

# Learning in living lab collaboration in primary care – a qualitative study

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## Abstract

**Purpose** – To meet future healthcare needs, primary care is undergoing a transformation in which innovations and new ways of working play an important role. However, successful innovations depend on joint learning and rewarding collaborations between healthcare and other stakeholders. This study aims to explore how learning develops when entrepreneurs, healthcare professionals and older people collaborate in a primary care living lab.

**Design/methodology/approach** – The study had an action research design and was conducted at a clinically embedded living lab at a primary care centre on the west coast of Sweden. Data consisted of e-mail conversations, recordings from design meetings and three group interviews with each party (entrepreneurs, healthcare professionals and older people). Data were analysed with inductive qualitative content analysis.

**Findings** – An overarching theme, “To share each other’s worlds in an arranged space for learning”, was found, followed by three categories, “Prerequisites for learning”, “Strategies to achieve learning” and “To learn from and with each other”. These three categories comprise eight subcategories.

**Originality/value** – This research contributes to knowledge regarding the need for arranged spaces for learning and innovation in primary care and how collaborative learning can contribute to the development of practice.

**Keywords** Innovation, Primary care, Qualitative research, Action research, Collaborative learning, Living lab

**Paper type** Research paper



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## Introduction

As society changes, healthcare needs to adapt. Living labs are an emerging phenomenon used to develop and introduce new technologies and services in various societal arenas, including healthcare (Leminen and Westerlund, 2019; Picard, 2015). Primary care, which forms the backbone of the Swedish healthcare system (Anell *et al.*, 2012), will need to expand to manage demographic change and meet the growing needs for healthcare (Willadsen *et al.*, 2016). Therefore, primary care is evolving to provide more modern, equitable, accessible and efficient healthcare (Ministry of Health and Social Affairs, 2018), and in that transformation, innovations play an important role (Young and Nesbitt, 2017). New products and services should meet existing needs in healthcare, lead to higher efficiency, be safe, user-friendly and fit into the context of use, and to achieve this, fruitful collaborations between industry, academia, healthcare and citizens are needed (Emilsson *et al.*, 2020; Larisch *et al.*, 2016). Such cross-border collaboration enables the necessary learning and knowledge sharing needed to create successful and sustainable future healthcare services (Emilsson *et al.*, 2020).

### *Living labs as an arena for collaboration*

The living lab approach has proven useful in co-creating health innovations (Kim *et al.*, 2020). As living labs can take different forms and cover a variety of innovation activities, there is no single definition of the concept (Westerlund *et al.*, 2018). In this study we define living lab as “physical regions or virtual realities in which stakeholders form public-private-people partnerships (4Ps) of firms, public agencies, universities, institutes, and users all collaborating for creation, prototyping, validating, and testing of new technologies, services, products, and systems in real-life contexts” (Westerlund and Leminen, 2011, p.20). The collaboration between stakeholders is a key element of the living lab approach and is essential for at least two reasons.

First, in the spirit of open innovation (Chesbrough, 2006), it enables organisations to share and acquire knowledge from external sources which, in turn, can lead to improved incremental and radical innovation performance in organisations (Chiang, and Hung, 2010), increased customer satisfaction (Chesbrough, 2011) and be a successful way to address societal challenges (McGahan *et al.*, 2021). As a result, healthcare organisations cannot rely solely on their own research and development. On the contrary, Larisch *et al.* (2016) argue that collaboration with other sectors, such as telecommunications, medical technology, the gaming industry and banking, is crucial for healthcare to take advantage of knowledge-spillovers and keep up with rapid developments.

Secondly, the collaborative living lab approach is advantageous when it is important that a product or service fits a certain context or a specific group of people (Almirall *et al.*, 2012). For example, Nymberg *et al.* (2019) found that older patients in primary care expressed ambivalent feelings towards new technologies and needed tailor-made solutions for user acceptance. Collaboration and involvement of all stakeholders (including users) allows all voices to be heard in the innovation process, resulting in better products and services that are accepted by users and fit the context of use (Holopainen *et al.*, 2018). This is especially relevant for healthcare, with its complexity, various types of users and stakeholders, conflicting interests and wide range of possible solutions to innovation problems (Almirall *et al.*, 2012).

