

Mainstream technologies in facilities for people with intellectual disabilities. A mixed-methods study using the nonadoption, abandonment, scale-up, spread, and sustainability (NASSS) framework

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Abstract

People with intellectual disabilities in residential or outpatient facilities for people with disabilities run the risk of being digitally excluded by not having opportunities for taking advantage of the digitalizations' possibilities. We therefore aim to investigate how disability caregivers and managers describe barriers and facilitating factors to implement and adopt mainstream technology for people with intellectual disabilities in residential or outpatient facilities and how competencies and capabilities of the caregivers are assessed in the procedure. For this reason, we conducted a mixed-methods-study applying the nonadoption, abandonment, scale-up, spread, and sustainability (NASSS) framework. As a result, we identified barriers and facilitators across NASSS domains. 1. Condition: People with intellectual disabilities are a diverse group of people, where the individual condition of the person and e.g. their communication skills were seen as a prerequisite for implementing mainstream technologies. 2. Technology: The extent to what mainstream technology fits the individual needs and demands contributed to the implementation process. 3. Value proposition: Communication was seen as a life area where mainstream technology can add value. Adopters: The caregivers needed competencies and capabilities to accompany their caretakers' technology use. Organization: Missing legal regulations and lack of personnel resources were described as barriers. Wider context: Funding opportunities were seen as unclear in disability services, as mainstream technologies could not be financed as participation benefits. 7. Embedding and adaptation over time: The COVID-19 pandemic has forced facilities to digitalize to some extent, but were still in need of standardized procedures to promote digital participation of their residents.

1. Introduction

The use of digital mainstream technologies such as smartphones, tablets or personal computers (PC) is ubiquitous nowadays and can promote participation of people with intellectual disabilities. Mainstream technologies have been shown to promote digital participation by enabling people with intellectual disabilities to access digital content e.g. by using voice interfaces [1]. The use of social media can promote social participation of people with intellectual disabilities. [2, 3]. Furthermore, mainstream technologies can even be used as assistive devices, for example, to help people with intellectual disabilities to perform daily tasks like getting directions using navigation applications [1, 4]. However, people with intellectual disabilities are less likely to use digital technologies [5]. Compared to people with physical or sensory disabilities, the mainstream technology use of people with intellectual disabilities is even more infrequent [6]. They therefore run the risk of being excluded from digital possibilities and be affected by the digital divide [7]. People with intellectual disabilities often live in residential or outpatient facilities for people with disabilities, which in Germany rarely offer a digital infrastructure for their residents like access to Wi-Fi or digital devices [8]. Service-related IT use by disability professionals in Germany, such as digital documentation systems, has increased in recent years [9]. Nevertheless, facilities for people with disabilities in Germany are in a particularly poor position. In their study, Heitplatz and Sube [10] point out that especially residents living in residential settings are less likely to have their

own internet-ready devices and internet access. The effects of the COVID-19 pandemic have internationally brought the digital participation of people with disabilities into the spotlight, especially in residential facilities. Although the pandemic situation has pushed digital participation to some extent, it has not ensured that digital exclusion will be overcome [11]. In Germany, in particular, the poor digital infrastructure of the facilities and missing support structures have become apparent. The residents' lack of equipment with digital devices, insufficient access to the internet (e.g., via Wi-Fi), and a lack of financial resources became apparent [12–15]. Where access to digital technologies was possible, satisfactory use of digital technologies could not always be guaranteed. A lack of skills and support in using the technologies and their lack of accessibility made their use by people with intellectual disabilities difficult [16, 17].

On the other hand, there are also reports of positive impacts on the digital participation of people with disabilities. People with intellectual disabilities' technology use has increased during the COVID-19 pandemic. Some people even came into first contact with information and communication technologies (ICT) due to removing barriers to access by previously gatekeeping caregivers [18–20].

Research indicates that services for people with disabilities had to find inventive strategies to offer digital solutions during the COVID-19 pandemic [11]. However, there is little evidence in the literature about barriers and facilitating conditions under which technologies can be implemented in residential or outpatient facilities for people with intellectual disabilities and how sustainable this can be. Clifford Simpican et al. [21] investigated staffs' perceptions of challenges in integrating new technologies for people with intellectual disabilities in residential settings and found that this refers to an interplay of several factors like the personal conditions of the residents (like age, abilities or financial resources), skills and time resources of the staff or ethical and safety issues. Ramsten et al. [22] point out that the organizational provision of information about ICT and the development of staffs' ICT-knowledge can be beneficial for developing ICT implementation strategies. But unclear regulations about policy and funding of digital technologies can be a barrier for people with intellectual disabilities in accessing these [23]. In addition, the implementation of ICT in disability services must fit the daily routines and organizational culture [24]. An evaluation of the implementation process from external experts can thereby be seen as problematic, due to the missing view from inside the organization [24].

Barriers and facilitators for implementing new technology are already well explored in other social services like healthcare. The nonadoption, abandonment, scale-up, spread, and sustainability (NASSS) framework [25, 26] is hereby used to investigate technology innovations in healthcare organizations like video consulting systems [27], psychiatric online therapy applications [28] or artificial intelligence (AI) applications [29]. We therefore decided to apply the NASSS-framework to investigate mainstream technology adoption in services and supports for people with intellectual disabilities. The NASSS-framework originally comes from the objective of examining technology innovation implementation in health and social care institutions through an "evidence-based, theory-informed and pragmatic framework" [25]. According to the NASSS-framework, the more complexity there is in a technology-related change process, the less likely is to be implemented sustainably. The framework consists of seven

domains (and sub-domains) that help to reveal different kinds of complexity: 1. Condition, 2. Technology, 3. Value Proposition, 4. Adopters, 5. Organization, 6. Wider System and 7. Embedding and Adaptation Over Time.

