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# Learning with and about Digital Technology in Later Life: A Socio-Material Perspective

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**Abstract:** Literature has widely explored the learning processes with information and communication technology (ICT) in later life, mostly focusing on the individual learner rather than materialities—such as smartphones, notepads, and handouts. The aim of this paper is to introduce a socio-material perspective by focusing on the question: What role do materialities play in digital learning processes in later life? This paper draws upon a situation analysis of data from a qualitative multi-perspective study. Researchers conducted participatory observations of five ICT courses for older adults in Austria and semi-structured interviews with seven trainers and nine older participants (61–81 years). By identifying three social worlds (digital devices, education, and participants' everyday lives), the findings show how ICT-learning processes are embedded in the everyday lives of older adults and include not only digital, but also everyday materialities, such as pens, paper and books. These material convoys of digital learning in later life are vital in facilitating successful technology appropriation in later life.

**Keywords:** learning in later life; socio-material perspective; ICT-courses; situation analysis



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## 1. Introduction

Digital infrastructures increasingly shape the experiences of age and aging. While older adults are often seen as 'laggards' in their technology use and are consequently seen as 'outsiders' of digitalization processes, recent studies, especially at the intersection of gerontology and science and technology studies [1], have challenged this thinking and instead framed demographic and technological change as two interrelated and co-constitutive phenomena that together shape the everyday life experiences of older adults in Europe and beyond. Educational gerontology, the scientific discipline concerned with learning in later years [2], has started to explore questions around digital learning in later life, asking how, when, and where older adults successfully learn to use digital technologies and how these processes can be supported through later-life learning. Sayago and colleagues [3], for instance, suggest linking digital learning to real-life needs, learning collaboratively and informally, and adopting appropriate memory aids. Calvo and colleagues [4] describe how older adults can acquire ICT skills similar to younger people, although they might need more time to reach a similar level of mastery. Further, literature focuses on motivational aspects, e.g., the role of social support on motivations to learn ICT, the role of self-efficacy, or experiences of successes, but also the role of anxiety and frustrations or attitudes towards ICT [5,6].

While research in educational gerontology has hence widely explored the motivations for and barriers to digital learning in later life, existing literature also suggests that research has so far primarily focused on older individuals as the main actors of learning in later life that use technologies in the learning process. This literature therefore tends to rely on an overall instrumentalist understanding of digital technologies [7] which might, however, underestimate the complex and multifaceted ways in which digital technologies and older learners interact in later-life learning. In recent years, gerontological research has, therefore,

significantly broadened the scope of technologies in later life beyond viewing them as mere instruments that can be used by older adults [8], but instead questioned how technologies actively shape learning processes in later life. An ethnographic study has, e.g., shown how older adults who engaged with medical alert bracelets learn to understand themselves as frail and vulnerable as a consequence of this interaction [9].

These approaches have started to study age and aging from a socio-material perspective and have put more consideration into the role of materialities in aging research [10–13]. Being heavily influenced by cultural gerontology [14] as well as new materialism [15], studies within socio-material gerontology have developed a conceptualization of age and aging as a socio-material phenomenon that asks how aging and technologies intra-act [16].

Taking such a socio-material perspective on aging and technologies as a starting point, this paper attempts to discern which role diverse materialities play in digital learning processes of older adults. This paper draws upon a situation analysis [17] of data from a qualitative multi-perspective study on five ICT-courses including the perspective of trainers, older participants and our own perspective as researchers. In doing so, the study investigates what role materialities play in digital learning processes in later life and which recommendations arise from these results to successfully support the digital learning of older adults in the future.

## 2. A Socio-Material Perspective on Learning in Later Life

Numerous studies on learning ICT in later life investigate the barriers, reasons, and motivations of older people to learn digital technologies, mostly understanding learning processes as a question of acceptance that happens between different humans [18]. This paper aims to widen this discussion by focusing on the various materialities that shape digital learning processes in later life. What does such a socio-material perspective of learning in later life entail?

First, a socio-material perspective of learning in later life approaches the topic from an everyday life perspective [19]. It focuses on the socio-material practice of learning, asking: What is learning and through which social and material actors is it facilitated in everyday life [20]? Just as traditional approaches of geragogy [21,22], the socio-material perspective situates learning in later life in manifold formal and informal learning spaces. Hence, it considers all learning practices as potentially equally important; for example, through taking explicit and implicit education into account [23]. However, the socio-material perspective contributes to the everyday life perspective in traditional approaches by considering materialities. Consequently, materialities that are relevant in learning processes might be pens, or notepads, but also living rooms, water bottles, coffee mugs, TVs, or radio sets.

Second, a socio-material perspective differs significantly from traditional understandings of learning in how it perceives the outcomes of learning processes. In its most basic form, learning can be considered as processes in which new competences are acquired, or new skills are learned to be used in or outside of learning situations. Rather than seeing learning processes as ways of learning new things, a socio-material perspective extends this to recognize processes of subjectivation [24] where subjects learn to understand who they are–through engaging with other humans, but also with materialities during the learning process. Learning can, hence, "be conceived of as the successive acquisition and embodiment of a repertoire of heterogeneous dispositions or habits" [24] (p. 18) through engaging with humans and materialities. Therefore, learning is a process of positioning and differentiating that produces subjectivities, as through learning, we learn to describe ourselves as competent members of societies, talented children or committed teachers, technological 'laggards,' or digitally fit seniors. Learning, from a socio-material perspective, is thus a process of becoming [19] through engaging with the materialities that are part of that learning process.

Finally, as the name suggests, a socio-material perspective of learning in later life would then ask who plays a role in these subjectivation processes that are relevant in

late-life learning. Materialist approaches towards learning suggest that a variety of actors—including humans and materialities—are involved in learning and socialization processes [19,25], since we both learn with and through our bodies, but also interact with other materialities while learning—whether pens, paper, or screens. From a socio-material perspective, actors in learning processes are, in line with Bruno Latour [26], everyone that modifies an action by making a difference. Rather than being pre-defined by trainers, teachers, or participants in a particular learning situation, actors only become relevant in learning processes through their capability to modify a situation as a series of transformations [27]. In other words, it is not the actors themselves, but the transformative effects they cause in a learning situation that makes them part of a situation as actors.

