comparison and competition between learners, typically associated with achievement motivation. For example, upward social comparisons and seeking to rank better than others involves a strong volition towards improving one’s skills and capacities (Heckhausen & Dweck, 1998; Heckhausen & Schulz, 1995). In this vein, Kelemen (1980) found that achievement motivation is more salient among younger adult learners and that the strength of the achievement motive declines with age. In an experimental study of Mayr, Wozniak, Davidson, Kuhns, and Harbaugh (2011) it was also found that competitive behavior declines after the age of fifty.

Finally, learning also involves instrumental motives (Heckhausen & Heckhausen, 2006; Vroom, 1964) related to the expected values of the consequences of learning. For example, a learner may expect that the success of the learning effort may be instrumental for career options or other long-term consequences. This means that instrumentality refers to consequences of learning outcomes related to material security, or to social acceptance in society. Typically, instrumentality of learning involves long-term investments into the future, and is thus expected to be typically more salient to learning motivation in early adulthood. Similarly, Gingermann and Perlmutter (1995) observed that older persons focus on the here-and-now, whereas younger people focus more on the more distant future. This implies that immediate benefits of learning contexts may be more relevant for older adult learners than long-term consequences of learning outcomes.

Few studies have investigated explicit learning motivation in older adults. For example, Kolland (2000) and Kolland and Ahmadi (2010) found that older adult learners (older than 55 years of age) who participated in special university programs for older adults had more experience-oriented motives than younger adult learners who took similar classes. The older adult learners also had quite often wishes like “prove to others that you are still able to study” or used learning as a mechanism to compensate losses like health limitations or the end of the professional life. In a replication of this study with older adult learners in adult education centers, Kolland and Ahmadi (2010) found that older adult learners had more experience-oriented motives but also instrumental motives related to consequences of learning outcomes in the future. But these instrumental motives were less strongly emphasized among very old participants (older than 75 years).

The four types of motives are supposed to be differentially related to chronological age as well as to subjective age. For example, Wagner, Hassanein, and Head (2010) argued that psychological perception of peoples own age may influence computer use and thus also the motive to learn how to use computer and internet. However, this effect is not tested yet, but it is well researched, that a younger feel-age compared to chronological age is related to higher levels of well-being (Westerhof & Barrett, 2005), better health (Hubley & Russell, 2009) and higher levels of extraversion and the tendency to be more active and social (Hubley & Hultsch, 1994) and might therefore influence learning motivation.

2.2. Computer-based electronic learning in old age

In Germany ICT-skills in later life are often learned by face-to-face courses (Reichart & Huntemann, 2008), but electronically supported learning (e-learning) as new and innovative learning context for young and older adults seems to be a way of learning which is growing. In this vein, information and communication systems serve as specific media to implement the learning process (Bates & Poole, 2003). This method is very well suited for the heterogeneous group of older adult learners, because the invested time, the learning speed and the preferred time and place of learning can be chosen independently and communication tools to interact with other learners are usually also available. Moreover, older adults who are not mobile may participate with greater ease, and for them online courses might be a welcome opportunity to make new social contacts. Electronic learning contexts also provide greater opportunity to self-determine the learning process, for example, with regard to being able to repeat learning material as much as is convenient. Considering the challenges of the cognitive aging process (Baltes, 1989), such options may be more adequate and more supportive in the learning process.

Of course, some basic comprehension of computer and internet use is needed for e-learning contexts. This may be the reason that most e-learning programs for older adults focus on computer knowledge and new media. The percentage of older adults older than 60 years of age who learn by using internet courses or distance learning is only 1% (Schroder & Gilberg, 2002). This is also due to the quite low numbers of older adult internet users in Germany, but numbers are increasing in the last years; in 2010 already 54% of the 60–69 year olds and 23.3% of the older adults of 70 years or older use the internet on a regular basis (Initiative D21, 2010). Of course, the percentages are still lower than the percentages of internet using adolescents and adults up to 60 years of age, but the market for e-learning courses specifically made for older adults seems to grow. In countries were the use of the internet is more frequent for older people, also more e-learning courses for older...
persons are offered and widely accepted, like in the UK were already more than 10,000 older adult learners followed courses via the Open University (Kimpeler, Geogrieff, & Revermann, 2007).