However, although living labs are becoming more common in society, their potential as a platform for knowledge exchange and learning, especially in healthcare, has not been fully explored and realised (Archibald *et al.*, 2021). Previous research has focused on challenges in achieving learning in a living lab collaboration, such as tensions and conflicts of interest between involved parties (Hakkarainen and Hyysalo, 2013; Swinkels *et al.*, 2018), challenges

in contact with end-users (Bergvall-Kåreborn *et al.*, 2010; De Moor *et al.*, 2010) and positions of power and unclear role descriptions (Bygholm and Kanstrup, 2014; Hakkarainen and Hysalo, 2013; Logghe and Schuurman, 2017). However, there is a need to further study the learning processes that occur when stakeholders collaborate in a healthcare context (Emilsson *et al.*, 2020). With this study, we want to contribute to filling this knowledge gap by exploring how learning develops when entrepreneurs, healthcare professionals and older people collaborate in a primary care living lab.

### *Collaborative learning in the light of the sociocultural perspective*

The sociocultural perspective (Vygotsky, 1978) can shed light on how and why individuals learn in collaborative environments. It is based on the central idea that human activities take place in social and cultural contexts and are mediated by various symbolic systems, such as language, art, writings. These socially shared activities are transformed into internalised processes, leading to the construction of new knowledge, meaning-making and cognitive development (John-Steiner and Mahn, 1996). These processes of internalisation happen gradually, “first, at the social level, and later, at the individual level; first between people (interpsychological) and then within the learner (intrapsychological)” (Vygotsky, 1978, p. 57). In a similar way, Billet (2004) describes learning as ongoing cognitive processes, not reserved for specific contexts or interludes but activated whenever individuals engage in social practices, such as work activities or as in this case – a 4Ps living lab collaboration. Accordingly, in this article we regard learning as situated in sociocultural contexts, which refers to “learning through goal-directed activity situated in circumstances which are authentic, in terms of the intended application of the learnt knowledge” (Billett, 1996, p. 263).

While collaboration generally is defined as “the mutual engagement of participants in a coordinated effort to solve the problem together” (Roschelle and Teasley, 1995, p.70), collaborative learning is an umbrella term with no universal definition (Laal and Laal, 2012). However, Haraldseid-Driftland *et al.* (2022, p. 2) point out that it is generally agreed “that it comprises a group of learners, working together to solve a problem or complete a task and it is through these activities and interactions that participants’ learning arises”. In collaborative environments, learning occurs in various ways. In addition to gaining new knowledge, collaborative activities can expand learners’ ability to solve problems collectively, confront ineffective strategies and misconceptions (Brown *et al.*, 1989), understand different roles and provide collaborative skills (Björklund and Silén, 2021; Brown *et al.*, 1989).

However, collaborative activities do not automatically lead to collaborative learning. Dillenbourg (1999) argues that there is no guarantee that expected interactions between people that trigger learning mechanisms actually occur in collaborative settings. Instead, learning in collaboration can be inhibited by various factors, such as a lack of mutual respect and trust amongst group members, lack of time and space for interaction (Day-Duro *et al.*, 2020), lack of collaborative skills, free-riding, unequal competence status (individuals with high competence status dominate over those with low status) and friendship groups (being less self-disciplined and critical) (Le *et al.*, 2018).

## **Methodology**

### *Design*

This study was framed as an action research (AR) design, denoting a change-oriented, democratic and participatory approach (Brydon-Miller *et al.*, 2003; Reason and Bradbury, 2012) where researchers are engaged in the context of their investigation (McKay and Marshall, 2001) and take on both the role of subject and object. The first author (SS) had the role of subject when participating in the design team as a district nurse and living lab

coordinator and the role of object and researcher when collecting and analysing data. The combination of AR and living lab methodology has proven to be effective, as these two approaches complement and reinforce each other. By being able to swiftly capture the perspectives and viewpoints of the users during the living lab activities, there is an opportunity to co-create and implement practical solutions to the issue at hand (Logghe and Schuurman, 2017).