Further, through negotiations and collective actions of those human actors and materialities, social worlds become visible, which are referred to as 'universe[s] of discourse' [28] (p. 113). Social worlds, thus, entail ways of (inter)acting, 'assemblages of language, motive and meaning' (p. 116)—they describe the ways that different groups of actors create meaning in shared spaces together to 'do things together' [28] (p. 113). In other words, social worlds are referred to as dynamic interactions of meaning making between all elements that shape a situation. Social phenomena, such as technology use or learning in later life, are hence understood as a convergence of multiple interacting influences that always include human actors and materialities, but also discourses, temporal, socio-cultural and spatial elements [17,25].

Consequently, the following empirical analysis avoids imagining learning as an individual process. Instead, it imagines it as a shared social practice that involves humans and materialities that are 'grouped' together in the social worlds of later-life learning. In the data analysis, we therefore focus on the questions:

- Which roles do materialities play in the learning processes of older adults with new digital technologies?
- Which social worlds become relevant when older adults encounter and learn to use new digital technologies?

## 3. Materials and Methods

To explore these questions, this paper draws upon data from a qualitative multi-perspective study on older adults' digital learning experiences, which was conducted over five ICT courses in Austria.

### *3.1. Data Collection*

We collected data from the perspective of trainers and older participants, as well as our own perspective as researchers. First, we conducted participatory observations of the first and the last session from each course to capture the course regarding its interactions and materialities from our perspective. Therefore, we also created sketches of the room, where people and materialities were positioned, and people's movements during each session. Second, we conducted seven semi-structured interviews with trainers to speak about the organization and course goals, as well as trainers' impressions of aging and learning approaches.

Third, we conducted nine semi-structured interviews with older adults to discuss their course participation and learning processes. To gain a deeper understanding of learning processes outside of the course setting, we additionally asked them to keep a visual diary [29] for the duration of the course. Hence, we asked them to be co-researchers and to investigate their everyday lives regarding the following research questions: "Why is it important that older adults use digital technologies?" and "Why is it difficult to use digital technologies in later life?" To answer these questions, interviewees took photos of situations from their everyday lives; for example, from a bus stop when they missed their bus and used their phone to check when the next bus was coming. These photos were discussed after the semi-structured interviews. Most interviewees used their smartphones to take the pictures and sent them to us via the messaging application WhatsApp. However,

one interviewee used a camera to take photos that she printed for us, and another refused to take any photos but participated in a semi-structured interview. In total, we received 103 pictures from the interviewees.

All interviews were conducted between February and October 2020. The interviews with the course participants lasted between 36 and 118 min (Mean = 84 min.), while those with the trainers lasted between 29 and 119 min (Mean = 65 min.). All interviews were audio recorded and later transcribed verbatim (in German), and quotes were translated by one author and verified by two others.

### 3.2. Sample

After conducting extensive online research about various programs offering digital senior education in Austria, we selected and contacted five course providers. To include a variety of course situations, we selected the five ICT courses based on three criteria: organization (non-profit, commercial, governmental), learning approach (peer-to-peer, teacher-centered, intergenerational), and devices (smartphone, laptop). Table 1 shows how the criteria are distributed over the courses. The course providers and the older adults received incentives for their participation, which facilitated the access to the field.

**Table 1.** Course description.

| Organization | Pedagogic Method | Topics |
|---|---|---|
| Non-profit | Peer-to-Peer | Smartphone for beginners 65+ |
| Commercial, private | Teacher-Centered | Smartphone for beginners 65+ |
| Commercial, private | Teacher-Centered | Smartphone for beginners 65+ |
| Governmental | Teacher-Centered | Laptop for beginners 65+ |
| Governmental | Intergenerational | Smartphone for beginners 65+ |

The final sample of interviewees consists of nine participants between 61 and 81 years and seven trainers between 23 and 77 years. Due to the high proportion of female participants in the five courses, the sample consists of eight women und one man (see Table 2).

**Table 2.** Sample description.

| Participants (P)/Trainers (T) | Gender | Age [1] |
|---|---|---|
| P1 | Female | 61 |
| P2 | Female | 73 |
| P3 | Female | 75 |
| P4 | Female | 65 |
| P5 | Female | 71 |
| P6 | Female | 73 |
| P7 | Female | 81 |
| P8 | Female | 78 |
| P9 | Male | 76 |
| T1 | Female | |
| T2 | Male | |
| T3 | Female | |
| T4 | Female | |
| T5 | Female | |
| T6 | Male | |
| T7 | Male | |

[1] To preserve the anonymity of the trainers and the participants, we will not show the trainers' ages.

### 3.3. Data Analysis

Situation analysis [17] was used to analyze the data. This method is based on grounded theory and aims to identify human actors and materialities in a specific situation and the universe of discourses that connect those actors (social world). Thus, the interviews and

observation protocols were first openly coded using the software MAXQDA 2020. This means that in a first step we identified relevant actors and materialities but also other elements in our data. In the second step, a situation map was created for each interview and protocol based on the coded data. The situation map consisted of all elements that played a role in the learning process and illustrated their complex relationships with each other. In the third step, all three perspectives (i.e., trainers, older participants, and researchers) from one ICT course were analyzed together. The situation analysis enabled combining the analysis of the three perspectives into one map per course. Finally, we compared the situation maps of the five courses and identified social worlds.

### *3.4. Limitations*

Several limitations to this study must be acknowledged when interpreting these results. First, it used a sample of only five ICT courses; however, this small sample enabled a deeper look into interviewees' everyday lives and the course situations than a larger sample would have permitted. Second, three of the five courses were organized differently than usual due to the COVID-19 pandemic. Some trainers wore facemasks or face shields, and the participants were asked to leave an empty chair between each other. This might have influenced the course situation, although most participants and trainers did not strictly follow all COVID-19 safety recommendations. Third, the interviewees participated in the visual diary component quite differently. While some sent us many pictures, others focused on special moments from their everyday lives, and one interviewee refused to take any pictures.

