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Motivation of people with intellectual disabilities in technology design activities: the role of autonomy, competence, and relatedness

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ABSTRACT

While people from marginalised groups are increasingly involved in design processes, research is scarce on the reasons why people with intellectual disabilities participate in such activities. Drawing on Self-Determination Theory, we explore what motivates young adults with intellectual disabilities to participate in technology design activities. This case study is based on reoccurring interviews and focus groups interviews with seven young adults with intellectual disabilities who participated in design activities. We also gathered reflective notes from eight support staff and conducted participant observations of the activities. An inductive thematic data analysis revealed six themes that contribute to motivation. These themes were deductively analysed with a focus on the three basic psychological needs in Ryan and Deci's (2002) Self-Determination Theory: autonomy, competence, and relatedness. Our study shows that a sense of enjoyment, influencing the designed technology and the design activity, enhancing skills and knowledge, experiencing a sense of self-efficacy, developing social relationships, and experiencing a sense of meaningfulness can lead to the fulfilment of the need for autonomy, competence, and relatedness. The results suggest that participation over time is essential to understand participants' needs for autonomy, competence, relatedness and to facilitate enjoyable design activities that motivate participants with intellectual disabilities.

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Intellectual disabilities; user involvement; design activities; technology design; motivation; self-determination theory

1. Introduction

Technology is increasingly used to support activities of people with intellectual disabilities such as independent travel and wayfinding (Mechling and Seid 2011; Lancioni et al. 2010; García-Catalá, Rodríguez-Sánchez, and Martín-Barroso 2020), social networking (Caton and Chapman 2016), time management (Green, Hughes, and Ryan 2011), employment tasks (Collins et al. 2014), communication (Murphy and Cameron 2008; Saturno et al. 2015), completion of daily tasks (Mechling 2007), and engagement in daily and leisure activities (Lancioni et al. 2020). Intellectual disability is characterised by significant limitations in both intellectual functioning and in adaptive behaviour, including many social and practical skills (Schalock, Luckasson, and Tassé 2021). Given the positive impact that technology can have on the lives of people with intellectual disabilities, providing them with an opportunity to participate in technology design is essential (Benton and Johnson 2015; Mankoff, Hayes, and Kasnitz 2010; Ghanouni et al. 2020). Today there is an increasing body of research on user involvement of people with intellectual disabilities (Benton and Johnson 2015; Wilson et al. 2016; Sitbon 2018; Wass, Hansen, and Safari 2020; Safari, Wass, and Thygesen 2021; Bayor et al. 2021; Raman and French 2021).

User involvement, described as direct contact with users during design activities, ranges from being observed to having an active role in providing information and making decisions (Kujala 2003). The core idea is that the future user should have an opportunity to influence the design (Robb et al. 2021). User involvement can reduce the cost of developing solutions, increase users' well-being (Steen, Manschot, and De Koning 2011), and positively impact user satisfaction, system performance, and quality (Cinquin, Guitton, and Sauzéon 2020; Bano and Zowghi 2015; Baroudi, Olson, and Ives 1986). Previous research shows that involvement of people with disabilities in design activities not only increases the usability of the technology but can also empower participants (Robb et al. 2021), increase their self-confidence, lead to feelings of enjoyment and ownership (Benton and Johnson 2014; Benton et al. 2012). While the positive outcomes of user involvement in technology design processes are well established, user involvement of people

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with intellectual disabilities in design activities can be complex due to additional support needs (Benton and Johnson 2015) and requires the use of different methods and techniques, such as workshops, photo-elicitation, prototyping, interviews, and observations (Muller 2012; Sanders, Brandt, and Binder 2010).

Studies show that participants are motivated to contribute to design activities by factors such as interest in technology, cooperation, and of being endorsed as experts (Hansen and Iversen 2013). According to Iversen, Dindler, and Hansen (2013), 'democracy' and self-determination in design activities are closely linked to motivation for participation. However, the responsibility of motivating users to engage in the design process lies with the design team. While several studies have focused on technology and design processes (Benton and Johnson 2015), less is known about how users can be motivated in design activities (Hansen and Iversen 2013). Self-Determination Theory is a theory of motivation that accounts for how the psychological needs of autonomy, competence and relatedness motivates behaviour (Ryan and Deci 2000). Previous research in disability studies has shown the relevance of the Self-Determination Theory and used it as a lens to study well-being and health (Ryan and Deci 2000), autonomy support (Frielink, Schuengel, and Embregts 2018), education (Deci et al. 1992; Katz and Cohen 2014) and employment (Garrels and Sigstad 2019). Although the basic psychological needs in the Self-Determination Theory are universally important, regardless of the level of intellectual functioning (Frielink, Schuengel, and Embregts 2018; Ryan and Deci 2000), research utilising this theoretical framework within the context of technology design activities has, to date, been scarce.