### *Empirical setting*

This study was carried out in a living lab located at a primary care centre (PCC) on Sweden's west coast. The living lab is clinically embedded, which means that the healthcare professionals, in addition to their clinical work, participate in developing and testing new products, services and working methods together with industry and other stakeholders. This study describes a living lab project where entrepreneurs, healthcare professionals and older people co-create an informational film on fall prevention to be shown in waiting rooms at PCC and other public places in the community. The company involved develops 3D patient-information films for healthcare to be displayed on waiting room screens and viewed online in patients' homes.

### *Selection of design team participants*

The first author (SS) used purposive sampling (Clark *et al.*, 2021) to select suitable candidates for the design team (Table 1). A registered nurse from PCC was asked because she had previous experience working with older people in home healthcare. A municipal occupational therapist was asked because she had experience of working with older people both in the municipality and in primary care, and thus perspectives from both environments. After the first design meeting, we realised that we were missing the end user perspective in the discussions and therefore two older people with experience of fall accidents were asked to be a part of the design team. All participants received oral and written information about the study, and all gave their voluntary and informed consent to participate.

### *Data collection*

The data collection process lasted from December 2019 to June 2021 (Figure 1). Data consisted of e-mail conversations containing feedback and planning, audio recordings from three design meetings and three group interviews with each party: the entrepreneurs, the healthcare professionals (registered nurse and occupational therapist) and the older people. Focus group discussions (Krueger, 2015) were used in the design meetings (Hevner, 2010). In

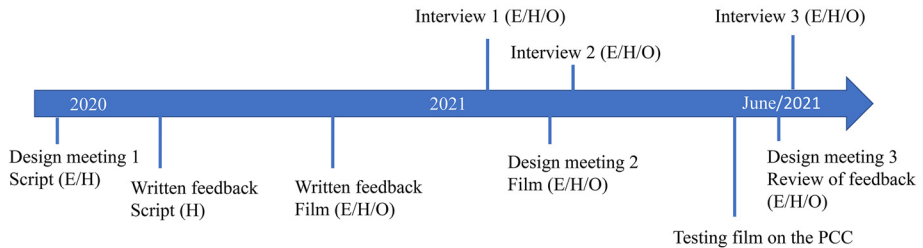
Role	Gender	Age	Profession	No. of years in the profession
Entrepreneurs	Male	34	3D-animator, self-employed	8
	Male	34	3D-animator, self-employed	8
Healthcare professionals	Female	50	Occupational therapist	11
	Female	49	District nurse*	26
	Female	32	Registered nurse	9
Older people	Male	79	Former civil engineer	43
	Female	75	Former social worker	45

**Notes:** \*The district nurse participated in the design process but was not interviewed

**Source:** Authors' own work

**Table 1.**  
Demographics and  
background of the  
design group  
participants ( $n = 7$ )

E = Entrepreneurs  
H = Healthcare professionals  
O = Older people



**Figure 1.**  
Data collection  
process

**Source:** Authors' own work

the first design meeting, the discussions focused on the script, the second on the film's graphical content and the third on the evaluation of the testing of the film at PCC (Table 2). The first design meeting was at the PCC, while the next two were virtual. All interviews were conducted virtually, except for the first interview with the entrepreneurs which took place at the company's premises. The first author (SS) conducted the interviews with the older people while the entrepreneurs and the healthcare professionals were interviewed by

Participants	Description of design process*
<i>Design meeting 1</i> 2 entrepreneurs 3 healthcare professionals	Focus: the film script. The entrepreneurs read up on fall prevention and prepared a manuscript that was sent to the healthcare professionals to read before the first design meeting. The discussions concerned textual content (add/remove), language use and film outline
<i>Design meeting 2</i> 2 entrepreneurs 3 healthcare professionals 2 older people	Focus: the graphic content and design. The entrepreneurs produced an initial draft of the film based on the manuscript and feedback from the first design meeting. The film was sent to the healthcare professionals and the older people who watched it and provided written feedback. The entrepreneurs adjusted according to the feedback and made a new film version before the second design meeting. Feedback mainly concerned the graphic content, such as animations, images, colours and finding a suitable narration speed
<i>Design meeting 3</i> 2 entrepreneurs 3 healthcare professionals 2 older people	Focus: testing and evaluating the film at the PCC. Before the third design meeting, the film was displayed on two waiting-room screens at the PCC. The first author asked 30 patients after their visit to the PCC if they had seen the film and what they thought of it in order to gather feedback and determine how many patients actually watched it while they were sitting in the waiting rooms