## 4. Results

Materialities such as pens, paper, digital devices, or seating arrangements played an important role in the learning processes we analyzed. Data showed that even though learning processes were clearly directed towards the digital device that was to be learned by older participants, there were also many other materialities at play in these learning situations. The diverse materialities represented different experiences, meanings and discourses that were present in the analyzed learning situations. Referring to Clarke [17], we want to understand those different discourses as social worlds or connected 'universe[s] of discourse' [28] (p. 113) that together shape the learning processes in later life.

Clarke and Star [28] describe how multiple social worlds, represented by different materialities, can intersect with each other, if they share conditional elements and commitments [28] and might sometimes even stand in conflict with each other. The intersection between the distinct social worlds in the situation shapes the learning processes and, in turn, the learning outcomes.

To grasp this diversity of materialities and their manifold meanings, we therefore aim to differentiate between the three social worlds, and its materialities, that are relevant in our data: (1) The social worlds of digital devices, (2) the social worlds of education, and (3) the social worlds of older adults' everyday lives. In the following we will first introduce these three social worlds and then discuss the relations and potential conflicts between them and the influence these relations have on learning outcomes.

### *4.1. Social World of Digital Devices*

The social world of digital devices was the first relevant world in the analyzed learning situations. Every participant brought their own digital device to the course (see Figure 1a)—sometimes even more than one device. Some participants, such as the woman in Figure 1b, brought a laptop and smartphone to the course and tried to work with both. These digital devices formed a social world with the participants and trainers by shaping the learning situation through their (1) functions, (2) design, and (3) complexity.

(a) (b)

**Figure 1.** Participants' visual diaries: (**a**) Course room: Projector separating trainer from participants (**b**) Course room: Assorted digital devices are used during the course.

First, the different operating systems on the digital devices often made it hard for trainers to manage the various devices according to the learning situation. As a result, some trainers did not allow people to participate in an Android or Windows course with Apple products (T7, male). Nevertheless, there were many cases where participants had the right operating system but an older version or a different device manufacturer. In such cases, participants could not access all the functions being taught, join exercises, or they required a lot of attention from the trainers, which tended to disrupt the course situation (T6, male).

> *One person has a Samsung, the other one a Huawei and the third one has an LG smartphone. Then, you cannot follow his thing [the trainer's agenda] anymore because it becomes bogged down in details. ( . . . ) Explaining it to everyone and finding a common ground, so that everyone has the same picture in front of them, that takes way too long, because they [the smartphones] are too different.* (P9, 76 y., 94)

Second, data indicated that the digital devices often had an unsuitable design for use by older adults—especially those with health limitations. One interviewee described how small the course laptop's "on" button was and how such small and barely visible buttons are a general problem for older adults. She explained that not finding the buttons makes her nervous and frustrated in the course situation (P6, 73 y.). Therefore, digital devices serve as a representation of negative discourses of aging by constructing old age in the light of frailty and health limitations. Further, this required the trainers to handle the complexity of the interaction between participants and digital devices, which they do by trying to react calmly when the participants become nervous or discuss those discourses of aging in the course. In one course, the trainers even prepared touch pens for the participants in case one had trembling hands or arthritis (T3, female).

> *One had a slightly skewed finger and that didn't work with the touchscreen, and she got totally nervous. Therefore, I said: "It's ok, no worries, right?" and then she tried it again. They immediately become stressed out because they want to do it right.* (T3, female, 215)

Third, the digital device is regarded as highly complex by both the trainers and the participants. The complexity lies in their diverse functions, but also that those functions are continuously changing (e.g., through updates). This continuous development of digital devices also structured the learning processes for participants as well as the trainers. For example, interviewees often described the digital learning processes as "never complete," because they had to update their devices regularly (P6, 73 y.) or bought new ones that repeatedly confronted them with a new appearance and functionality: "And if you get a new smartphone, then everything is different again, then you have to relearn it again.

That is the problem!“ (P3, 75 y., 250) This was a third layer of digital device complexity that trainers had to handle in the analyzed learning situations: The trainers described the challenges they encountered when designing curricula or planning courses in advance, as they had to adapt to the complexity of digital devices; they needed to be flexible and open to questions and problems that the digital devices introduce during the course (T4, female):

> *Since when I want to learn a language, then I go there to learn this language and that's a clear path: I need my vocabularies, I know it's about conversation and there is also a clear structure to the curriculum. The technology is so broad and so multi-faceted, and there are so many questions possible, so that some [participants] do not even have questions in the beginning, because they don't know where to start. ( . . . ) Therefore, it is really effective, that it [the course] has more modules, because when I hear something new, I try it out at home, then the questions come up and I can bring them back to the course, and that works. That is different from learning a language.* (T4, female, 170)

This flexibility, however, sometimes also meant that participants found it hard to follow the course (P7, 81 y.) and described how they perceived the learning situations as unstructured or even chaotic (P7, 81 y.). Others described how other participants' questions interrupted the course, detracted from the original topic, and made the course boring (P9, 76 y.).

> *Well, sometimes it was too long-winded, right? Since at the beginning, I had a neighbor who said: "Well that's too boring for me. That's too boring for me." There was no progression, everyone interrupted, everyone wanted to know something, nobody knew anything and nothing happened. Therefore, she [the neighbor] said: "That what is happening here, is not enough." She did not return to the course.* (P9, 76 y., 133)

### *4.2. Social World of Education*

In addition to the devices themselves, we also identified manifold materialities in the data that played an equally important role in the learning processes: pens, paper, notes, tables, blackboards, or other study materials that participants and trainers brought to the course. We clustered these materialities within 'the social world of education'.

Within this social world, digital technologies were perceived as a matter of education–something that needed to be studied in order to function. Similar to learning a new language, one must study the correct vocabulary (P9, 76 y.; P3, 75 y.) and combinations of steps (P6, 73 y.)—and must always follow those steps (T1, female). For example, one participant compared learning digital device-specific English terms to his English classes from school (P9, 76 y.). This discourse is materialized through different materialities such as notepads and pencils, written handouts, and homework notes which made participants feel as if they were part of a learning situation.