Given the importance of the three basic psychological needs and their role in motivation (Deci and Ryan 2002), we use Ryan and Deci's Self-Determination Theory as a theoretical framework to explore what motivates young adults with intellectual disabilities to participate in technology design activities. In particular, we investigate how participants experience that participation in design activities contributes to the fulfilment of the needs for autonomy, competence, and relatedness during technology design activities. A case study approach (Yin 2017) was taken throughout this study.

2. Related work

2.1. User involvement of people with intellectual disabilities in design activities

User involvement includes approaches such as participatory design, co-design, user-centred design, ethnography, and contextual design. Such approaches and engagement are particularly important as designers have little experience to see the world from the perspective of participants with intellectual disabilities (Brereton et al. 2015). However, while people with disabilities have previously been overlooked in the development of technological solutions, in recent years the number of studies engaging people with intellectual disabilities in design activities has been growing (see literature reviews: Börjesson et al. 2015; Benton and Johnson 2015). Newer examples include design of technological solutions such as a transport support tool (Wass, Hansen, and Safari 2020), a mobile goal-setting application (Wilson et al. 2016), a web application (Sitbon 2018; Bayor et al. 2021), a game-based learning tool (Raman and French 2021), and multisensory wearables (Neidlinger, Koenderink, and Truong 2021).

User involvement of people with intellectual disabilities can be challenging as commonly used design methods and tools draw on multiple cognitive and sensory abilities (Benton and Johnson 2015; Raman and French 2021). However, methodological frameworks, approaches and principles have been suggested to engage and facilitate participation (Raman and French 2021). For instance, the 'Handlungsspielraum' or 'Action-Play-Space' which provides a theoretical lens combined with practical tools for co-design activities with children with different abilities (Makhaeva, Frauenberger, and Spiel 2016) and the 'Who-what-when-where-how' framework for planning and organising co-design activities with children (Mazzone, Read, and Russell 2011). Other approaches include the method stories, which advocates for a highly individual approach towards adjusting co-design techniques (Hendriks, Slegers, and Duysburgh 2015) and an approach based on principles underpinned by a rights-based ethos (Raman and French 2021). However, only a few of the existing frameworks focus specifically on people with intellectual disabilities in co-design (Raman and French 2021).

2.2. Self-determination and motivation

While self-determination is important in technology design activities (Dent-Spargo 2018), promoting and enhancing the self-determination of people with intellectual disabilities has also become best practice (Soresi, Nota, and Wehmeyer 2011) and an essential focus of disability services (Wehmeyer and Bolding 2001). There is a consensus that self-determination is vital for children, adolescents, and adults with intellectual disabilities (Wehmeyer and Bolding 2001). Wehmeyer (2005, 117) describes self-determined people as 'causal

agents in their lives'. While intellectual capacity is not considered a significant contributor to self-determination, the freedom and ability to make choices is thought to enhance self-determination and autonomy (Wehmeyer and Garner 2003). Self-determination of people with intellectual disabilities has been linked to several positive outcomes such as employment, social integration, community access, and financial independence (Shogren et al. 2015; Wehmeyer and Palmer 2003; Nota et al. 2007). Still, people with intellectual disabilities experience limited self-determination, and few or limited opportunities to express preferences and make choices (Wehmeyer and Palmer 2003).

The notion of self-determination is broadened through the lens of the Self-Determination Theory as a means to understand why people are motivated to act in ways that are autonomous (Deci and Ryan 2000). The self-determination framework considers people to be actively searching for optimal challenges and new experiences to master, cope, and integrate (Deci and Ryan 1991). According to Deci and Ryan (1985), *amotivation, extrinsic motivation, and intrinsic motivation* lie on a continuum of self-determination and account for reasons why people engage in activities or not. The most self-determined type of motivation is intrinsic motivation, which is highly autonomous (Deci and Ryan 2000), and refers to doing activities for their own sake, out of interest, without the need for external rewards (Deci and Ryan 2002).