**Table 2.**  
Outline of the living  
lab intervention

**Notes:** \*Between the design meetings, there was e-mail correspondence that mostly contained feedback on the script/film and planning  
**Source:** Authors' own work

the second author (AS). The semi-structured interviews were based on an interview guide containing open-ended questions on the subject area of learning in collaboration. Examples of questions were “What are your reflections after the last design meeting? How did you prepare for the design meeting? How did you experience the collaboration? Did you learn something new? What did you contribute? What makes it easier/difficult to share your knowledge and experience in a setting like this?” To get rich descriptions, the questions were followed up wherever necessary with probing questions (DiCicco-Bloom and Crabtree, 2006) such as “What do you mean by [...]?” and “Can you explain further how [...]?” The focus group discussions lasted on average 68 min (39–96 min) and the interviews lasted on average 45 min (26–68). The entire data set comprised 300 pages of text.

### *Analysis*

Data were analysed based on inductive qualitative content analysis with a focus on both the manifest and the latent content of the text (Graneheim *et al.*, 2017; Graneheim and Lundman, 2004), performed as follows. All recorded material was transcribed verbatim. All texts were initially read several times to get an overall picture of the content and gain an understanding of the text’s essential meaning. With the aim of the study kept closely in mind, meaning units, i.e. words, sentences or paragraphs that contained related aspects in content or contexts, were identified. Meaning units were condensed into shorter text, without losing their core meaning. The condensed units of meaning were abstracted into codes which were then compared and sorted by similarities and differences. This extensive process ultimately resulted in the emergence of subcategories. Subcategories with similar content were grouped into categories. Finally, the categories were abstracted and summarised in an overarching theme (Table 3). Throughout the analysis, the first author strived to adhere as faithfully as possible to the data by reading back and forth between meaning units, codes, subcategories and categories. Various levels of abstraction and interpretative possibilities (Lindgren *et al.*, 2020) were discussed and reflected upon together, involving all authors until the most probable interpretation of the data was agreed upon.

### **Findings**

This study aims to explore how learning develops when entrepreneurs, healthcare professionals and older people collaborate in a living lab in primary care. The findings are presented with the overarching theme “To share each other’s worlds in an arranged space for learning” followed by three categories: “Prerequisites for learning”, “Strategies to achieve learning” and “To learn from and with each other”, with eight subcategories (Table 4). The overarching theme reflects how learning develops through parties exchanging knowledge, experiences and perspectives. Moreover, it highlights the need for time, place and a mandate to meet and the learning space requires given frameworks or structures for learning to be optimised.

#### *Prerequisites for learning*

For learning to take place, certain basic preconditions were needed, such as everyone’s involvement and contribution to the collaboration and to have a favourable learning environment. Moreover, the collaborating parties needed space for interaction.

#### *Involvement and contributions of all parties*

Learning developed in interplay between the parties and thus each party was an important piece of the puzzle, needed to make the picture of the problem area clear and understandable. Although no piece was more important than any other, both the entrepreneurs and the

**Table 3.**  
Examples from the  
analytical process

Meaning units	Condensed	Code	Subcategories	Categories	Theme
<p>"Before, there has been more feedback from care... that is care recipient perspective. Or, sorry, I mean the caregiver perspective, and yesterday it was more care recipient perspective. Both are very interesting and important, but they are different... they are slightly different perspectives".</p> <p>"It would have been good to know the schedule to be able to stay a bit updated as you work completely with other things in between..."</p> <p>"... I feel like it is a kind of expertise in that sense that it is actually only we who have the age... who can tell</p>	<p>Both caregiver perspective and care recipient perspective are very interesting and important, but they are different</p> <p>Need to know the schedule to be able stay up to date</p> <p>Our expertise is in knowing how it is to be old</p>	<p>The different perspectives are interesting and important</p> <p>Need to know the schedule</p> <p>Sharing experience based knowledge</p>	<p>The involvement and contributions of all parties</p> <p>To need a clear structure and plan for collaboration</p> <p>To share knowledge experiences and perspectives with each other</p>	<p>Prerequisites for learning</p> <p>Strategies to achieve learning</p> <p>To learn from and with each other</p>	<p>To share each other's worlds in an arranged space for learning</p>