> *You have to study it, you have to switch on your brain. That's not for everyone. I have really great participants who consequently say: "I practice one hour per day."* (T1, female, 245)

Further, we observed that nearly all participants took notes during the course or asked for written, step-by-step guidelines (P6, 73 y.). Therefore, most interviewees relied on clear descriptions and explanations and were afraid to try things out on their own (P1, 61 y.; IP5, 71 y.; IP4, 65 y.). The trainers attempted to provide such instructions whenever possible (see Figure 2b), thereby confirming the need for step-by-step instructions.

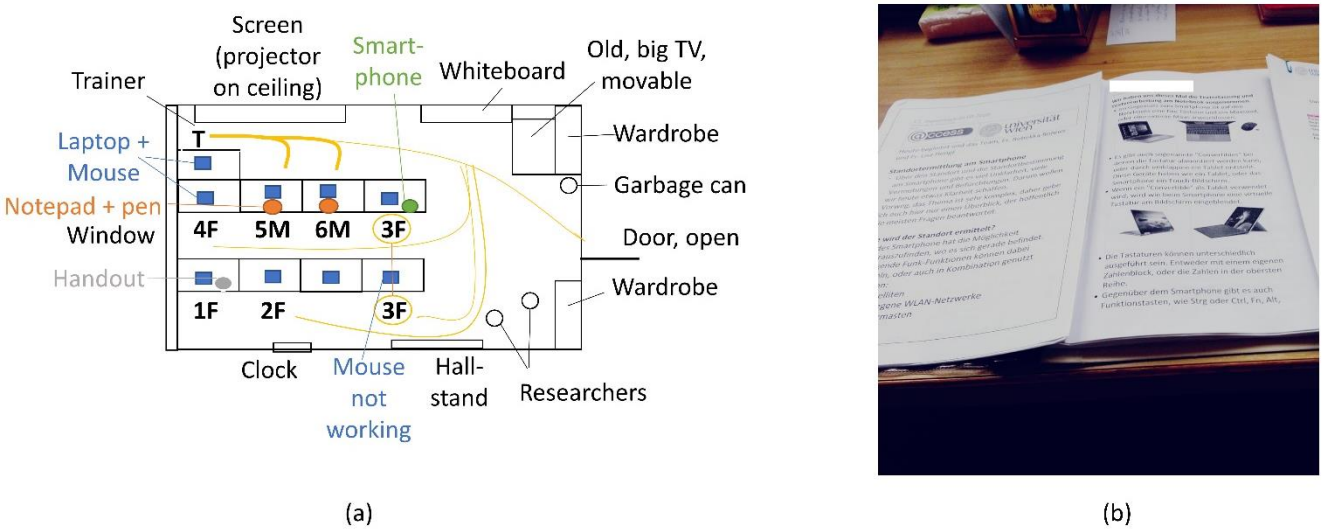



**Figure 2.** (**a**) Researcher's map of the learning situation. Yellow lines represent movement. (**b**) Participant's visual diary: Studying the handout.

> *I go there with my A4 notepad, my ballpoint pen, my smartphone, and the charger, and I just think: "What is new today, what can I try out? What questions do I get answered that I have noted in my notepad? Because that's also important that you note questions from one session to the next."* (P1, 61 y., 100)

> *Well, I usually ask first before I do something, because one can delete various things and then the trainer is naturally not happy when she has to install things again. Thus, it is better to write the things down and ask her.* (P1, 61 y., 112)

In addition to notepads, pencils, and guidelines, we observed that the way tables and chairs were arranged promoted different atmospheres. One trainer explained that they arrange their tables in circles and not in rows to make a coffeeshop atmosphere, because many older adults have had bad experiences with school education and might reject going to a school-like setting (T4, female). Further, all trainers prepared content in advance and usually started the session by giving a lecture of varying lengths using PowerPoint or Word. They stood before the projector and explained vocabulary and functions with a chalk and talk technique (T7, male). Figure 2a illustrates the movements by the trainer who mostly used the space in front of the projector (thick yellow lines). Within the course, all the materialities and learning approaches constructed the social world of education that led participants to believe that digital technology is highly complex: It needed to be studied instead of simply being used.

In this context, we also identified discourses of aging about learning in old age. Participants regarded old age as a handicap in the learning processes, because they felt that they learn slower than younger adults do (P6, 73 y.) and forget the steps more easily (P3, 75 y.). One participant even told us, that she wants to gain digital literacy now, before she becomes older and "even more stupid" (P2, 73 y., 87). Therefore, old age is constructed through this social world as a process of degradation with a negative impact on learning practices.

### *4.3. Social World of Older Participants' Everyday Lives*

The third social world of materialities that shapes digital learning situations in later life was found in the everyday lives of older adults. Their learning processes were not restricted to the classroom, and most encounters with digital technology happened in their everyday lives. Therefore, participants' homes—their living rooms, kitchens, and everyday environments—influenced how they engaged with new digital technologies and how they participated in the course.

Our interviewees were surrounded by digital technology in their everyday lives. They all possessed diverse digital devices such as smartphones (P3, 75 y.), cars (P2, 73 y.), or stereos (P9, 76 y.), and all told stories about how their environment became increasingly digitalized over the last few years (P9, 76 y.; P5, 71 y.). Therefore, their actual encounters with digital technology and the Internet happened outside of the course setting. The older adults came to the learning situation with many positive and negative experiences (T4, female) that needed to be addressed within it. Even though most participants described how interesting this new digital world was (P1, 61 y.; P2, 73 y.; P3, 75 y.), they also shared many stories about situations in their everyday lives where they felt forced to use digital technology (P9, 76 y.; P3, 75 y.; P6, 73 y.) or failed to use it (P7, 81 y.). For example, participant 5 had to acquire an email account because a service provider switched to online-only communication:

> *Well, I thought I don't need it [an email account], but I realize over and over that it does not work without it. Since you always [hear]: "Do you not have an email account? Do you not have this?" For God's sake: "No, I do not!" And now I registered everything. But we are forced to do it, because nobody wants to talk on the phone with someone anymore or somehow personally. Now I thought I have to start with it so I can keep up just a little bit.* (P5, 71 y., 13)