To date, there is no research that applies the NASSS-framework to investigate mainstream technology implementation in facilities for people with intellectual disabilities. However, we believe that the framework can be made useful for this purpose. Firstly, the authors [25, 26] point out, that the NASSS-framework can be applied to investigate health as well as social care organizations under which we consider services for people with intellectual disabilities. Furthermore, we assume that services for people with disabilities and health services may be related as some of them involve similar objectives, such as independent living or self-determined mobility. Greenhalgh et al. [30] demonstrate this in their case studies about GPS-tracking, pendant alerts and care organizing software that informed the empirical validation of the NASSS-framework. Finally, studies show that the private use of mainstream technologies by people with intellectual disabilities is strongly embedded in and dependent on the structures of the organization they reside. The residents' technology and internet access can be depending on the facilities' digital infrastructure [6] or on caregivers' competencies, motivation and attitude towards technology [31, 32]. We therefore assume that the usage of mainstream technologies by people with intellectual disabilities residing in residential or outpatient facilities requires a complex implementation and adoption process that can be analyzed with the NASSS-framework. We are therefore addressing the following research questions:

R1: How do disability caregivers and managers describe barriers and facilitating factors to implement and adopt mainstream technology for people with intellectual disabilities in residential or outpatient facilities?

R2: How do disability caregivers assess their capabilities in the technology implementation and adoption procedure?

2. Methods

2.1 Design

We used a mixed-methods approach conducting 14 qualitative semi-structured interviews with staff of facilities for people with intellectual disabilities about barriers and facilitators of mainstream technology implementation. We additionally conducted a quantitative online-survey asking 65 caregivers about their basic information and communication technology (ICT) skill beliefs.

2.2 Interview Study

2.2.1 Recruitment

In the interview study we conducted 14 semi-structured interviews with managers (n = 6) and caregivers (n = 8) from different residential or outpatient facilities for people with intellectual disabilities from Germany. Eight female and six male persons were interviewed as shown in the table below. All caregivers had previous experience in implementing mainstream technology for at least one adult resident they care for. All managers run an organization in which mainstream technology was implemented for at least one resident.

Table 1
Interview sample

Pseudonym	Profession	Sector	Gender
B1	manager	residential	m
B2	manager	residential/outpatient	m
B3	manager	residential/outpatient	m
B4	manager	outpatient	f
B5	caregiver	outpatient	f
B6	caregiver	outpatient	f
B7	caregiver	outpatient	f
B8	caregiver	residential	f
B9	manager	outpatient	f
B10	caregiver	residential	m
B11	manager	residential	f
B12	caregiver	residential	m
B13	caregiver	residential	m
B14	caregiver	residential	f

2.2.2 Data Collection

Semi-structured interviews were held in German language via a videoconferencing tool and lasted between 20 and 45 minutes. Interviews were audio recorded and transcribed verbatim in German language using a semantic content transcription system [33].

2.2.3. Data Analysis

For analyzing interview data we applied a qualitative content analysis using inductive and deductive coding [34]. Inductive coding was conducted with MAXQDA software resulting in an inductive category system which consist of main- and subcategories. Additionally, the interview statements that referred to a certain life are, where technology use was described as useful, were coded deductively using the domains

of activities and participation according to the International Classification of Functioning, Disability and Health ICF [35]. This is seen as a framework that cover “the full range of life areas (from basic learning or watching to composite areas such as interpersonal interactions or employment)” [35]. Subsequently, the NASSS-domains were used as a deductive code system that was applied to the inductive category system and guiding the matching between NASSS-domains and the inductive category system (see table below). Anchor quotes were then translated into English language for the publication.

2.3 Survey Study

2.3.1 Sample

65 completed questionnaires were used for the analysis. 42 female, 22 male and one diverse person working as caregivers in different residential or outpatient facilities for people with intellectual disabilities in Germany were surveyed about their self-assessment of digital competencies.

2.3.2 Data Collection

There are no validated questionnaires for assessing digital and media competencies of disability caregivers. Therefore we decided to adapt the self-assessment questionnaire for teachers’ basic ICT competence beliefs by Rubach and Lazarides [36]. The instrument includes the following competency areas: 1. Information and Data Literacy, 2. Communication and Collaboration, 3. Digital Content Creation, 4. Safety and Security, 5. Problem Solving, 6. Analyzing and Reflecting. We used the items for self-assessment of general, profession-independent competencies of using digital media that apply also to non-school areas and added a specific competency and capability domain – Disability and Technology – for adaptation to the services and supports for people with disabilities. The questionnaire was created using online survey tool LimeSurvey in German language.

2.3.3 Data Analysis

65 completed datasets were exported from LimeSurvey. Descriptive statistics were used to analyze the data with Microsoft Excel software. The diagrams created were afterwards translated into English language. Statistical findings were subsequently included into the analysis of NASSS-domain 4 (adopters) were competencies of caregivers appeared to be relevant.

2.4 Ethical considerations

In the study, we declare that participation in the study was voluntary, that respondents would not be disadvantaged by participating, that results would be published in a form that would not allow any conclusions to be drawn about individuals. The study received a positive ethics approval from the German Society for Educational Science (DGFE).

3. Results

Table 2

shows the overall category system by NASSS-domains and the matching inductive category codes from the interviews as well as the self-assessed competency and capability areas. Results are described in detail in the following.

NASSS Domains and Subdomains	Main Categories	Subcategories and Sub-Subcategories
1. Condition		
1A Nature of condition or illness	Barriers and facilitators to technology adoption	The role of people with disabilities (Needs and demands, competencies)
1B Comorbidities, sociocultural influences	Barriers and facilitators to technology adoption	The role of people with disabilities (previous experience with technology, motivation)
2. Technology		
2A Material features	Barriers and facilitators to technology adoption	The role of technology (control and customization options, accessibility)
2B Type of data generated	n/a	
2C Knowledge needed to use	Barriers and facilitators to technology adoption	The role of people with disabilities (competencies)
	Barriers and facilitators to technology adoption	The role of caregivers (digital and media competencies)
	Barriers and facilitators to technology adoption	The role of technology (exercise options)
2D Technology supply model	Actual technology use	Selection and purchase of apps/devices, initiative for purchase apps/devices, support with technical problems
3. Value proposition		