The Self-Determination Theory identifies three basic psychological needs – autonomy, competence, and relatedness – that support healthy functioning, well-being, and motivation in social environments (Deci and Ryan 2002). When the need for autonomy, competence, and relatedness are fulfilled, individuals experience intrinsic motivation and are likely to function and develop optimally (Ryan and Deci 2017). According to Ryan and Deci (2017), the conditions that thwart basic psychological needs undermine intrinsic motivation. The Self-Determination Theory proposes that people are driven to engage in actions to fulfil the basic psychological needs of autonomy, relatedness, and competence, furthermore, the environments that support the fulfilment of these needs enable the person to be engaged and energised about achieving goals (Deci and Ryan 2012).

2.3. Autonomy, competence, and relatedness in design activities

Autonomy is defined as 'being the perceived origin or source of one's own behaviour'. Autonomy is the need to feel ownership of one's behaviour and to act based on one's interest (Deci and Ryan 2002, 8). An environment or situation is autonomy-supportive when the individual experiences being in control of their actions. According to Niemiec and Ryan (2009), having a voice and a choice can support the need for autonomy. Design activities may provide people with intellectual disabilities an autonomy-supportive environment, as users are encouraged to take control and make decisions based on their own experiences and preferences (Robb et al. 2021; Sanders and Stappers 2008). Indeed, research shows that design activities can lead to a sense of ownership for people with disabilities (Frauenberger, Good, and Alcorn 2012; Benton et al. 2012). Furthermore, design activities provide opportunities for people with intellectual disability to be recognised and listened to (Benton and Johnson 2015).

The second basic psychological need is the need for competence and refers to experiencing mastery and producing desired outcomes in a social environment (Deci and Ryan 2002). The need for competence leads people to seek challenges that are optimal for their abilities and skills, with the goal of maintaining and enhancing those skills. According to Deci and Ryan (2002), competence is not a skill or capability, but a felt sense of confidence in action or during an activity. Design activities can lead to the development of creative skills, teamwork, and social skills for people with disabilities (Benton et al. 2012; Benton and Johnson 2014). Design activities may also offer opportunities for mutual learning and outcomes that can be sustainable beyond the design project (Benton and Johnson 2015). Dent-Spargo (2018) states that design activities can facilitate a sense of competence when they challenge a person's capabilities. Indeed, previous studies have reported participants in technology design activities experiencing a sense of mastery, coping and competence (Safari, Wass, and Thygesen 2021). Moreover, design activities can be an opportunity for young adults and adults with intellectual disabilities to learn and increase competence (Safari, Wass, and Thygesen 2021). Bayor et al. (2021) state that a competency-based approach to co-design technologies with people with intellectual disabilities is empowering and provides room for enhancing skills.

The third basic psychological need is relatedness, described as the need to relate and connect to others (Deci and Ryan 2002). Relatedness is a feeling of caring for and belonging to others (Deci and Ryan 2002); it is a sense of security or unity. As people with intellectual disabilities are among the most socially excluded groups (Xu et al. 2014), design activities can provide an opportunity participate in new activities (Benton and Johnson 2015). Building a relationship with the participants to help them feel comfortable in design activities is

essential (Piper et al. 2006). This is supported by Benton and Johnson (2015) who point out that design activities offer an opportunity to develop and practice social skills and teamwork. Furthermore, the environment should be facilitated to mediate social interaction where needed and enforce social rules (e.g. turn-taking and listening to others) (Benton et al. 2012). Internal, external, and contextual factors influence the fulfilment of autonomy, competence, and relatedness, which, when satisfied, lead to enhanced self-motivation (Ryan and Deci 2000).

3. Methods

3.1. Context

One should not artificially create a technology design team for the sole purpose of studying the effects of participation. Preferably, the research is conducted in parallel to other research activities performed by a design team (Guha, Druin, and Fails 2010). Thus, this study was conducted in collaboration with an action design research project (see Table 1 for overview of design activities). Action design research combines action research and design science research and allows researchers to solve a practice-inspired problem through the design and development of theory-ingrained artifacts (Sein et al. 2011). It outlines a 'method for generating prescriptive design knowledge through building and evaluating ensemble IT artifacts' (Sein et al. 2011, 4). This research approach stresses the need to involve the end-user in the design process to design and develop useful services (Sein et al. 2011) and was therefore a relevant context to explore motivation of participation.