To our knowledge, only few studies have explored e-learning contexts of older adults. For example, Hernández-Encuentra, Pousada, and Gómez-Zúñiga (2009) reported that older adult learners participated in e-learning courses for several reasons such as interest in the topic, joy of learning, as well as seeking to feel an active member of society and for actively engage in new media. Chu (2010) and Trentin (2004) found evidence for positive effects of e-learning classes among older adults. A meta-analytical study of Means, Toyama, Murphy, and Bakia (2009) summarized positive effects of e-learning, however, without addressing possible age or cohort differences. E-learning represents a promising and relatively new learning context for older adult learners.

2.3. Personality and learning motivation

Another source of differences in learning motivation is personality. Personality traits related to the Big Five are known to be relatively robust and stable across adulthood while there is also some mean-level change (Roberts, Walton, & Viechtbauer, 2006). For example, older adults show stronger levels of ‘agreeableness’ (Field & Mills, 1991) and ‘conscientiousness’ (Allemand, Zimprich, & Hendriks, 2008). Traits such as ‘openness’ and ‘extraversion’ appear to slightly diminish in older persons (Körner, Geyer, Gunzelmann, & Brähler, 2003). Such personality changes may also account for changes in learning motivation, and thus need to be considered.

Huang et al. (2007), for example, report that a positive personality is positively associated with learning motivation and with participation in courses for physical fitness. This effect might be possible for ICT-courses, too. A positive personality indicates that persons have low levels of neuroticism, high levels of extraversion, agreeableness, openness to experience and consciousness. Baltes and Lang (1997) observed that high levels of extraversion and goal strength were associated with more frequent intellectual, cultural and social activity among older adults and with more positive outcomes. Positive affect (high levels of excitement, interest, enthusiasm) is known to be associated with improved cognitive performance (Kunzmann, 2008). In sum, considering such findings we argue that personality characteristics may moderate the motivation and ability to learn.

2.4. The present studies

Our two studies aim at exploring individual differences in learning motivation between young and older adult learners in the field of computer based learning. Young adult and older adult learners who followed voluntarily different ICT-learning courses to learn various key skills filled in a questionnaire about learning motivation and personality. A new questionnaire on learning motivation was developed in order to assess the four theoretically derived relevant age-associated dimensions of learning motivation that is personal growth, belonging, competition and instrumentality. Because of the uniqueness of this instrument, we conducted two studies to validate the data of the first data with the second study and test if the factors for learning motivation and age differences in learning motivation are replicable. Additionally, we explored the potential intervening or moderating roles of personality, gender and education as well as subjective age (in the second study).

Specifically, we tested the following hypotheses: (1) older adult learners are expected to express stronger motives of belonging and personal growth, while young adult learners were expected to express greater instrumental motivation and greater motivation for competition. (2) We expected that age is the strongest predictor for the effects on the different motives, although some effects of personality and subjective age on motivational dimensions are also possible. (3) Although we did not have explicit expectations we tested for possible differences between male and female learners, and possible influences of education.

3. Materials and methods

3.1. Respondents

For this research, we conducted two studies with younger and older adults who participated in computer based learning courses. In the first study, younger and older adults of various e-learning courses completed a questionnaire about learning motivation after participating in the learning course. The e-learning courses trained different key skills like improving learning and self-management skills, improving ones computer knowledge and using the computer for learning and research. All e-learning courses offered communication tools like a forum, chat and e-mail and were tutored by well-trained teachers, who encouraged their learners to communicate with each other.

In this first study we invited 629 participants via email to participate in the study. 24.3% of the older adult learners and 18.2% of the young adult learners filled in the questionnaire. All respondents filled in the questionnaire voluntarily and did not receive any rewards. Of the 126 persons who filled in the questionnaire, 18 respondents had to be excluded because they did not answer important demographic questions. The final sample size of the first study is 108 persons, 55 older adult learners (mean age = 69.8 years, age range 60–88 years) and 53 younger adult learners (mean age = 26.0 years, age range 19–41 years).

In the second study, we asked participants who recently took part in a face-to-face ICT-course to respond to a questionnaire. Participants became aware of the study with distributed flyers and articles in newsletters of organizations who offer face-to-face courses about various computer skills. Of the initial 132 respondents a total of 103 persons were in the expected age range. From these 57 were older adult learners (mean age = 69.5 years, age range 61–81 years) and 46 were younger adult learners (mean age = 26.7 years, age range 20–43 years). Table 1 gives an overview of sample characteristics of gender and education of both learner groups in both studies.