NASSS Domains and Subdomains	Main Categories	Subcategories and Sub-Subcategories
3A Supply-side value (to developer)	n/a	
3B Demand-side value (to patient)	Barriers and facilitators to technology adoption	The role of areas of activities and participation (ICF)
		The role of technology (risks and potentials)
		The role of caregivers (ability to recognize needs of the target group)
4. Adopters		
4A Staff (role, identity)	Barriers and facilitators to technology adoption	The role of the institution (motivation of manager, attitude towards technology)
4B Patient (simple v complex input)	Barriers and facilitators to technology adoption	The role of people with disabilities (needs and demands, financial resources)
		The role of legal representatives
		The role of relatives and friends
	Actual technology use	Equipment of the residents, Technology use by the residents
4C carers (available, nature of input)	Barriers and facilitators to technology adoption	The role of caregivers (digital and media competencies, attitude towards technology, accompanying technology use, time resources, ability to recognize needs of the target group, motivation, mandate to promote participation, caregiver as rolemodel)
5. OrganiZation(s)		
5A Capacity to innovate (leadership etc)	Barriers and facilitators to technology adoption	The role of the institution (human resources, motivation of manager)
5B Readiness for this technology / change	Barriers and facilitators to technology adoption	The role of the institution (attitude towards technology, digital infrastructure, conceptions)
5C Nature of adoption / funding decision	Barriers and facilitators to	The role of the institution (conceptions)

NASSS Domains and Subdomains	Main Categories	Subcategories and Sub-Subcategories
	technology adoption	The role of people with disabilities (financial resources)
5D Extent of change needed to routines	Barriers and facilitators to technology adoption	The role of caregivers (time resources, capabilities)
5E Work needed to implement change	Barriers and facilitators to technology adoption	The role of areas of activities and participation (ICF)
		The role of caregivers (time resources, capabilities)
		The role of the institution (provision of offers and information)
6. Wider system		
6A Political / policy	Barriers and facilitators to technology adoption	The role of the institution (legal conditions)
6B Regulatory / legal		
6C Professional		
6D Socio-cultural		
7. Embedding and adaptation over time		
7A Scope for adaption over time	Actual technology use	Sustainable technology use
	Barriers and facilitators to technology adoption	The role of the institution (digital infrastructure, conceptions, motivation of manager)
		The role of caregivers (motivation)
7B Organizational resilience	Impact of the COVID-19 pandemic on digitalization	At the levels of the institution, caregivers, residents and relatives

Table 2 *NASSS-code-matching*

3.1 NASSS-Domain 1: The Condition

The interviewed caregivers and managers indicated that certain individual preconditions of people with intellectual disabilities are advantageous or disadvantageous for the use of digital technologies. So, when it comes to the suitability [25] of the group of people with intellectual disabilities, it is important to bear in mind that this concerns highly individual cases, which must be considered in their unique personal, environmental and health factors. The ability to verbally express the desire to use technology thereby was described as an important precondition for its implementation. These indications regard varying kinds of impairments as well as difference in age and previous experience with technologies that condition differing needs and demands.

Well, I would say, (...) the group of people living here is very diverse and it always requires individual adaptation. That makes the whole thing a challenge, you cannot say, we simply build ten devices or twenty and distribute them among the residents, so it will not work this way. (.) On the one hand there are the physical difficulties, (...), that a person has. (..) And the other is/are so the, (...) cognitive competences in the end also, (B1, Pos. 263–269).

Referring to the understanding of disability according to a bio-psycho-social approach [35], the conditions of the persons concerned vary individually depending on personal and environmental factors as well as their health condition. This impression was also conveyed in the interviews.

In this respect, the interviewees reported, for example, that people with intellectual disabilities can have difficulties with fine motor tasks, which can make touch operation of a smartphone more difficult. However, speech interfaces were not seen as adequate compensation. The residents' pronunciation may be blurred, which makes operation via voice control more difficult. A satisfactory use thereby was mentioned as a basic requirement for sustaining motivation. Although this can be a matter of previous experience and/or training. This also applies to the learning of digital and media skills to learn an adequate use of digital technologies.

So it's like with children, too, you just have to dose it, too, depending. Sure, so if they then only lose themselves in some tablet or mobile games and can no longer really participate in everyday life or the structure in everyday life is lost, because they are only on the tablet or the tablet or cell phone all the time, then of course you have to dose the everyday life. (B11, pos. 200–205)

According to the statements of the interviewed persons the elderly residents they care for have less previous experience with technology than the younger residents.

3.2 NASSS-Domain 2: The Technologies

To ensure a successful technology adoption, the material and technical features of the technologies are highly linked to the unique conditions of the residents. Therefore, the accessibility of the certain technologies plays a primary role. The interviewees referred to the control and customization options of the device or application that need to fit with the needs and competencies of the respective resident. This was described as challenging due to “a wide spectrum from cognitive impairment, I mean the severity of the disability, to also the severity of motor impairments” (B1, Pos. 273–276). So as the interfaces of

digital technologies usually offer different input modalities such as touch, speech or even via external switch, the interviewed persons saw these benefits also in certain applications like messengers.

That's also very different, so what everyone actually likes to use is WhatsApp, to simply be in the group chat, or even to write people. Of course, the use of voice recording is also very useful, because not everyone can read and write so well. (B9, pos. 81–85).

The customization options of the device or application were described as helpful. The interviewed employees mentioned for example screen enlargements as an easy and quick accessibility tool. Other customization options rather concern security and protection measures such as parental control settings, ad-blocker or third party charge block to enable the residents a largely independent use. As mentioned above a satisfying technology use may be a matter of previous experience and/or training. Accordingly, it was described as beneficial if the person is given the opportunity to try things out individually.

So I just installed games for him, this person and I said just try out and then he just worked his way through it and then told me at the end I'll play these and these games, but I can't manage the rest. He was able to report back to me, then I chucked the games back down and had a look at what he had mastered and what he was able to do. I then followed that up and downloaded more. Yes. So just tried it out. Yes. And so I would also say, you can't predict that, you have to try out you have to try out what the person can manage to intellectually cope with. (B14, pos. 150–159).

A given space for exercising may additionally affect questions of sustainability. So when a resident has tried different things, it is easier for caregivers, relatives and/or legal guardians to decide what makes sense to purchase in each individual case. Then the legal guardian plays a significant role if the residents need support when it comes to the purchase of a device or the conclusion of a contract. However, technical problems can occur regularly, regardless of whether residents are able to use the device easily. Continuous accompaniment of the use was described as elementary by the interviewed persons. Therefore, a competent caregiver (see domain 4), who is able to react spontaneously to technical problems was described as important. It is also possible to get support via the IT-management of the facility even though this was marked out as cumbersome.