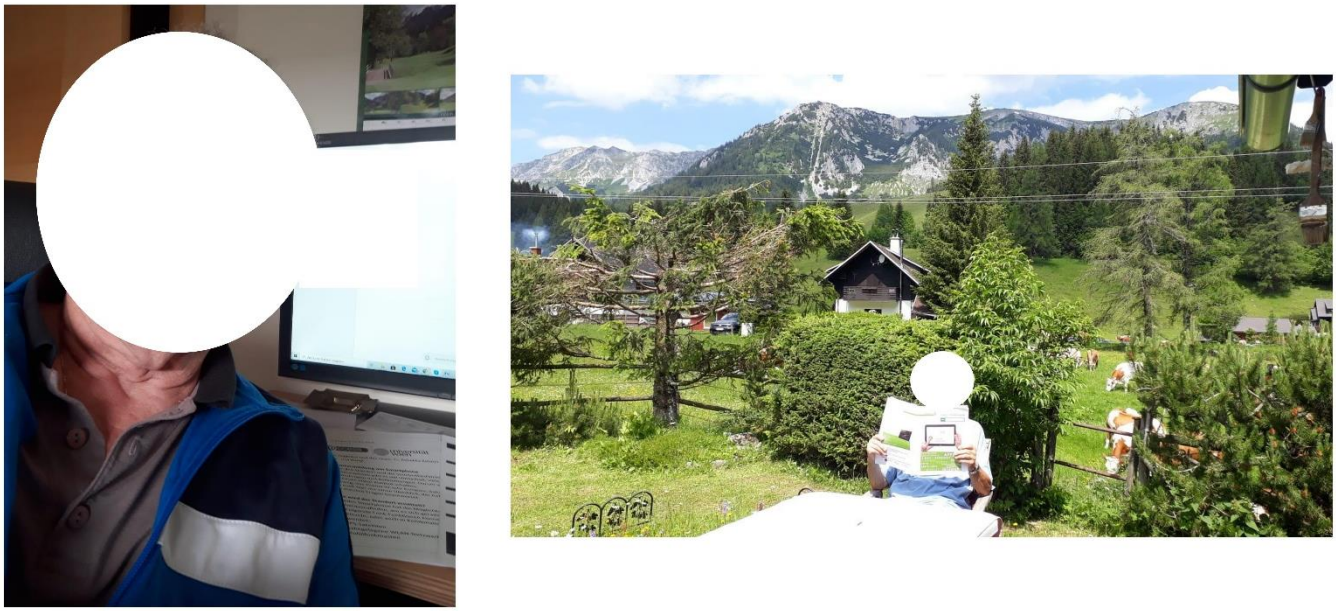
The interviews were strongly characterized by discourses about digitalization and aging. Even though participants were using digital technology in their everyday life, they felt excluded from digitalization processes. Some tried to keep pace with the digitalization; however, believed that due to their age they can never reach the literacy level of younger adults (P6, 73 y.), especially the so called 'digital natives'.

> *My children did not grow up with it [digital technology] either. They needed to appropriate it later as well when they were long gone from school. However, they managed: They understand it faster. They get along with this world easier or faster, let's say it like that. I do not want to say that older adults are more stupid, not at all. But it does not always go as fast as one would want it to.* (P8, 78 y., 120)

Therefore, learning processes are not reduced to the course location since it happens in multiple places and includes multiple materialities. The interviewees described how they practiced, for example, at home in their living room (see Figure 3a; P9, 76 y.) or that they studied the course guidelines at an alpine hut (see Figure 3b: P3, 75 y.). One participant practiced the new functions she learned from the course by teaching them to her friends when meeting up at a café (P2, 73 y.). Another always had a notepad and pencil at hand so that she could write down questions for her trainer whenever she saw or heard something interesting in her everyday life (P1, 61 y.).

> *I write them [questions] down day-to-day. Not just on the day of the course. The A4 notepad is always coming with me. I don't carry it around, but it lies at home where I note the questions.* (P1, 61 y., 128)

Learning processes are, hence, shaped by assorted human actors and materialities in the participants' everyday lives. Two trainers (T1, female; T7, male) tried to take the social world of participants' everyday lives into account by also offering support outside of the course sessions. One participant explained how she started to try things out on her own because she knew that if she has any problems, she could send the trainer a message and acquire help (P2, 73 y.).



(a) (b)

**Figure 3.** Participant's visual diary: (**a**) Skyping with a friend (**b**) Studying the course handout at an alpine hut.

### *4.4. The Relationship between the Three Social Worlds within Learning Situations*

Finally, our data showed that the specific way that the three social worlds relate to each other shapes older adults' learning processes. The three worlds were present in every observed learning situation; however, their relation was quite different in each course setting. In some situations, they even conflicted with each other. Thus, in the following section, we will illustrate the impact of the relations between the social worlds by focusing on three case examples.

#### 4.4.1. Case P2: Alma (73 y.)

Alma's case shows what happens when the three social worlds overlap, and their different logics complement each other. In her case, this promoted long-term course participation, feelings of pride and self-confidence, and the regular usage of digital technology.

Alma participated in the evaluated course using a new smartphone that her husband had bought and installed for her before his death. Therefore, she participated with a fully functional digital device (Social world of digital device). Within the course situation, Alma only used her smartphone to follow the exercises. She did not take notes but helped other participants and thereby repeated the exercises. The trainer focused on individual guidance throughout the exercises and encouraged the participants to help each other (Social world of education). Further, the trainer helped with installing software on new devices and the participants could call her if they had a problem at home. As a result, the education was not restricted to the course lesson. Knowing that she could always ask the trainer for help, Alma started to solve problems on her own, always citing the words of her trainer: "Try it! Nothing can explode!" (P2, 73 y., 118) Now, more than one year after first participating in a course, Alma proudly teaches her friends the new functions she has learned (Social world of everyday life).