3.2. Measures

A questionnaire to measure explicit learning motivation with 12 single-choice questions and one open question was developed with questions that cover all motivation aspects which were discussed in the theoretical section. These questions were collected by interviewing five older adults who participated in many learning courses and by theoretical considerations.

The single-choice questions were rated on a five-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). One open question assessed if there were other reasons for learning and was included to check if all motivational aspects were asked or if respondents frequently add other motivation aspects which are important to them. Here no additional motives were found. This question could be answered voluntarily whereas the other questions were compulsive. Two independent raters coded the items with regard to typicality for the respective dimensions of motivation (personal growth, belonging, competition and instrumentality) according to the respective theories. One item ‘distract from problems’ could not be assigned to one of the four dimensions, but was included in the study with regards to content. Cohen’s Kappa between two independent raters reached .62. The four expected underlying dimensions were confirmed with exploratory
Personality was measured in the first study with the German version of the NEO-Five-Factor-Inventory (Borkenau & Ostendorf, 1993). All 60 items were used. Respondents answered these questions on a five-point Likert scale from 0 (strongly disagree) to 4 (strongly agree). Answering this part of the questionnaire also was compulsive. Internal consistency, retest-reliability, and validity of this instrument are good. Cronbach's alpha was measured. For neuroticism \( \alpha = .86 \), for extraversion \( \alpha = .80 \), for openness \( \alpha = .77 \), agreeableness \( \alpha = .76 \) and for conscientiousness \( \alpha = .82 \).

In study 2 we measured personality with the 15-item Big Five Inventory (BFI-S) (Gerlitz & Schupp, 2005; Lang, John, Lüdtke, Schupp, & Wagner, 2011). Every personality factor is measured with 3 items on a seven-point Likert scale form 1 (strongly disagree) to 7 (strongly agree). The validity and reliability of this instrument are acceptable compared with the NEO-FPI (Gerlitz & Schupp, 2005). Cronbach’s alpha for this instrument was \( \alpha = .69 \) for neuroticism, \( \alpha = .69 \) for extraversion, \( \alpha = .69 \) for openness, \( \alpha = .65 \) for openness and \( \alpha = .65 \) for conscientiousness. Additionally in study 2 we assessed subjective age; respondents rated how old they feel and we compared this to their actual age. We measured life-satisfaction with an single question and on a 11-point scale, they feel and we compared this to their actual age. We measured life-satisfaction with an single question and on a 11-point scale, they feel and we compared this to their actual age.

For neuroticism, \( \alpha = .69 \) for extraversion, \( \alpha = .69 \) for openness, \( \alpha = .65 \) for openness and \( \alpha = .65 \) for conscientiousness. Additionally in study 2 we assessed subjective age: respondents rated how old they feel and we compared this to their actual age. We measured life-satisfaction with a single question and on a 11-point scale, a method which is commonly used for the German Socio Economic Panel Study (Baird, Lucas, & Donnellan, 2010) and offers a valid measurement for life satisfaction (Veenhoven, 1996).

We measured demographic variables with a questionnaire with questions about age, sex, education level, computer experience, e-learning experience and marital status.

### 3.3. Procedure

Potential respondents of the first study received an e-mail with an individual link to an anonymous online survey. In the mail, the content of the study was briefly described. The link only worked once after the respondent started the survey and it was not possible to exit the survey and complete it later. For the second study, no individual links were possible, because the respondents were searched by flyers, posters and newsletter articles which informed potential respondents briefly about the survey and provided contact information and a link to the survey. The flyers and posters were distributed at adult education centers and at the university and the information was send around by newsletters of education centers for older adults and of computer clubs. When using the link, the respondent was guided to the welcome site of the survey; the purpose of the survey was explained again and then the survey started by clicking a ‘start’ button. To guarantee that only computer course users were included in the survey, respondents reported whether they had participated in a course over the last three years. If the answer was no, the survey ended for these respondents. Respondents, who met this criterion, completed a questionnaire on their computer and e-learning skills and then they answered the explicit learning motivation questionnaire.

After that they answered the questions about personality and satisfaction and in the second study some questions about subjective age and aging. The respondent had the opportunity to leave a comment after filling in the survey and the contact address was listed again, if the respondent had any questions. In total, it took respondents approximately 20 min to complete the entire survey. After four weeks the surveys were closed and we exported the data from the survey platform (ILIAS platform) to a PAWS statistic file and to Mplus version 6 (Muthén & Muthén, 1998–2010) for statistical analysis.