3.3 NASS-Domain 3: The Value Proposition

This domain addresses supply- as well as demand-side value [25]. In case of our research there is not much interest in the supply-side value, because with already existing, well distributed mainstream technology the business case for these technologies can be neglected. Much rather relevant is the demand-side value asking for cost-effectiveness, desirability, safety and efficacy [25]. Cost-effectiveness therefore refers to the end-users' financial resources which can be scarce with people with intellectual disabilities, as the interviewed staff reported (see below). How desirable a technology is, depends on the one hand on the person with disabilities and their wishes and ideas. The caregivers' ability to recognize the needs of people with complex communication needs was described as a challenge, when it comes to identify a certain technology. People with intellectual disabilities who struggle with verbal communication

seem to be less likely equipped with digital technologies. “So actually our professionalism is already to recognize what someone wants to tell me without being able to put it into words. So register, the need (..) works (..) well already. Well, it is sometimes a bit tricky” (B2, pos. 173–177).

The desirability of a technology on the other hand is depending on the balancing between risks and potentials which can be put in a process of negotiation between caregivers, relatives and/or legal guardians. The interviewed caregivers referred to risks when using digital technologies such as reducing social interaction, privacy issues, addiction, financial risks and fraud or an adequate use of certain applications like messengers. To counteract these risks, not only the appropriation of digital and media skills was seen as crucial but also individual presets of the device as well as accompanying the use by caregivers. For the interviewed persons, the potentials of digital technologies for people with intellectual disabilities weighed way more than the risks. Fundamentally, it is about becoming “a part of society, which is also appreciated in this area” (B2, pos. 343). This became especially significant during the COVID-19 pandemic, when many areas of life shifted online and the participation in social interaction required access to video conferencing tools. So desirability in this case can rather be discussed concerning participation rights of people with intellectual disabilities. Efficacy, therefore, is analyzed by asking how the technology contributes to participation. When it comes to efficacy of digital technologies for people with intellectual disabilities, the interviewees referred to certain life areas according to the ICF [35], where digital technologies for promoting participation seem suitable. Communication is the life area that was mentioned by far the most by the interviewees as the area where some residents already use digital technologies for and that holds the biggest potential for participation.

Two of the three residents with down syndrome in our group, they have a cell phone and of course they can and of course they have the possibility to call home all the time. That is fortunately possible nowadays, even if the people, or now in particular the people I know people I know don't know how to use a smartphone, there is the possibility of using the possibility of calling someone with a simplified cell phone. And that is also frequently used. (B13, pos. 62–68)

Other life areas mentioned that seem to be relevant for participation of the residents were community, social and civic life specifically recreation and leisure activities such as gaming, listening to music and watching videos as well as the mobility domain. Traveling alone and independently on public transportation can be a big issue for people with intellectual disabilities. This was stated by the interviewees related to using bus or train schedule apps, using the phone in an emergency or even GPS-trackers to surveille the location of the resident. Appropriate mobility can open up opportunities such as employment related issues.

We have actually thought about that at some point he (...) attends a vocational preparation facility no sheltered workshop, but rather tries to gain a foothold in the first labor market. But then he has to travel from [place] to [place], 20 minutes by train, but I think we can trust him to do that. And if he then simply has the security that he can reach various people with his smartphone to reach different people relatively

unproblematically if the track suddenly suddenly the track changes or something else, is good, I think. (B9, pos. 311–320)

There were less frequent mentions of the areas learning and applying knowledge, general tasks and demands, domestic life and interpersonal interactions and relationships. There were hardly any statements in the areas of self care and major life areas.

3.4 NASSS-Domain 4: The Adopter System

This domain focuses on the practices, roles and identities of staff and caregivers as well as the technology adoption by the patients respectively residents [25].

3.4.1 Residents

When it comes to acceptance and adoption of technology by the residents, the interviewees reported about the actual technology use and a successful technology adoption by some residents. As mentioned above, it was stated that people with disabilities who are living in outpatient facilities are more likely to use digital technologies. Individual adaption and customization of the devices can thereby be beneficial. Moreover, it was reported that the wish to use technology can also derive from symbolic meanings and aesthetics. The need to participate in a digitalized society can be based on the residents' idea of mainstream technologies as "status symbol" (B2, pos. 111). Again, the condition of the resident was seen as a prerequisite for whether they have their own device and to what extent an independent use is imaginable.

So it always depends on the degree of impairment. Of course, the more they need support, the more difficult it is for them to have their own device or to have it permanently in their room or whatever. You just have to use it in small doses in everyday life, where it would be practical. (B11, pos. 82–86)

When it comes to the financial background of the residents, the interviewees reported precarious financial situations of some residents, which are more likely to affect people in outpatient assisted living than in residential care. This may have an impact on the adoption of a new technology.

Then I hope that (...) either technology is so cheap to get and also the maintenance of this technology, that people on social welfare level can afford proper technology, without no longer being able to afford bread. Because that is (...) a huge issue in my opinion, also a huge issue why technology may not arrive at some (...) especially at the people with assistance needs. Of course we also have people where money is in the family background and who then has an Apple and an iPhone and whatever. But THEY do not have the problem. It is now about describing the problem. The problem is that there are some people in our facility who have to make sure that they can afford the co-payment for the medication. (...) And if I then say, Yes, a larger tablet would be better for you, then it becomes difficult, doesn't it? (B3, Pos. 345–357).

Speaking of the background of the residents, the interviewed persons also mentioned different family backgrounds that can affect the adoption of a new technology. „Sometimes it was not easy to convince the legal guardians that it is not bad. But that it is actually only about benefiting someone” (B3, Pos. 386–388). Therefore, family members or legal guardians and their attitude towards technology play an important role in providing individuals with access to certain technologies.

3.4.2 Staff and Caregivers

In our study there is only little data concerning staff-related questions. The interviewed managers refer to this questions as a matter of motivation that is linked to their private technology use. So their technology acceptance and attitude influences to what extend technology use is enabled for the residents. They somewhat function as gatekeepers for digital participation. “So (...) just as I reach limits in my private life, the users here, the clients also reach limits that I would like to have that it is at least not worse than at my home” (B2, pos. 78–80). As the interviewees all work in facilities that are organized by a welfare association, it was reported, that the associations’ attitude towards technology must be kept in mind. “There are also fears in the association, but also among the employees. The feeling of being under surveillance. We have surveillance fantasies, surveillance fears. Personally, I don't have it that much (B1, pos. 245–248)”.