> *My friend, well friend, my neighbor in the opposite building, I said: "I just want to tell you, you need to cut my finger off now if you want to get in my phone, because I have fingerprint [password] now." "Me too, me too, me too, I want that too!" Well then, we did it together on her phone. On Friday, when I send you the picture, where I met with friends, he also switched to fingerprint then.* (P2, 73 y., 133–135)

Alma's case illustrates what can happen when the three social worlds overlap. After previously being dependent on her husband's help and explanations, she turned out to be the one who explained digital technology to others. Using digital technology "became [her] second nature" (P2, 73 y., 620). She felt self-confident and "proud" (P2, 73 y., 145) about herself, which shows how the learning process led to her subjectification as a digitally fit senior.

> *It increases self-confidence tremendously because one starts to think: "Well, actually I'm not that stupid!".* (P2, 73 y., 342)

#### 4.4.2. Case P7: Theresa (81 y.)

Theresa's case shows that feelings of guilt and frustration can arise in learning processes if the three social worlds do not overlap and have no common ground.

She joined the course with an older smartphone and therefore lacked half of the functions that were covered in the course and could not join most of the exercises (Social world of digital devices). The trainer defined his role as a "lecturer" (T6, male, 162), stood in front of a PowerPoint presentation, and was separated from the participants by the projector and tables. He prepared his agenda in advance and delivered it, although some participants could not follow along (Social world of education). For Theresa, most of the presented topics, such as how to change a router password, visibly exceeded her digital literacy. As a result, she spent most of her time searching for functions on her phone that she did not have. Furthermore, many of the covered topics were irrelevant in her everyday life, such as the advantage of having two SIM cards—one private and one for business (Social world of everyday life). After completing the course, Theresa primarily felt "lazy" (P7, 81 y., 130) and felt as if she had been more courageous and asked questions, she might have learned something. However, it is "our fault and not his [trainer]" (P7, 81 y., 130) that the participants did not ask more questions. Thus, Theresa's experience led her to perceive herself as lazy and not courageous enough to participate in ICT courses.

> *I went there [to the course] without expectations. I wanted to ask more, what I never actually did. That's also a complex of mine: Never disgrace yourself! And then you are afraid of asking questions. But I was quite satisfied because we could have asked more, right.* (P7, 81 y., 146)

#### 4.4.3. Case P5: Heidi (71 y.)

Finally, Heidi's case shows that conflict between the three social worlds can lead to feelings of displacement and to resignation. Heidi had a smartphone but never learned how to use the Internet, such as Google, before. Thus, she enrolled in the course to learn more about the Internet.

The course content focused on the Internet but used the organization's laptops. Heidi had never used a computer before and did not expect that she would have to use one during the course. Even though she tried to follow along, she had problems with the mouse. Heidi thought that she had used it incorrectly and tried to find out how to operate it. At the beginning of the course, the trainer focused on the participants that could use a laptop and follow her program. She eventually checked on Heidi and realized that the mouse was actually broken and gave her a new one, but Heidi was too frustrated with the experience at that point and tried to follow the rest of the course session on her smartphone. However, the Internet looked different on Heidi's smartphone, which made it difficult for her to follow the instructions (Social world of digital devices). Meanwhile, the trainer presented a little bit of content and then answered all the questions from the other participants in detail. In doing so, the trainer focused on participants who asked a lot of questions, leaving Heidi behind with a feeling of exclusion. (Social world of education). Furthermore, she did not intend to use a laptop in the future, but rather wanted to use the Internet on her smartphone (Social world of everyday life).

> *( . . . ) if there are six people, the trainer cannot focus solely on me. But I didn't know that all of the others had advanced skills and a computer at home. In addition, I am the only*

> *one who doesn't, and there it is somehow—because I just wanted that [Internet] on the smartphone—and because of that, it was a complete mismatch. Thus, my expectations were [low]: I joined it once, but I saw that it doesn't work, right? ( . . . ) And she cannot always be by my side, right? Since then, the others cannot get further, so there I was, completely out of place.* (P5, 71 years, 41)

At the end of the first session, Heidi concluded that it would be best to drop out of the course. Due to this learning experience, Heidi saw herself as technological 'laggard,' especially in comparison to other older adults.

In conclusion, data highlights that the social world of digital devices is not separated from the social worlds of education and older adults' everyday life. In the learning situation, the three worlds are related to, and sometimes even in conflict with each other. In our data, learning to use digital technologies therefore meant not only learning how to deal with one material object–the digital device itself–but it meant managing the diverse materialities that are part of the learning processes. These "material convoys" [30] of digital learning in later life, that consist of, e.g., laptops and smartphones, but also pens, papers, and living room furniture, are vital in facilitating successful technology learning in later life. Not being able to manage the material convoy of digital learning led to dissatisfaction, frustration and even to dropouts.

Data further showed that the different social worlds, and their related materialities, can either overlap and facilitate successful learning processes or be in conflict and make learning processes difficult. For example, older digital devices of participants are only a problem, if the course content is focusing on newer operating systems. Further, even the best step-by-step guideline will not be used if the function in question is not relevant for the everyday life of older adults. Hence, the three social worlds overlap if participants' experiences, values, or needs match throughout the three worlds. Materialities serve as representations of those experiences, values, or needs and can therefore cause a mismatch leading to conflicts between the three worlds. This also suggests that digital learning in later life is a specific process that differs from digital learning in younger age because of different experiences, values, needs, and expectations of the older adults themselves and their environment.

## 5. Discussion

This paper introduced a socio-material perspective on the learning processes with digital technology by using a situation analysis to explore data from five ICT courses. In sum, the researchers conducted 10 course session observations, seven semi-structured interviews with trainers, and nine semi-structured interviews with participants including a visual diary.

First, the data revealed that the digital technology learning processes involve a variety of different materialities that are connected within the course situation through three social worlds as shared spaces of meaning. The social worlds of older adults' (1) digital devices, (2) education, and (3) everyday life encompass multiple human actors and materialities. Materialities such as pens, notepads, tables, projectors, and smartphones shape the learning processes in- and outside the course. Even though literature suggests that other learners, trainers, learning tools, and places of learning influence the learning processes [31], our identification of constructive elements of the three social worlds adds to the literature and calls attention to how multiple interacting influences converge in the learning process. Recognizing the materialities and their interactions in the analysis enabled a broader assessment of the older adults' learning experience and helped to uncover the important role that the design and complexity of digital devices plays in the learning processes. Likewise, it illustrated the ambivalent role of participants' notes and step-by-step guidelines, which the literature considers an appropriate teaching method [32].