### 4. Results

We report the results in two steps. As a first step, we applied exploratory structural equitation modeling (ESEM, Asparouhov & Muthén, 2009) to test for equivalence of factor structures across both studies as a grouping variable. As a second step, we tested for age differences between the identified factors and for possible additional effects of gender and education.

#### 4.1. Exploratory structural equitation modeling (ESEM)

The inspection of the scree plots for study one and study two identified in both cases four different factors. Thus the ESEM Model was tested with four factors. As estimator we used MLR and as rotation geomin (oblique). In Table 2 all standardized factor loadings of both studies and their \( p \)-values are listed.

The components in both studies reflect the expectations quite well. The first factor reflects an intrinsic motive of learning which we call personal growth in our research. Persons scoring high on this factor are motivated to learn because of the learning and the course contents itself; they enjoy learning and the topic of the course and are looking for meaningful and fulfilling activities in their daily life. The second factor consists of two social items: participants scoring high on these items learn because of the opportunity to meet interesting people while learning and enjoy social contacts in their learning course. Thus this item was labeled the belonging component. Additionally the item ‘I am learning because this distracts me from problems’ belongs according to the factor analysis to this factor, which is an item that actually describes a coping mechanism. We argue though that seeking distraction in a learning context typically involves a social motive as well. The third component describes achievement and power motivation. The items are ‘I am learning because I am willing to show my learning abilities to others’; ‘...because I want show that I am the best in this...’
area’ and ‘... because I want to reach a good achievement compared to my peer group’ and they form the competition component.

The forth factor consists of items that describe learning as a more extrinsic factor. People scoring high on this factor are not learning because of pure interest in learning and the topic itself but because they see the learning content as a tool for work or activities they have to manage in their lives. The two items ‘...because it helps me in my daily activities’ and ‘... because it will be become useful in the future’ belong to this factor, which we call instrumentality. The item ‘... because it is useful for my (volunteer) work’ would also fit in this factor, but based on the factor loadings this item does not load purely on this factor in both studies. For this reason we did not use this item in further analysis.

Fit indices show acceptable fit of the model (CFI = .966, RMSEA = .043, SRMR = .084). Cronbach’s alpha for the personality growth factor is .69, for the belonging factor $x = .69$, for competition $x = .71$ and for instrumentality (without the excluded item ‘...because it is useful for my (volunteer) work’) $x = .58$.

### 4.2. Age effects on learning motivation in study 1

Based on these four dimensions, we tested for possible differences between the young adult and the older learner group. Table 3 gives an overview over means and standard deviations of the four dimensions of the explicit motivation questionnaire and of the personality constructs. A MANOVA was performed to compare young and older adults on all factors.

As expected, older adults more strongly endorsed personal growth motives ($F_{(1, 106)} = 25.90, p < .001$) as well as belonging motives ($F_{(1, 106)} = 31.83, p < .001$) as compared to the younger adults. Young adult learners endorsed more often the competition motives ($F_{(1, 106)} = 13.11, p < .001$), which was also expected. Instrumentality, however, was more important to the older adult learners, contrary to expectations ($F_{(1, 106)} = 7.43, p = .008$).

Table 4 reports the correlations between the four factor components in the first study. We found a significant moderate correlation between belonging and personal growth (.486, $p < .001$), between personal growth and instrumentality (.304, $p < .001$), belonging and instrumentality (.304, $p = .001$) and a small correlation between belonging and competition (.191, $p = .048$).

Furthermore, we assessed differences on personality between young and older adults. Except for neuroticism where young adults scored significantly higher than older adults ($F_{(1, 106)} = 5.47, p = .021$), no differences in personality were found (see Table 3).

In a regression analysis (see Table 5) we tested if age is indeed a good predictor for the dimensions of learning motivation or if learning motivation is better predicted by gender, education or personality. A first model of regression revealed that age is a significant predictor for all dimensions of learning motivation (for personal growth adjusted $R^2 = .24, F_{(1, 106)} = 35.44, p < .001$, for belonging adjusted $R^2 = .24, F_{(1, 106)} = 34.67, p < .001$, for competition adjusted $R^2 = .09, F_{(1, 106)} = 12.10, p = .001$ and for instrumentality adjusted $R^2 = .06, F_{(1, 106)} = 7.94, p = .006$).