The action design research project aimed to design and develop a self-reflective career tool to support the transition of people with intellectual disabilities from school into work (Figures 1 and 2). The concept consisted of six main parts: (1) login and user details, (2) mapping of skills and abilities, (3) mapping of interests, (4) goal setting, (5) progress evaluation, and (6) generating a CV. Through the design process, that served as a context for this paper, the prototype was designed to enable and inspire the user to map their skills, abilities, interests and needs (Figure 2). This included features such as mapping of interests based on swiping, grading of skills and abilities using smileys, goal setting and an overview of registered information. Drawing on TV and mobile games, the user is on a 'road' on which the user has to solve tasks in order to get to the next level (Figure 1 centre) and included aspects of gamification and positive feedback.

The action design research project and development of the self-reflective tool is iterative. However, the project is still ongoing, and the intention is to redesign

Table 1. Overview of design activities in the action design research project.

	Timeframe	Session (s) Duration	Focus of design activity	Techniques and involved prototypes
Group 1	Week 1	Session 1 2 hours	Introducing the aim of the project and testing the first paper prototype. Feedback on mapping information such as schools, favourite subjects, previous internships, work tasks and characteristics.	Paper prototype test (individual) Interviews, collaborative warm-up.
	Week 12	Session 2 1.5 hours	Feedback on the first prototype and insights on possible ways to visualise grading of skills and abilities, and interest mapping.	Paper prototype test (individual), digital prototype test (individual on a computer), card sorting techniques, group discussions.
	Week 19	Session 3 1.5 hours	Focusing on design elements and feedback on the use of icons and wording. Insight on ways to map adjustments needed in work settings.	Digital prototype test (individual on a smartphone), group discussions.
	Week 20	Session 4 1.5 hours	Feedback on design elements, and insight on user login and ways to map interests.	Digital prototype test (individual on a smartphone), group discussions.
	Week 23	Session 5 1.5 hours	Feedback on gamification elements and insight on motivation in games.	Testing of three different games, group discussion.
	Week 36	Session 6 1.5 hours	Following up session 5 and to gain insights on progress and rewards in games. Feedback on login and mapping (interests, skills and abilities) features.	Group discussions, digital prototype test (individual on a smartphone).
	Week 52	Session 7 2 hours	Usability test of the self-reflective tool in lab. Test of features including log in, mapping skills and abilities, interests, adjustments needed in work settings and an overview of registered information	Usability test of the latest version of the prototype (video recorded), interviews, SUS.
Group 2	Week 22	Session 1 1.5 hours	Introducing the aim of the project and giving feedback on design elements and the use of icons. Feedback on gamification elements, games and insight on motivation in games.	Testing of three different games, group discussion, card-sorting techniques.
	Week 23	Session 2 1.5 hours	Insight on ways to map and categorise interests.	Group discussions, digital prototype test (individual on a computer), card sorting techniques.
	Week36	Session 3 1 hour	Insight on progress and rewards in games. (This session was digital du to restrictions connected to the Covid-19 pandemic)	Group discussions on Zoom, adding information to digital whiteboard.