The caregivers play the central role in sustainable technology adoption for several reasons. First of all, the interviewed persons stated, that the caregivers and their private technology use act as role models for the residents. Residents who live in residential homes seem to lack of social interactions outside the residential setting and therefore “people who live here also want to be like the others and in this case company is mainly the staff” (B2, pos. 154–156). In this sense, it stands to reason that interviewees stated that caregivers’ attitudes towards technology influence the extent to which residents are enabled to use technology. “So if I'm working in a team where all the employees already don't enjoy using their devices or leave their cell phones at home and prefer to have nothing to do with technology, then the opportunities for residents are smaller” (B2, pos. 216–219). Personal motivation and attitude towards technology can depend on age and therefore technology normalization as stated by the interviewed staff. This then has an impact on whether the mandate is taken to promote the digital participation of the residents.

I also see it in older colleagues, not only older colleagues, but for the most part. There are also older colleagues who are very reflective and are very busy with giving people participation and self-determination and yes, but they (laughs) are disabled people he or she doesn't need that, he or she doesn't need that, because he or she is disabled. I think that is still difficult to understand. (B13, pos. 208–214)

When accompanying technology use in practice, caregivers must first assess which technology with which customization or adaption makes sense in which area of life. Digital and media competencies seem to be a beneficial precondition for that.

3.4.3 Digital Competencies of Caregivers

In the following, the results of the self-assessment survey for basic ICT competence beliefs of caregivers in disability care are presented.

Communication was described as the most relevant life area for promoting participation in the interview study. Therefore we assume that the communication related competencies of caregivers themselves play an important role. The survey about competence beliefs in the area of Communication and Collaboration revealed 53.08% strongly agreeing. In this area, the associated items deal with communication via digital media, such as Skype, quoting and passing on information, jointly editing files and documents, rules of conduct when communicating in the digital space, active participation in society through the use of digital media and passing on one's own media experiences to others, e.g. recommending and explaining apps.

Safety issues matter in terms of adequacy of content and frequency of use, as reported in the interview study. The area of Safety and Security of the survey has given strong agreement in a middle range (42.31%). Uncertainties about one's own skills seem to exist in the area of Analyzing and Reflecting (28.31% strongly agree). The items in this area represent the ability to evaluate the impact of media in the digital space and the ability to evaluate content, such as advertising and fake news, as well as the benefits and risks of business activities on the internet.

Skills such as using and adapting digital tools, organizing learning resources, developing their own technical solutions and recognizing algorithmic structures, seem to be less present in the group of respondents. These skills represent the area of Problem Solving that achieved a low assessment with full agreement in the overall sample (24.18%).

The area of Disability and Technology that was added to the original survey has reached the lowest measure of strongly agreement (18,29%) compared to the other areas. For this reason, and because this is considered the most relevant area of self-assessment for our study, the corresponding items are hence presented in detail.

The strongest agreement is found in the item of risks and potentials. Taken together, 76,92% of the respondents strongly agree or agree that they know the potentials and risks for the digital participation of persons with disabilities.

Asking for the abilities to include technologies in the educational work, 24.62% consider themselves to be fully capable of using digital technologies for pedagogical activities, while 33.85% would say that they are more likely to do so. 40% of the respondents would only be partially or rather not confident to do this.

When it comes to consulting data security officials or legal guardians for certain decisions, 50,77% of the surveyed employees seem to be aware due agreement or strong agreement.

53.85% of the surveyed staff members in disability care see themselves as fully or rather competent in guiding and selecting digital technologies and accompanying technology use for people with disabilities. Still 27.69% seem to be partially confident in this.

Asking for media pedagogic skills, 18.46% of the respondents see themselves as fully and 33.85% as rather capable to teach digital skills to the people with intellectual disabilities cared for.

Employees seem to be uncertain about the provision of assistive devices. Only 33, 85% of the respondents know the possibilities and procedures of applying for assistive devices. Partial knowledge in this area seem to have 24, 62%. Disagree and strongly disagree still do 35.38%. This value is thus higher than the people who feel rather confident in these skills.

Only 10.77% strongly agreed with the question of taking into account the possibilities of digital technologies in support and participation planning. Another 24.62% simply agreed and 26.15% appear to take no account of this aspect in participation planning.

The last two items of the Disability and Technology area of the survey rather address caregivers' capabilities to use the structures of the organization and are therefore presented in the following chapter.

3.5 NASSS-Domain 5: The Organization

This domain addresses questions of the organizations' capacity and readiness or rather willingness to adopt certain technologies [25]. In our interview study we found statements of the employees about human and other resources committed to digitalization issues. It was described as advantageous to assign extra professionalized staff for ICT and digital issues. However, these people coming from a different professional background may have reservations about providing access to the internet for people with intellectual disabilities.

Exactly, we have our system administrator at [the institution], of course, who is responsible for all questions relating to PCs and Wi-Fi and so on. As I said, he was also against setting up a Wi-Fi via [the institution] for a long time. Simply because of liability reasons. (B9, pos. 254–257).

Asking about the readiness of the organization to implement digital technologies in the residents' everyday lives, first of all, the digital infrastructure can be focused. We found that the interviewees reported about a well-used digital infrastructure and a widely use of service-related technologies by the caregivers such as digital documentation systems or digital timetables. This does not apply to the private technology use of the residents. So, a digital working sphere is therefore not yet a prerequisite for a digital private environment for the residents. In case of the last-mentioned, the interviewed persons stated that there were found individual solutions to set up a digital infrastructure. There was no standardized procedure mentioned here. Instead, they reported that it must always be examined on an individual basis, e.g., who uses the internet to what extent and who pays for it and how. So this depends on the type of accommodation and whether the residents live in residential group homes that can come close to a form of nursing home or outpatient facilities, where they live in a shared flat or on their own with partially support from caregivers. With regard to the facility-wide Wi-Fi equipment, however, various circumstances were mentioned that seem unclear. On the one hand, this referred to the costs and the question of whether, for example, the residents themselves should or can pay for the Wi-Fi access or whether a fund could also be considered. In addition, the shared use of the network by residents and caregivers could

cause difficulties, especially with regard to data protection issues. It has also not yet been clarified how the costs for the internet access could be divided up if the Wi-Fi is used to different extents by different people (even if only different residents). This also affects differences between residential and outpatient facilities.