**Source:** Authors' own work

**Table 4.**  
Overarching theme,  
categories and  
subcategories

Overarching theme	Categories	Subcategories
To share each other's worlds in an arranged space for learning	Prerequisites for learning	The involvement and contributions of all parties To have a favourable learning environment To have space for interaction
	Strategies to achieve learning	To need a clear structure and plan for collaboration To use previous experiences in a new and unknown context To test in a real-life environment for learning
	To learn from and with each other	To share knowledge, experiences and perspectives with each other To reflect, consult and discuss together

**Source:** Authors' own work

healthcare professionals found the older people's contribution most rewarding, as it provided a wholly new perspective, namely, that of someone growing old and living with an increased risk of falling. However, involving the end-users in the design process was a new and unexplored experience for the entrepreneurs, as in previous collaborations with hospital clinics they had difficulty contacting patients:

This time, it appears that we have included all parties, as well as the entire circle of users. [...] So far, it feels like the collaboration has been more fruitful than previous collaborations in which we only worked with clinics and did not involve patients. (Entrepreneur 1, interview 3).

There was a consensus that everyone's contribution to the collaboration was crucial for learning and for producing a good and valid product. The healthcare professionals described their contribution to the collaboration in general terms as contributing knowledge based on clinical experience. In addition to knowledge of the design process and the technical platform, the entrepreneurs described their main contribution as being receptive, listening to feedback and incorporating it into the film. One of the older people was very clear that their contribution was to convey the experience of an older person related to the risk of falling, while the other one learned the importance of their contribution during the collaboration:

When we were asked to join in the first video conference, you sort of wondered why we should participate really. That was at least my reflection, 'I won't have anything to contribute to this.' But as the process got underway, you realise that input from everyone is really important to progress and, in the end, produces a great product. (Older person 2, Interview 3).

#### *To have a favourable learning environment*

The entrepreneurs played an important role in conveying a positive expectation of the collaboration, and they strived to listen actively and be open-minded. As the entrepreneurs praised and confirmed feedback, the confidence of the other parties to share knowledge, experience and perspectives increased:

These guys were very humble. It was not at all threatening, but they said 'we will fix that,' and 'we have not thought about that,' and so on [...]. (Older person 1, Interview 2).



Mutual respect and trust were also important for a favourable learning environment. The older people described how engagement in the project increased when they felt listened to and engaged in respectful dialogue. The entrepreneurs stressed the importance of recognising, valuing and trusting each other's expertise and being able to compromise when necessary:

[...] we trust their medical expertise and they trust our expertise. So, you have to meet somewhere in the middle. (Entrepreneur 1, Interview 1).

#### *To have space for interaction*

The collaborative parties needed space, that is, time, a mandate and a place, to meet and interact. The time aspect was particularly noticeable for the healthcare professionals. The ongoing COVID-19 pandemic generated a wealth of additional tasks in an already strained organisation, and although healthcare professionals had their employer's mandate to participate in the living lab collaboration, they had moral concerns setting aside time to prepare for the design meetings when more urgent clinical matters needed to be addressed. Thus, they did not feel optimally prepared for the design meetings:

Well, it's only vaccine in my head right now [...]. (Healthcare professional 1, Interview 2).

One of the older people pointed out the need to have an arena where you can meet and discuss and share knowledge and experiences with each other to innovate. As an example, he told of a radio programme he had heard that described why so many researchers from a particular laboratory at Cambridge University received the Nobel Prize:

[...] It is because of the canteen", he [the professor] said. That it is organised in a way that scientists from different disciplines sit and have lunch together and chat, 'well, have you been doing that? Yes, that was interesting' and so on [...] and so the beginning of a collaboration emerges, instead of people sitting isolated in groups and never having any contact with each other. And then I think it must be the same in healthcare. (Older person 2, Interview 1).

#### **Strategies to achieve learning**

To achieve learning, strategies were needed that facilitated the interaction and the sharing of knowledge and experiences. To have a clear structure and plan that all parties understood proved to be important as well as trying out previous experiences in a new and unknown context and testing the film in a real-life environment.