Analogous to the material convoy of the life course [30], the material convoy of digital learning in later life consists of various materialities involving not only the digital device, but many other materialities, such as pens and notepads. Thereby, "items assume a place

in the convoy in order to support daily life and functioning, the enactment of social roles, and projects of self-development or presentation." [30] (p. 442). However, materialities can also act as a barrier in learning processes or lead to a mismatch of values and needs. Supporting older adults' digital learning processes therefore also means to support them regarding the management of the involved material convoy.

These findings add to studies suggesting that technology is not a mere instrument, but an actor in the processes of learning ICT. Older adults do not just use but interact with digital technologies in diverse ways [33] and devices actively shape learning processes in later life. Therefore, technologies are not just being used by, but interact with older adults in learning processes by, e.g., constantly changing through updates. This interaction makes the digital learning processes in later life different from other learning processes.

Second, data showed that the specific manner that the three social worlds relate to each other shapes the learning processes—and its associated outcomes—for older adults. In some course situations, the three social worlds overlapped, which led to successful device use and a subjectification as a digitally fit senior. However, the three social worlds conflicted with each other in other situations, which promoted frustration, dissatisfaction, and a subjectification as a technological 'laggard.' This underscores how learning processes are processes of subjectivation in which subjects learn to understand who they are and embody a repertoire of habits [24]. Future research might therefore ask how older adults 'learn' to experience themselves as old [19] and as outsiders of digitalization processes through taking part in digital learning practices.

Third, interview data—especially the visual diary—showed that learning processes in later life are interwoven with older adults' everyday lives. They demonstrate how digital technologies are part of their everyday lives and that the life phase of old age comes with different needs, experiences, possibilities, and motivations. For example, some topics such as the advantage of having two SIM cards—one private and one for business- are irrelevant for retired older adults. Similar findings are implied by the situated learning perspective, which conceptualizes learning as a process that is influenced by the learning context and social interactions. This suggests that learning is not something that is bound to the older individual but becomes rooted in situations where learning takes place and occurs as a social practice [31]. This should be considered when planning interventions and highlights the necessity for linking learning to real-life needs and integrating it into informal support networks [3].

Furthermore, data showed that the three social worlds shape not just the learning processes but construct age and aging as well by transporting various discourses of aging. In other words, how older adults experience age and aging is influenced by their participation in digital learning processes. We therefore argue that the digital learning processes in later life do not happen in a vacuum, it is related to a social world of aging involving various discourses, actors, and relationships to other social worlds. With Alkemeyer and Buschmann [24], we can see that digital learning processes are opportunities, in which "alongside practical and propositional knowledge, identity and social membership are formed" [24] (p. 8). Our research participants therefore did not only participate as older adults in these learning processes, they also learned to be older adults in these situations. Conceptualizing these processes of 'learning to be old' [19] not as an individual process but as a social world could be fruitful for future research because it may help to better understand how those complex situations-like digital leaning processes-construct age and aging.

## 6. Conclusions

Which interventions can be drawn from these results? Applying these findings to intervention development suggests fostering senior education programs that are intertwined with older adults' everyday lives. The learning processes are not restricted to the space and time of the course, which demonstrates the need for courses that offer learning sessions and technical support at home as well as support for buying and installing new devices. To

achieve a better fit between older adults' everyday life and the course content, older adults should acquire a more active role in shaping the learning situation. Further, trainers should reflect on the role of materialities within the course situation. Regarding materialities as actors that actively shape the learning situation could help to better understand and manage the learning processes in later life. In this context, it is important to understand, that digital learning processes in later life differ from those in younger age because of different experiences, values, and needs that are represented through diverse materialities. Therefore, interventions are required that foster trainers' competencies regarding the agency of the material convoy. The findings also suggest that more research is needed about the role of materialities in digital learning processes and the discourses they produce about aging and about the complexity of digital devices.

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## References

1. Peine, A.; Marshall, B.L.; Martin, W.; Neven, L. (Eds.) *Socio-Gerontechnology: Interdisciplinary Critical Studies of Ageing and Technology*; Routledge: London, UK, 2021.
2. Glendenning, F. What Is the Future of Educational Gerontology. *Ageing Soc.* **2008**, *11*, 209–216. [CrossRef]
3. Sayago, S.; Forbes, P.; Blat, J. Older People Becoming Successful ICT Learners Over Time: Challenges and Strategies through an Ethnographical Lens. *Educ. Gerontol.* **2013**, *39*, 527–544. [CrossRef]
4. Calvo, I.; Elorriaga, J.A.; Arruarte, A.; Larrañaga, M.; Gutiérrez, J. Introducing computer-based concept mapping to older adults. *Educ. Gerontol.* **2017**, *43*, 404–416. [CrossRef]
5. Tyler, M.; De George-Walker, L.; Simic, V. Motivation Matters: Older Adults and Information Communication Technologies. *Stud. Educ. Adults* **2020**, *52*, 175–194. [CrossRef]
6. Damodaran, L.; Olphert, W.; Phipps, S. Keeping Silver Surfers on the Crest of a Wave: Older People's ICT Learning and Support Needs. *Work. Older People* **2013**, *17*, 32–36. [CrossRef]
7. Tsai, H.S.; Shillair, R.; Cotten, S.R.; Winstead, V.; Yost, E. Getting Grandma Online: Are Tablets the Answer for Increasing Digital Inclusion for Older Adults in the U.S.? *Educ. Gerontol.* **2015**, *41*, 695–709. [CrossRef] [PubMed]
8. Wanka, A.; Gallistl, V. Socio-Gerontechnology: Ein Forschungsprogramm zu Technik und Alter (n) an der Schnittstelle von Gerontologie und Science-and-Technology Studies. *Z. Gerontol. Geriatr.* **2021**, *54*, 384–389. [CrossRef] [PubMed]
9. Aceros, J.C.; Pols, J.; Domènech, M. Where is grandma? Home telecare, good aging and the domestication of later life. *Technol. Forecast. Soc. Chang.* **2015**, *93*, 102–111. [CrossRef]
10. Calasanti, T.M. Theorizing Age Relations. In *The Need for Theory: Critical Approaches to Social Gerontology*; Biggs, S., Lowenstein, A., Hendricks, J., Eds.; Baywood: Amityville, NY, USA, 2003; pp. 199–218.