It's trickier to do this than it is now in a shared apartment where we simply provide outpatient support. Of course, the residents can purchase the Wi-Fi together, which is available on site, and depending on whether they live on the edge of the forest or somehow in the middle of it, it works more or less well, and then it's more of an agreement among the residents of this shared apartment what they want to spend, what they need. It will always be about fairness somehow. But that's just their topic, you can support them and here in the facility it's just rather my topic, so (4) which concerns well, fairness and all the things (...). (B2, pos. 290–299)

The scarce time resources of the employees were stated as crucial and must be kept in mind when it comes to (additional) work and routines that are involved in the technology implementation process. This depends on the individual cases, the residents' and caregivers' needs and competencies as mentioned above. In our survey study, we found that the item with the lowest measure in strongly agreement is the question of time resources. So, respondents were asked about the time resources they have for selecting technology and for introducing and accompanying the use of technology in everyday life. Here, 61.54% of the respondents state that they have no time or rather no time for this. Another 20% see only partial time resources here.

At the end, the interviewees reported that facilities face an external pressure to provide the residents they host with an environment in which they can easily use their digital devices. This for example, concerns the question whether the institution provides offers and information for residents and caregivers.

I would say over half have a smartphone definitely and use that. Yes. Exactly so I think that's coming. The facilities are exposed to this pressure, that there are also the respective needs there and that then also appropriate offers are made. That will also be the case with us. (B14, pos. 300–304)

In our survey study we found that only 10.77% strongly agree that they can use the facility's structures to find and implement suitable technological options for their clients. 13 respondents 20% would tend to agree.

3.6 NASSS-Domain 6: The Wider Context

The wider context in case of our study relates to legal issues. On the one hand, there is social legislation and the *Bundesteilhabegesetz* (a federal participation act in Germany which revises inclusion assistance in accordance with the Convention on the Rights of Persons with Disabilities) as the basis for legal options for action. Like mentioned above, the question if digital technologies and internet access must be considered as a participation benefit and therefore include them to assistance plans was portrayed. On the other hand, the interviewees reported that there are individual questions, such as giving consent to

data protection regulations, conclusion of contracts or the like where legal guardians become also relevant.

Addressing the adoption of a new technology one might assume that the technology use of the residents is rather a private matter and depends on the individual financial resources. However, the interviewees reported that it would be beneficial if digital mainstream technologies were understood as participation benefits, so they could be funded via public health care like other assistive devices. For the interviewees, another possibility seemed to be funding options provided by nongovernmental organizations (NGO) like *Aktion Mensch* (a German NGO addressing participation and inclusion issues). B9 (pos. 86–93) reported, for example, that training PCs were funded via Aktion Mensch.

3.7 NASSS-Domain 7: Embedding and Adaptation Over Time

As has become clear, the individual domains can only be separated from each other analytically as many things overlap or repeat in different contexts. It also has become clear, that there are missing strategies in facilities for people with intellectual disabilities which makes it difficult to promote technology use in a sustainable way. There are statements by the interviewed staff about how technology should be used in long term matters. Mainstream technologies, where there is hardly any support provided by the supplier, can become buggy over time and therefore need competencies to deal with such things. “That is finally we do, we do, we do and then it is lying around at some point and no one can take care of it” (B3, Pos. 425–426). That there are no standardized strategies in the organization also means that the technology implementation is a rather individual process, where there is an idea or a need at the beginning that needs to be investigated in terms of suitable technology use. This can be challenging and a matter of “perseverance” (B1, pos. 350). “I have experienced too many things in my professional years, where I myself also and yes, or I have only seen observing, there are great ideas on the desk, but then actually fails implementing them” (B1, Pos. 355–358).

In terms of organizations’ innovation process, interviewed staff reported that the COVID-19 pandemic has had a noticeable impact on service-related digital infrastructure, as well as residents’ opportunities to access the internet and digital technologies. Setting up video conferencing systems for staff and residents seems to be the most widespread effect of the pandemic. Enabling residents to communicate with relatives was described as elementary during the pandemic, although this also revealed problems. “So not only we have to overcome the barrier, but also the relatives. We have 80-year-old relatives who have a tablet in their hands for the first time and have purchased it, and then it is also difficult until a connection is possible” (B1, pos. 293–297).

4. Discussion

In our study, we examined ex post barriers and facilitating factors for the implementation of mainstream technologies for people with intellectual disabilities in residential and outpatient facilities of disability services, applying the NASSS framework. The study showed that successful technology implementation

for the target group depends on complexities in the different dimensions that influence each other in different ways.

When it comes to the condition of the assisted persons, it was shown that the group of assisted persons consists of highly individual cases with very individual and diverse prerequisites. For the field of disability care, the condition can be described as disability concerning the interplay between body functions and structures, activities and participation as well as environmental factors according to the ICF [35]. Whereas the NASSS framework considers condition as clinical and comorbid conditions of a persons' health problem, we have operationalized this dimension to suit the specifics of the disability perspective accordingly. Here, the special disability-related needs and demands as well as individual competencies, experiences and life circumstances play a role. It has been shown that it is overall seen as a facilitating factor if the person being cared for is able to communicate his or her wishes and needs with regard to the use of technology and thus provides the impetus for technology implementation. Barriers and facilitators in the Technology dimension refer to the degree to which the technology is adaptable to the individual needs and competencies of the person being cared for. The value proposition of a newly introduced technology is related by the interviewees to different areas of life, whereby it is noted that technologies can be used primarily in the area of communication support. This seems to be a paradox, since the communication of a desire for technology use is seen as an important prerequisite for its implementation. Caregivers also play a major role as adopters. On the one hand, since they have to interpret the needs regarding a wish to use technology in persons with complex communication problems. On the other hand, we have shown that the digital competencies of the caregivers are relatively good, but they fail in the application with the target group as well as not having enough time resources are available. This is linked to the organization, where there is often a lack of sufficient human resources. In addition, the institutions lack clear guidelines and strategies for implementing technology, which means that this remains a highly individual, non-structured process. The wider context is also unclear, as the promotion of digital participation is not clarified in detail and the question of whether mainstream technologies count as participation benefits or not remains open. Lastly, it was reported that the COVID-19 pandemic has forced facilities to promote digital participation among residents to some extent. However, it remains unclear how sustainable these changes have been.