#### *To need a clear structure and plan for collaboration*

Regardless of collaborating with primary care or hospital clinics, the entrepreneurs found it challenging to explain and make the work process understandable for the other parties. Without understanding the work process or being able to visualise the end result of the film, the healthcare professionals were unsure of what type of feedback was relevant, which inhibited them from sharing knowledge and experiences. As the understanding increased, it was easier to give feedback, which happened at the end of the project:

[...] it was a pity that you did not have a structure to follow all the way because you could have contributed *even more*. It was only when you began to understand the whole film and what it might look like, that you could give even more [feedback]. (Healthcare professional 2, Interview 2).

For the older people, it was important that someone had the task of leading and structuring the design meetings. Being unfamiliar with the setting, they were not entirely comfortable

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taking advantage of the opportunities at hand and therefore found it helpful when they were encouraged to reflect and share their thoughts:

It is especially evident in a reference group, like us, who are not used to ‘promoting oneself’ in a setting like this. At such times I do believe we could do with a bit of help. (Older person 2, Interview 2).

#### *To use previous experiences in a new and unknown context*

Previous experiences served both as a structure and a stimulus for learning, as these experiences were interpreted and adapted to the new context and thus transformed into new knowledge and skills. The entrepreneurs had previous experience of collaboration with hospital clinics and were aware that the primary care context differed from these collaborations, as primary care was a new and mostly unknown context for the entrepreneurs:

Yes, well [...] it’s a bit new. We do not know exactly. [...] So, it will be interesting to see if this process, both the film and the process of developing the film, differs from that [previous experiences of collaboration] [...] and also how the area of use develops. (Entrepreneur 2, Design meeting 1).

In previous collaborations with hospital clinics, the entrepreneurs had developed structures and efficient work processes that were used in the collaboration with primary care. However, the entrepreneurs had a flexible approach to the work processes, as they knew these might not be suitable for primary care:

It is not set in stone that it must be done exactly this way. However, we have seen that it works on the hospital side, so we have tried to do something similar here. (Entrepreneur 2, Design meeting 1).

During the collaboration, several differences regarding both context and processes turned out to be greater challenges than originally expected, such as the accessibility aspect and the distribution and implementation process. These differences were discussed and reflected on together and they learned that some processes needed to be adjusted and adapted to the primary care context.

#### *To test in a real-life environment for learning*

In the final step of the design process, the film was tested at the PCC, providing information and new insights that would not otherwise have been available to either party. For example, the parties learned that very few patients (4 out of 30) watched the film in the waiting room during their PCC visit. This new knowledge was discussed and reflected on together during the third design meeting. The parties jointly brainstormed alternative ways to distribute the film, rather than showing it on waiting room screens, resulting in adjustments to the film’s distribution plan. The lessons learned from the test were also valuable to the PCC, which relied to some extent on waiting room screens as an information channel to convey health-related information:

[...] we can utilise the experience of the waiting room trial and simply find a more effective solution for the distribution [of the film]. (Entrepreneur 1, Design meeting 3).

#### *To learn from and with each other*

The sharing of knowledge, experiences and perspectives with each other and reflecting, consulting and discussing together were at the heart of the learning process.

*To share knowledge, experiences and perspectives*

The parties shared knowledge, experiences and perspectives with each other, which formed the basis for learning and gaining new knowledge. The healthcare professionals felt both knowledgeable and not-so-knowledgeable in the field of fall prevention. They felt knowledgeable because they all had experience working with older people and with fall prevention, albeit to varying degrees. However, since fall prevention is a very comprehensive topic, it was difficult to have up-to-date knowledge in all areas. The healthcare professionals shared knowledge that related to their profession, experiences from working with older people and the context of primary care.

To increase understanding of what it is like to be old, the older people shared their experiences of ageing and living with an increased risk of falling. Some experiences were of the kind that older people do not often talk about, such as how cognition and perception deteriorate with age, making it difficult to perceive information delivered too quickly. By exchanging experiences, tacit knowledge could thus contribute to the film's design:

But it's not something you really talk about. You don't say, 'I don't keep up'. You just let it pass. (Older person 1, Interview 2).

The feedback mostly contained suggestions for or corrections of textual and graphical content, but also confirmations that content was accurate and relevant. The feedback enabled the entrepreneurs to adjust and improve the film:

After that meeting, we had a good idea of what was wrong and what was right and what to add. (Entrepreneur 1, Interview 1).