In a second regression model, we added education, gender and personality factors. Education was split into two groups, higher (more than 10 years of school education) and lower (10 years or less of school education). Personal growth was not associated with gender or education or with personality except for openness (adjusted $R^2 = .35, F_{(7, 99)} = 8.13, p < .001$), while the age cohort effect proved robust. Persons who scored higher on openness were more motivated to achieve personal growth. For belonging, age was also in the second model a strong predictor, but also persons who score high on neuroticism or extraversion reach significant higher belonging motives (adjusted $R^2 = .21, F_{(7, 99)} = 7.00, p < .001$). High competition motives were in the second model predicted by high neuroticism and high conscientiousness (adjusted $R^2 = .26, F_{(2, 99)} = 5.72, p < .001$). High instrumentality motivation was also predicted by high conscientiousness in the second model and not by age (adjusted $R^2 = .10, F_{(7, 99)} = 2.47, p = .018$). Age seems to be a strong predictor for the four learning motives in general. Personality, however, also adds some important effects to the model. Finally, in a third regression model, interaction effects were tested. No interaction effects between age and education, age and gender and education and gender were found.

### 4.3. Age effects on learning motivation in study 2

To see if these age differences are replicable, we also compared the age groups with regard to each learning dimensions in a MANOVA. Means and standard deviations can be found in Table 3. As in study one and as expected by theory, older adults reported stronger personal growth motives ($F_{(1, 101)} = 8.64, p = .001$) and a stronger belonging motive ($F_{(1, 101)} = 18.31, p < .001$). Younger adults also showed in this second study stronger competition motives ($F_{(1, 101)} = 9.09, p = .003$). In this study, instrumentality motivation was for all learners equally important ($F_{(1, 101)} = 3.51, p = .064$).

Table 4 shows the correlations of variables in the second study. In this second study, there were no significant correlations between the learning motives. Similar to study 1, younger adults

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1 Between studies, no significant differences were found in the means of motives. Effect sizes were in range between .00 and .38, indicating only small effects of different course methods on different motivations.
were more neurotic than older adults ($F_{(1, 101)} = 7.47, p = .007$, see Table 3). Overall, participants felt 3.83 (SD = 5.61) years younger than their actual chronological age. As expected, older participants felt 6.39 (SD = 5.94) years younger, while young adults felt only .67 (SD = 3.00) years younger. For life satisfaction no difference between young ($M = 7.1$, $SD = 1.9$) and older participants ($M = 7.5$, $SD = 1.9$) was found.

In Table 6 the regression analysis for the second study is reported. Again, as first step, age was used as predictor for the learning motives. It is a significant predictor for the first three dimensions (for personal growth adjusted $R^2 = .04, F_{(1, 101)} = 5.29, p = .026$, for belonging adjusted $R^2 = .13, F_{(1, 101)} = 16.60, p < .001$, for competition adjusted $R^2 = .06, F_{(1, 101)} = 12.10, p = .010$). For instrumentality, age was not a significant predictor (adjusted $R^2 = .03, F_{(1, 101)} = 3.53, p = .063$).

In a second regression model, we added education, gender, personality and subjective age differences as possible predictors for learning motives as in study one.

In the second model high personal growth was predicted by being female, having low rates on agreeableness or high rates on conscientiousness (adjusted $R^2 = .15, F_{(9, 93)} = 2.96, p = .004$). For belonging, age and education were significant predictors, gender and personality were not (adjusted $R^2 = .21, F_{(9, 93)} = 4.07, p < .001$). This means that people with lower education score higher on belonging than people in the higher education level. For competition, age is also a significant predictor and also a low rating on agreeableness and high ratings on openness (adjusted $R^2 = .31, F_{(9, 93)} = 2.70, p = .008$). High instrumentality in the second model is predicted by being female or by high openness ratings (adjusted $R^2 = .10, F_{(9, 93)} = 2.56, p = .025$).

Additionally for this study, in a third model, we tested interaction and found an interaction effect between actual age and subjective age. Old participants, who feel younger than they are, score significantly higher on instrumentality (adjusted $R^2 = .15, F_{(17, 85)} = 2.02, p = .018$, $\beta$-value $= .335$). Younger people score in general higher on instrumentality; their subjective age did not matter for this motive. This interaction effect is shown in Fig. 1.