11. Gubrium, J.; Holstein, J. Narrative Ethnography. In *Handbook of Emergent Methods*; Nagy Hesse-Biber, S., Leavy, P., Eds.; Guilford Press: New York, NY, USA; London, UK, 2008; pp. 241–264.
12. Buse, C.; Twigg, J. Materialising Memories: Exploring the Stories of People with Dementia Through Dress in "Ageing and Society". *Ageing Soc.* **2016**, *36*, 1115–1135. [CrossRef]
13. Artner, L.; Atzl, I.; Depner, A.; Heitmann-Möller, A.; Kollewe, C. *Pflegedinge: Materialitäten in Pflege und Care*; Transcript Verlag: Bielefeld, Germany, 2017.
14. Twigg, J.; Martin, W. The Challenge of Cultural Gerontology. *Gerontologist* **2015**, *55*, 353–359. [CrossRef] [PubMed]
15. Barad, K. Posthuman Performativity: Toward an Understanding of How Matter Comes to Matter. *J. Women Cult. Soc.* **2003**, *28*, 801–831. [CrossRef]
16. Gallistl, V.; Wanka, A. Connecting the Dots of New Materialist Approaches in the Study of Age(ing): The Landscape of Material Gerontology. *Tecnoscienza Ital. J. Sci. Technol. Stud.* **2021**, *11*, 119–124.
17. Clarke, A. *Grounded Theory nach dem Postmodern Turn*; VS Verlag für Sozialwissenschaften: Wiesbaden, Germany, 2012.
18. Wanka, A.; Gallistl, V. Doing Age in a Digitized World—A Material Praxeology of Aging with Technology. *Front. Sociol.* **2018**, *3*, 6. [CrossRef]
19. Gallistl, V.; Parisot, V.; Wanka, A. Learning to Be Old: 'Doing' Age in the Education of Older Adults. *Int. J. Educ. Ageing* **2018**, *4*, 157–175.
20. Alkemeyer, T. Lernen und seine Körper. Habitusformungen und—umformungen in Bildungspraktiken. In *Reflexive Erziehungswissenschaft*; Friebertshäuser, B., Rieger-Ladich, M., Wigger, L., Eds.; VS Verlag für Sozialwissenschaften: Wiesbaden, Germany, 2009; pp. 119–141.
21. Bubolz-Lutz, E.; Gösken, E.; Kricheldorff, C.; Schramek, R. *Geragogik: Bildung und Lernen im Prozess des Alterns. Das Lehrbuch*; Kohlhammer Verlag: Stuttgart, Germany, 2010.
22. Kricheldorff, C. Alter(n) lernen. *Z. Gerontol. Geriatr.* **2014**, *47*, 549–551. [CrossRef]
23. Bourdieu, P. *Sozialer Sinn. Kritik der theoretischen Vernunft*; Suhrkamp: Berlin, Germany, 1987.
24. Alkemeyer, T.; Buschmann, N. Learning in and across Practices. Enablement as Subjectivation. In *The Nexus of Practices: Connections, Constellations, Practitioners*; Shove, E., Hui, A., Schatzki, T., Eds.; Routledge: London, UK, 2017; pp. 8–23.
25. Höppner, G. Aktant_innen von Alter in Interviews. *Eine Agentuell-Realistische Erweiterung des "Doing Age" Konzeptes*. IfS Working Paper. 2017; pp. 1–15. Available online: https://www.soz.univie.ac.at/fileadmin/user_upload/i_soziologie/3_Forschung/3.7_IfS_Working_Papers/IfS_WP_2017-1_Ho__ppner_AktantInnen_von_Alter_in_Interviews.pdf (accessed on 25 October 2021).
26. Latour, B. *Reassembling the Social: An Introduction to Actor-Network-Theory*; Oxford University Press: Oxford, UK, 2005.
27. Latour, B. On recalling ANT. *Sociol. Rev.* **1999**, *47*, 15–25. [CrossRef]
28. Clarke, A.; Star, S.L. The Social Worlds Framework: A Theory/Methods Package. In *The Handbook of Science and Technology Studies*, 3rd ed.; Hackett, E.J., Amsterdamska, O., Lynch, M., Wajcman, J., Eds.; The MIT Press: Cambridge, MA, USA, 2008; pp. 113–138.
29. Pilcher, K.; Martin, W.; Williams, V. Issues of Collaboration, Representation, Meaning and Emotions: Utilising Participant-led Visual Diaries to Capture the Everyday Lives of People in Mid to Later Life. *Int. J. Soc. Res. Methodol.* **2016**, *19*, 677–692. [CrossRef]
30. Ekerdt, D.; Baker, L. The Material Convoy After Age 50. *J. Gerontol. Ser. B Psychol. Sci. Soc. Sci.* **2014**, *69*, 442–450. [CrossRef] [PubMed]
31. Kim, Y.S. Reviewing and Critiquing Computer Learning and Usage Among Older Adults. *Educ. Gerontol.* **2008**, *34*, 709–735. [CrossRef]
32. Chaffin, A.J.; Harlow, S.D. Cognitive Learning Applied to Older Adult Learners and Technology. *Educ. Gerontol.* **2005**, *31*, 301–329. [CrossRef]
33. Wanka, A.; Gallistl, V. Age, Actors and Agency: What We Can Learn from Age Studies and STS for the Development of Socio-Gerontechnology. In *Socio-Gerontechnology: Interdisciplinary Critical Studies of Ageing and Technology*; Peine, A., Marshall, B.L., Martin, W., Neven, L., Eds.; Routledge: London, UK, 2021; pp. 24–39.