*To reflect, consult and discuss together*

When the parties consulted, discussed and reflected together, new challenges and unresolved issues were identified. One such issue was the conflict between theory and practice, as not all fall prevention guidelines were applicable and could be prioritised by practice. It was a balancing act of not promising services that the PCC could not deliver and at the same time of following the current recommendations for fall prevention. In such cases, it was important that the text was formulated in such a way that all parties could support the content.

Listening to each other helped the parties to develop their own thinking and understanding. Moreover, new insights, ideas and solutions emerged:

[...] these thoughts about the [film's] speed came up during the meeting. I had not thought of that before either, but it came to my mind as I sat there. (Older person 2, Interview 2).

**Discussion**

In this study, we found a pattern where three categories appear to be important for collaborative learning to develop, namely, prerequisites for learning, strategies to achieve learning and learning from and with each other. These three categories are interconnected and form an arranged learning space, enabling entrepreneurs, healthcare professionals and older people to interact and share each other's worlds. Together, they seemed to have a synergistic effect on learning outcomes.

For learning to develop, an environment was needed that invited interaction and the exchange of knowledge and experiences. Based on the sociocultural perspective, the findings show that collaborative learning emerges from mutual interaction marked by respect and trust between the participants. Notably, the findings suggest that the entrepreneurs played a crucial role in fostering an atmosphere of trust, respect and

psychological safety within the living lab environment. Previous studies also confirm that environments that nurture psychological safety encourage learning and innovation by allowing individuals to freely express their thoughts, receive and provide honest feedback and experiment with new ways of doing things (Andersson *et al.*, 2020; Day-Duro *et al.*, 2020; Edmondson, 1999). Thus, this study suggests that trust and respect between collaborating parties are vital in creating high-quality collaborations that enhance learning, and that the entrepreneurs have a prominent role in this process.

A significant finding was that testing the fall prevention film in its intended context proved to be a valuable learning strategy. This finding is based on the sociocultural assumption that learning occurs in interaction with social and cultural contexts and practices (Vygotsky, 1978). The test at the PCC provided context-specific information on how the end-users perceived the film in its intended use and thus supplemented the context-specific, professional and experiential knowledge of the healthcare professionals. This is particularly important as context-specific knowledge is a key factor in developing successful innovations, even more so when it is the product's application rather than the technology itself that is the primary innovation (Emilsson *et al.*, 2020). By enabling tests in context of use, the living lab setting thus brought a new dimension of context-specific knowledge to the collaborative learning process that has the potential to broaden our understanding of collaborative learning.

In the findings, learning with and from each other formed the very essence of collaborative learning in the living lab context. From a sociocultural point of view, learning is not solely an individual cognitive process, but rather occurs through social interactions with others and the cultural tools and practices that are used in those interactions (Vygotsky, 1978). In this regard, visual artifacts such as a film can be seen as a cultural tool (Mutekwe, 2014) or boundary object (Singh, 2011) that facilitates communication and collaboration, making it possible to find common ground and negotiate shared meanings. Boundary objects often act as intermediaries between different perspectives, enabling people from different backgrounds and areas of expertise to understand each other's perspectives and work together towards a common goal (Wenger, 2000). As the partners consulted, discussed and reflected together, new knowledge and understanding emerged and were internalised within the individuals.

Another interesting aspect of collaborative learning in a living lab context is that it involves integration of both theory and practice as both theoretical knowledge and practice-based knowledge are applied when investigating and solving complex issues. Moreover, the stakeholders' various perspectives revealed tensions between theory and practice which required negotiation and compromise. For example, implementing fall prevention guidelines in the film (theoretical knowledge) was to some extent in conflict with the clinical reality in primary care (practice-based knowledge). This challenge has been recognised in research, showing that primary care providers need approximately 27 h per day to provide guideline-recommended preventive measures for chronic disease and acute care (Porter, 2022). The gap between theory and practice is usually described as a knowledge transfer problem (Van de Ven and Johnson, 2006). However, through the living lab collaboration, this gap was bridged by linking together the theoretical and practice-based knowledge in collaborative learning. In this context, collaborative learning enables applied knowledge, i.e. knowledge which, by integrating both theory and practice, is applicable in a certain situation and context and aims to improve practice.