To shed light on the findings in terms of existing literature, studies have shown that caregivers have been forced to provide access to digital technologies that they had denied before the COVID-19 pandemic [18]. We have further shown that it is important for caregivers to be able to appropriately interpret the needs of the person being cared for if the person cannot communicate the desire to use technology themselves. This would mean that especially people with complex communicative needs bear an increased risk of being excluded from digital participation, especially by gatekeeping caregivers. This refers also to the access to digital information. The use of digital technologies hereby seems to be a challenge for people with low literacy skills [37]. Our findings suggest that the degree to which technology is adapted to individual conditions becomes virulent. This is in line with other research, where individual customization of a new technology is a main facilitator for successful adoption [38]. At the same time, it should not be neglected that individual training is especially important for previous non-users. In the institutions we

studied, offerings to promote skills that are important for technology use hardly play a role. It depends on the social environment whether experience in using technology has already been gained or not. Friends, family or even caregivers act also as role models. Other studies have shown that, for example, a peer-to-peer approach can be fruitful, in which people with disabilities are tutors and support other people in technology use [18, 39, 40].

As studies show [6, 10], it is rather people in residential settings who lack digital participation. A tension arises here that indicates that the form of living has an influence on how easily a technology can be implemented. Although both residential and outpatient forms of care are concerned as the private living environment of the persons being cared for, residential settings seem to depend on more complex institutional parameters. In outpatient settings, for example, the installation of Wi-Fi can be based on informal agreements among the residents, whereby the internet connection is purchased directly from the provider. In residential facilities, however, the internet connection seems more likely to be considered as a facility-wide issue, where the approval of the IT-supervisor is required. Parsons et al. [24] have shown that the external evaluation of implementation projects can be seen critical by staff. Based on our results, we argue that despite a highly individualized, internal implementation process, there is a need for quality control measures to ensure digital participation. In addition, we have shown that the ability to communicate a desire to use is a facilitating prerequisite. It can be assumed that these abilities are more likely to apply to people in outpatient settings, since they require less support.

It also stands out that caregivers have a significant influence on whether a person in care uses a digital technology or not. However, as an extension to Heitplatz et al. [31], we assume that the introduction of new technologies for the target group does not only depend on the attitude of the caregivers towards the technologies. Furthermore, it depends on the areas of life in which the technology is to be used and how useful this is considered to be. To support communication needs through technology is seen as highly useful. In contrast, self-care and independent living is hardly seen as an area of life, where technology use of people with intellectual disabilities should be promoted. Thus, we agree with Clifford Simpican et al. [21] that the caregivers' attitude toward technology is related to the attitude toward the client and the assessment of the clients' abilities. In addition, the caregiver acts as a role model with his or her own technology use. We have also shown that the caregivers interviewed rate their competencies in their own use of technology as relatively high, but the application of these competencies in the media education setting with the individuals being cared for is largely absent. In this regard, then, we would add to Ramsten et al. [22] that simply promoting caregivers' ICT competencies is not enough and therefore needs media pedagogical training in order to support technology use and promote technology adoption of the people cared for. In addition, there are the organizational parameters, especially the lack of personnel and time resources of the caregivers that can prevent technology implementation. The additional professional roles and tasks need to be backed up with time and human resources, but are assumed to have been implicitly fulfilled within existing precariously care structures.

Finally, our results show that there are ambiguities in socio-legal regulations, e.g., related to the financing of technologies to promote participation. As Boot et al. [23] show, one of the biggest barriers for people

with intellectual disabilities accessing assistive technology is a lack of clear regulations and policy and funding. We argue that mainstream technology implementation can be accomplished without clear legal regulations as a highly individual, non-structured process, as the results show. However, the need for clear regulations is present and would bring more clarity to this process. In this sense, Bruland et al. [41] also confirm this with regard to financing. They state that public health insurance in Germany only finances the provision of an assistive device if it is not an item of daily use. These are understood to be items that are not specifically designed for people with disabilities. As assistive systems appear to be integrated in mainstream technologies like tablets, however, such a distinction is becoming increasingly problematic. This is also relevant insofar as the lack of financial resources of people with intellectual disabilities in Germany [13, 15] is also reflected in our results.

5. Conclusion

Since people with intellectual disabilities in residential or outpatient facilities for people with disabilities belong to a group of people who, for various reasons, have unfavorable preconditions for taking advantage of the opportunities offered by digitalization, we have explored barriers and facilitating factors for the technology implementation of mainstream technologies. For this, we applied the NASSS framework and showed that successful technology implementation is accomplished in different dimensions that interact with each other. Future research should address the questions of how to promote the digital participation of people with intellectual disabilities and how to guide and accompany the different actors in residential and outpatient settings to make appropriate technologies available to the target group. The focus should be on areas of life in which digital participation has received little attention to date.

Declarations

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Author contribution

Christian Menschik wrote the main manuscript. All authors 1) made substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data; or the creation of new software used in the work; 2) drafted the work or revised it critically for important intellectual content; 3) approved the version to be published; and 4) agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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Data availability

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

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Footnotes

1. The domains of activities and participation are 1. Learning and applying knowledge, 2. General tasks and demands, 3. Communication, 4. Mobility, 5. Self-care, 6. Domestic life, 7. Interpersonal interactions and relationships, 8. Major life areas, 9. Community, social and civic life [35].