Age is a strong predictor for learning motives, except for instrumentality. Instrumentality is predicted by gender and by interaction of age and subjective age. Education has also some influence in this study; belonging was predicted by education. Lower educated participants scored higher on the belonging motive than higher educated persons. Subjective age does not have much effect, only for instrumentality. It is however, a predictor for life satisfaction, which was also tested in study 2. Life satisfaction and the difference between actual age and subjective age correlate .348 ($p < .001$). People who felt younger than they are were more satisfied with their lives. Life satisfaction did not correlate with actual age, gender, education or motive scores. The difference between chronological age and subjective age correlates positively with extraversion (.337, $p = .010$) and openness (.327, $p = .013$). This suggests that a bigger difference between chronological age and subjective age in older people influences life satisfaction and positive personality traits in a positive way and might therefore be a moderator variable for many factors, like the readiness to learn new topics. This issue may be of interest for future studies.

### 5. Discussion

The present research explored fundamental dimensions of learning motivation, and their association with chronological age in the context of electronic learning courses and face-to-face ICT-courses. The four theoretically hypothesized dimensions of learning motivation were differentially associated with age in the expected directions. We confirmed the hypothesis that young and older adult learners differ on learning motivation dimensions such as personal growth, belonging, and competition in two separate studies. Unexpectedly though, instrumentality was higher for older adults in study 1 and equally high for both age groups in study 2. Older adult learners are less competition motivated and care more about the self-determined aspects of learning. They are more socially driven and focus more on the actual learning process and on the present. The instrumentality motive, however, is influenced by the interaction of age and subjective age; this shows that instrumentality can be important in all age groups, and more so for older participants who feel younger than they are. People who feel younger than they are observe their future as more open-ended as people who feel older than or as old as their chronological age.
Table 5
Regression analysis summary for the factors of learning motivation in study 1 (n = 108).

<table>
<thead>
<tr>
<th>Step and predictor variable</th>
<th>Personal growth</th>
<th>Belonging</th>
<th>Competition</th>
<th>Instrumentality</th>
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<td>( .24^* )</td>
</tr>
<tr>
<td>Step 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
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<td>( .35^* )</td>
<td>( .31^* )</td>
<td>( .26^* )</td>
</tr>
<tr>
<td>Education</td>
<td>( .01 )</td>
<td>( .01 )</td>
<td>( .01 )</td>
<td>( .01 )</td>
</tr>
<tr>
<td>Gender</td>
<td>( .01 )</td>
<td>( .02 )</td>
<td>( .08 )</td>
<td>( .12 )</td>
</tr>
<tr>
<td>Neuroticism</td>
<td>( -.08 )</td>
<td>( .26^* )</td>
<td>( .25^* )</td>
<td></td>
</tr>
<tr>
<td>Extraversion</td>
<td>( .03 )</td>
<td>( .11 )</td>
<td>( .12 )</td>
<td>( .03 )</td>
</tr>
<tr>
<td>Openness</td>
<td>( .36^* )</td>
<td>( .11 )</td>
<td>( .17 )</td>
<td>( .19 )</td>
</tr>
<tr>
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<td>( -.05 )</td>
<td>( -.04 )</td>
<td>( .06 )</td>
</tr>
<tr>
<td>Conscientiousness</td>
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<td>( .05 )</td>
<td>( .41^* )</td>
<td>( .22 )</td>
</tr>
</tbody>
</table>

Note: Gender with 1 = male, 0 = female, education with 1 = higher education, and 0 = lower education. In a third model, interaction effects between personality and age were measured. No interactions were found.

\( ^* \) \( p < .05 \)

\( ^{**} \) \( p < .01 \)

Table 6
Regression analysis summary for the factors of learning motivation in study 2 (n = 103).