#### *Strength and limitations*

Like all studies, this study has both strengths and weaknesses. One major strength is its relevance to today's primary care. To our knowledge, the clinically embedded living lab in our study is the only one of its kind in primary care in Sweden. Although living labs are becoming increasingly common in various societal arenas including healthcare, a recent

literature review (Kim *et al.*, 2020) reveals that very few studies have been conducted on living labs in healthcare, which may reflect a case of practice outpacing theory. Thus, this study contributes to filling this gap in research by exploring how learning develops amongst collaborating parties in a living lab in a primary care context.

The fact that the older people were not involved from the start of the project is a potential limitation of this study, as it may have affected their sense of belonging to the design team, which in turn may have affected their learning experiences. However, as they became involved later on in the project, their contribution to the collaboration became more evident to all parties and resulted in a new understanding of the importance of involving end-users at an early stage. Moreover, the Covid-19 pandemic prolonged the study period, causing people to lose some focus and forget between meetings, which may have affected the study's results.

In this study, the first author (SS) had a triple role as a district nurse, living lab coordinator and researcher. Given this rich engagement, and that the purpose was to study complex social processes (Zuber-Skerritt and Wood, 2019), AR was considered an appropriate method (Logghe and Schuurman, 2017). However, AR has been criticised because researchers who are deeply involved in their context of investigation may find it difficult to be objective about their research (Clark *et al.*, 2021). Also, as with most qualitative research, the researcher must remain aware of his or her own prior knowledge to avoid bias during analysis and in the results (Graneheim *et al.*, 2017). To minimise bias, the first author continuously reflected on her diverse roles and how these could affect the other participants in the collaboration. These issues were also discussed with the co-authors, and, for example, it was decided that the second author (AS), who was not a part of the design team, would conduct the interviews with the entrepreneurs and the healthcare professionals to ensure that they could speak freely without reservation. The older people preferred being interviewed by the first author (SS), as they felt more confident when they knew the interviewer.

#### *Practical implications and recommendations*

- *Invest in arranged spaces for learning and innovation in primary care* – To transform primary care, there is a need for arranged spaces for learning and innovation. In today's healthcare, restrictive rules on collaboration, especially in the case of 4Ps, hamper the opportunities to establish fruitful cross-border collaborations that generate learning and innovation (Larisch *et al.*, 2016). Within primary care, innovation sustainability is dependent on supportive networks, political and financial support (Martin *et al.*, 2012; Sibthorpe *et al.*, 2005) as well as competence, capacity and motivation within the organisation itself (Sibthorpe *et al.*, 2005). According to our findings, clinically embedded living labs in primary care can be one strategy for policymakers to promote sustainable collaborative spaces where healthcare stakeholders can interact and learn together to generate well-adapted and user-centred innovations that can drive healthcare development.
- *Involve all stakeholders in the co-creation process* – To ensure that innovations are well-adapted for their intended use, it is vital to involve all stakeholders in the co-creation process. This includes gathering input from various perspectives to ensure the validity and relevance of the innovation as well as testing in the context of use.
- *Ensure well-defined structures for the living lab collaboration* – An important lesson learned is that all living lab projects must be well-defined and comprehensible to all parties involved. In addition to a clear project plan that is accessible to everyone, the various stages of the design process need to be clear and understandable to those expected to contribute their knowledge and experience. For the healthcare professionals, who often have a demanding and task-intensive work practice, it is

crucial to have a clear mandate and designated time in their schedule for preparation and the living lab activity itself. This ensures that they can fully engage in the project and contribute their expertise effectively.

## Conclusion

Our findings suggest a pattern, where prerequisites for learning, strategies for achieving learning and learning from and with each other seem to be important for collaborative learning to develop. Together they have a synergistic effect on learning and create an arranged learning space, enabling entrepreneurs, healthcare professionals and older people to interact and share each other's worlds. Thus, this study implies that arranged learning spaces, such as living labs, comprise enabling structures that facilitate collaboration and joint learning between industry, healthcare and citizens. Moreover, these arranged learning spaces can provide an arena for theory and practice to interact and together create applied knowledge that aims to improve practice by solving complex problems and issues. Thus, collaborative learning together with arranged learning spaces emerges as a key factor in creating health services fit for use in primary care.

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