Figures

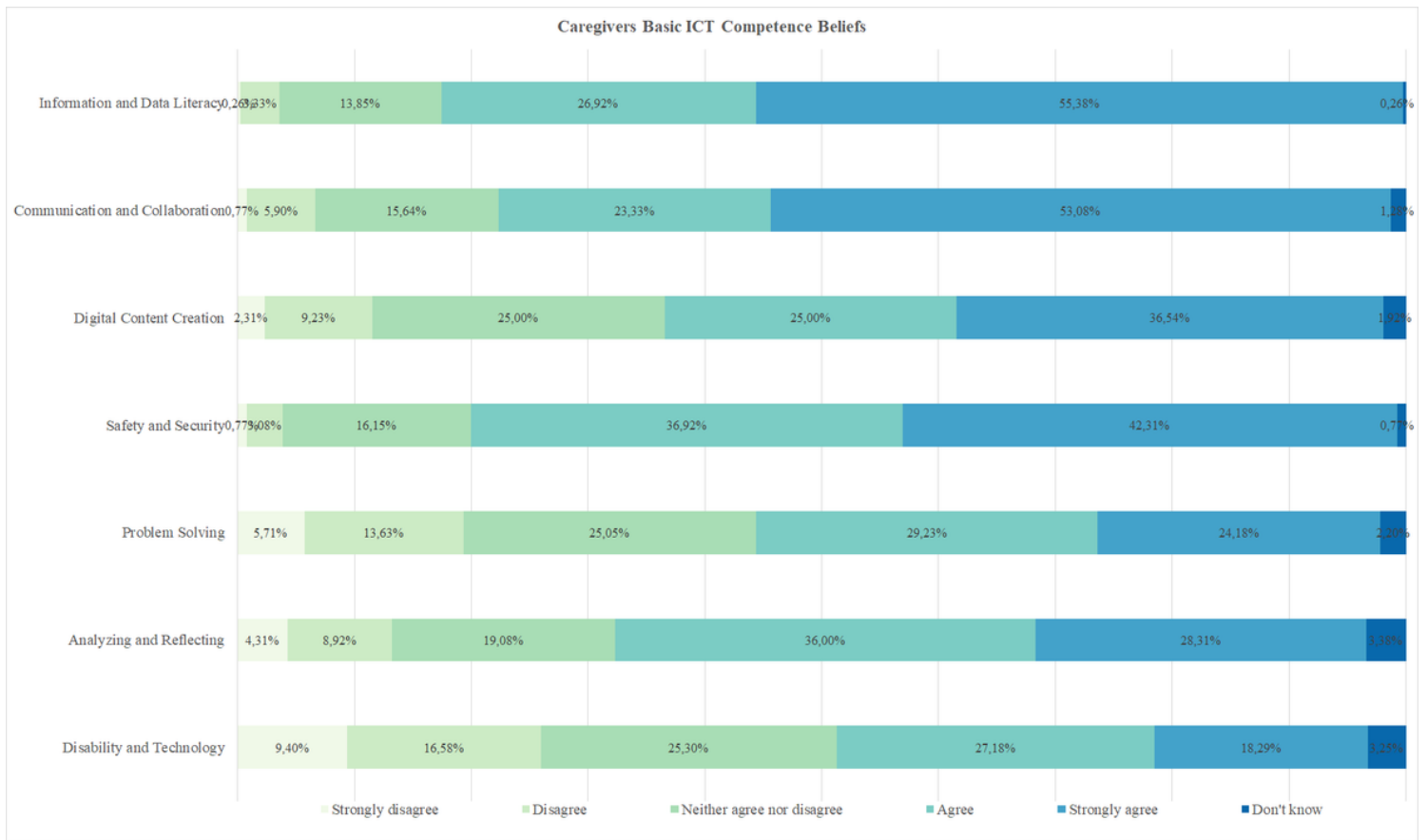


Figure 1

Caregivers basic ICT competence beliefs

Caregivers Competence Beliefs in the Area of Disability and Technology

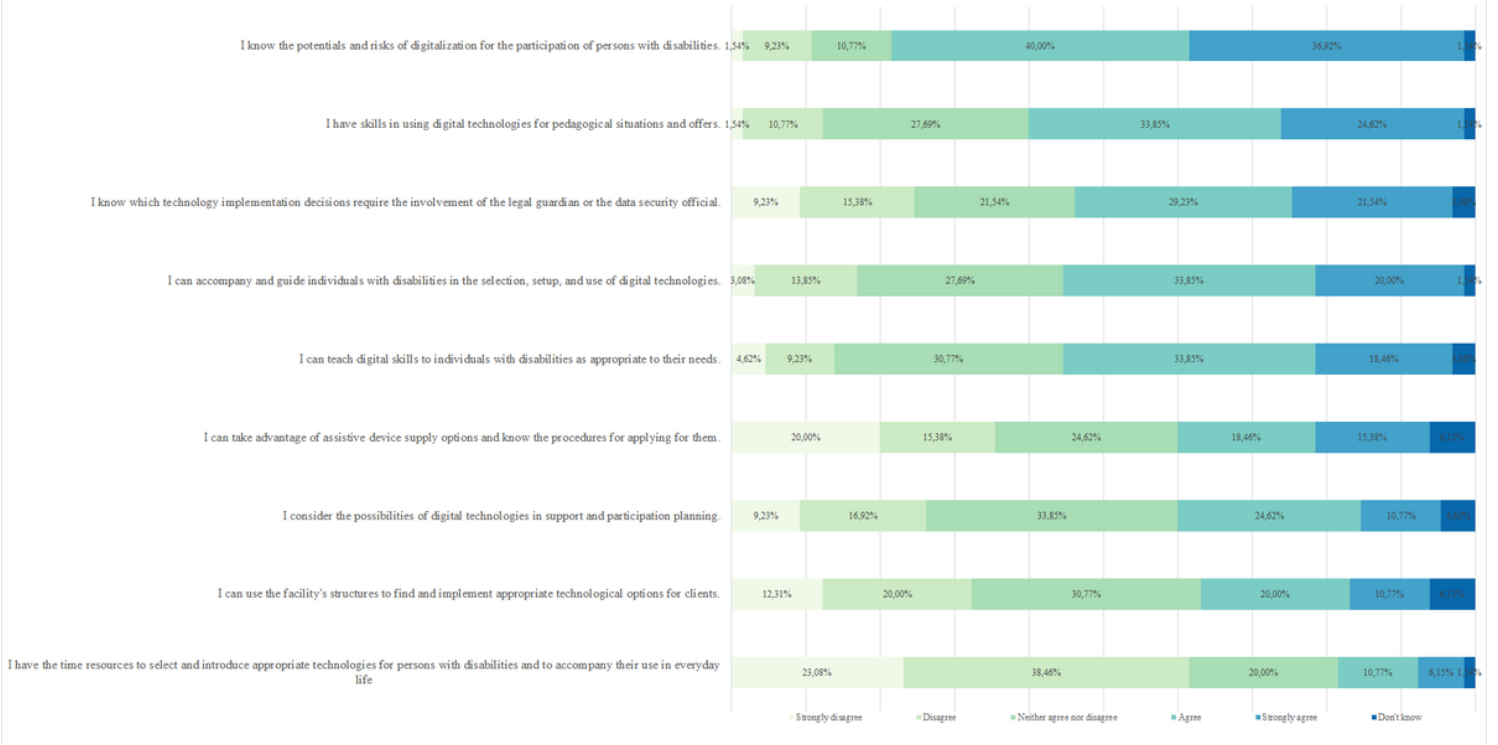


Figure 2

Caregivers competence beliefs in the area of disability and technology