<table>
<thead>
<tr>
<th>Step and predictor variable</th>
<th>Personal growth</th>
<th>Belonging</th>
<th>Competition</th>
<th>Instrumentality</th>
</tr>
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<tr>
<td></td>
<td>( \beta )-values</td>
<td>Adjusted ( R^2 )</td>
<td>( \beta )-values</td>
<td>Adjusted ( R^2 )</td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
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<td>( .04^* )</td>
<td>( .13^* )</td>
<td>( .06^* )</td>
</tr>
<tr>
<td>Step 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>( .18 )</td>
<td>( .15^* )</td>
<td>( .21^* )</td>
<td>( .25^* )</td>
</tr>
<tr>
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<td>( .21^* )</td>
<td>( .18 )</td>
<td>( .01 )</td>
</tr>
<tr>
<td>Gender</td>
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<td>( .03 )</td>
<td>( .05 )</td>
<td>( .25^* )</td>
</tr>
<tr>
<td>Sub. age</td>
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<td>( -.09 )</td>
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<td>( .18 )</td>
<td>( .07 )</td>
<td>( -.10 )</td>
</tr>
<tr>
<td>Extraversion</td>
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<td>( .02 )</td>
<td>( -.03 )</td>
</tr>
<tr>
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<td>( .22^* )</td>
<td>( .27 )</td>
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<tr>
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<td>( -.03 )</td>
</tr>
<tr>
<td>Conscientiousness</td>
<td>( .27^* )</td>
<td>( .12 )</td>
<td>( .12 )</td>
<td>( .04 )</td>
</tr>
</tbody>
</table>

Note: Gender with 1 = male, 0 = female, education with 1 = higher education, and 0 = lower education, subjective age was measured as the difference between actual age and felt age. In a third model, interaction effects between personality and age were measured. One interaction was found. This is reported in the text.

\( ^{p < .05} \)

\( ^{**} \) \( p < .01 \)

Fig. 1. Interaction effect of age and subjective age on instrumentality.

(Weiss & Lang, 2012). A more open-ended perspective fits well to the instrumentality motive: to invest in future goals older people need to believe in a distant future.

This is consistent with assumptions of Fingermann and Perlmuter (1993) as well as with socioemotional selectivity theory. We found that social motives are more important to older adult learners and the acquisition of knowledge that is helpful for the future is more important to younger adult learners and older learner with a more open-ended future. This influence of subjective age is an effect that should be investigated more deeply in the light of socioemotional selectivity theory. Usually socioemotional selectivity theory research only focuses on influences of chronological age. In future research it could be helpful to look more carefully at subjective age effects, because this influences peoples life time perspective. Life is perceived as more open-ended if people subjectively feel younger and this might change motives like the motivation to invest in the future and maybe also other motives which are not researched in this light so far.

Age is the strongest predictor for all motives except for instrumentality in the second study. Personality, gender and education were predictors for some motives but none of the effects was stable enough to be replicated in both studies. Moreover, feeling younger influenced life satisfaction and personality in positive ways. Regarding personality, only a chronological age difference for neuroticism was found in both studies, older adult learners were less neurotic than younger adult learners.

It needs to be taken into consideration that our findings are partly or fully attributable to cohort differences. Obviously, this possibility can only be ruled out when implementing the learning motivation items in a longitudinal study. Improved understanding of developmental changes in learning motivation seems relevant for future planning of lifelong learning.
Clearly, one caveat when interpreting the findings of this study is related to bias in sample selection. Not all adults are willing to learn ICT-skills voluntarily, so a group of voluntary learners might be selective. However, these findings will allow clarifying to some extent how learning can be made more attractive for older adult learners. It seems that indeed age and maybe also subjective age are important for the design of learning courses and that education and gender do not make a big difference in ICT-learning. ICT-courses for older adult learners should emphasize on social contact and commitment to the course in both, face-to-face learning and e-learning, where communication can indeed be enhanced by good support and communication tools. This might increase the satisfaction of the older adult learners with online courses, which can be high in general when good support and communication is offered (Hetzner & Held, 2009). Additionally the courses should emphasize on short-term or present-orientated outcomes and on the learning process and the joy of learning itself.

We contend that age-related learning motivation is an important but not yet well understood component of lifelong learning. The findings of this study point to a need for further research on possible ageing-related changes in learning. An experimental study with courses which address only one or two of the possible motives might be an idea. Furthermore a study on learning motives of older adults, who do not participate in formal or informal learning programs regarding ICT-knowledge yet, should be conducted. It should be investigated if these older persons might be willing to learn in the future and which motives potential learners have. Furthermore, other variables that might influence learning motivation should be considered in future research, like the influence of prior experiences with the use of ICT and with different learning courses and contexts.

Improved understanding of learning motivation in older adult learners may serve to attract older adults to learning opportunities and new contexts of lifelong learning. In order to achieve such goals, learning courses may be tailored to better suit the goals and motives of specific age groups. Our findings suggest that a good fit of learning contexts with personal preferences of the learners may contribute to better attendance and learning success.

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