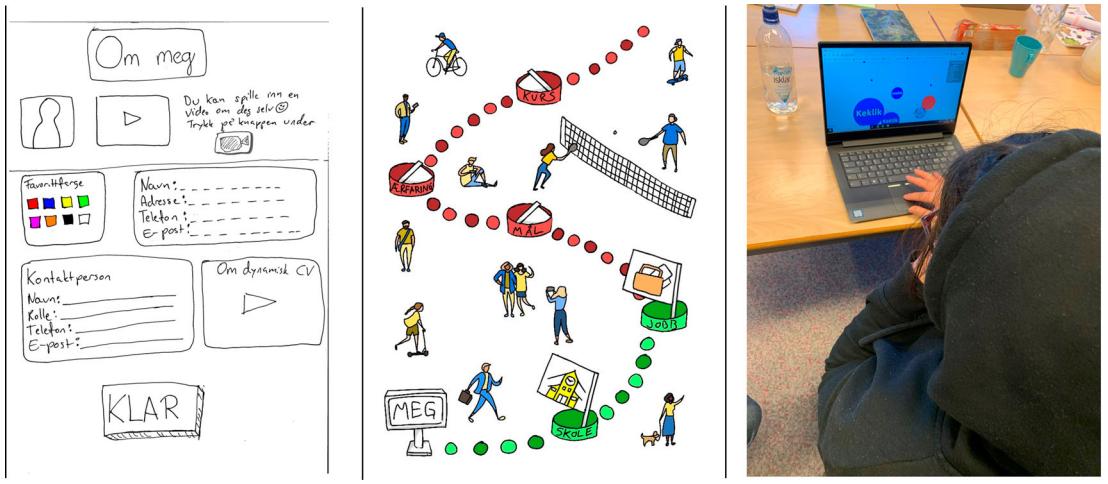

Figure 1. Left: Paper prototype used in design activities on mapping user details (session 1 and 3). Centre: Paper prototype sketch on visualising progress ('road') in the artifact (session 1 and 3). Right: Test of games in gamification workshop (session 5).

and evaluate the artifact in real settings. At the time of this study, features of the prototype had been tested on smartphones, tablets and computers and a usability test in a lab had been performed (Table 1). Figure 2 shows screencasts of the latest version of the prototype used in session 7 (Group 1).

The participants contributed to the designed technology by providing insights on possible ways to map abilities, skills, interests, and setting goals. The participants also contributed with insights on the need for customisable solutions, wording, figures, and colours. For instance, the participants provided insights on the need for and how to visualise how much of a task that is done. Other insights include the need for text to speech, using a smiley face rating and adjustment of font sizes. The participants also contributed with insight on how gamification elements and how rewards could be incorporated to motivate the users of the self-reflective tool. For instance, a suggestion that a trophy should appear whenever a task is completed.

3.2. Study design

A single-case embedded design was employed to investigate how participants in two different groups experience the fulfilment of the needs for autonomy, competence, and relatedness during technology design activities. Case study research provides the opportunity to combine multiple sources of evidence to in-depth investigate contemporary phenomena (the 'case') within

Figure 2. Left: Version of mapping skills and abilities (Smiley faces combined with colours to grade personal skills and abilities). Centre: Version of mapping abilities and preferences (User chooses what he/she dislikes or prefers, the bar below visualises task progress). Left: Version of mapping interest (User chooses which interests he/she has).

real-world contexts, especially when the boundaries between the case and context may not be clear (Baxter and Jack 2008; Yin 2017). Moreover, in a case study the contextual conditions are most likely relevant to understanding the case (Yin 2017). According to Yin (2017) case study research is suitable to answer questions of 'how" and 'why' through the use of more than one data collection technique. We used a triangulation of techniques to gather data (Yin 2017), consisting of individual and group interviews, participant observations, and reflective notes. These techniques were selected since short and repeated qualitative interviews combined with participant observations are recommended in studies with people with intellectual disability (Kittelsaa 2014). Moreover, participant observations allow the researcher to experience the activity (Spradley 2016) and observe verbal and non-verbal communication (Fangen 2010; Kittelsaa 2014).

3.3. Participants

Participants were recruited through the action design research project, in which they were already involved (Figure 2). The project included young adults with intellectual disability from two different high schools. The participants attended two separate school classes (not integrated into the mainstream curriculum) and were divided into two groups throughout the design project and research process. All participants in the action design project were invited to take part in this study. In addition, a supplementary sample consisted of the designers, teachers, university students, and other support staff who worked closely with the young adults during the design process. None of the participants had prior experience in design activities. The participants are anonymised for name, gender, and school.

3.3.1. The first participant group

The first group participated in seven design activities that lasted between one to two hours each (Table 1). During the first activity (1), the aim of the project was introduced to the group and a first paper prototype of the tool was tested . In design activities 2–6, the group participated in prototype testing on paper, computer, and smartphone. Individual interviews were conducted after the test sessions. The final design activity (7) was a usability test in a usability lab at the University. During this design activity, participants tested the latest version of the prototype on a computer and two of the tests were video recorded. The session finished with a lunch and playing Nintendo Switch together. During tests, participants gave feedback on how elements such as gamification, interest mapping, use of icons, wording, mapping of skills and abilities, log in functions, and progress could be incorporated into the solution. All design activities except the final one took place in a classroom at a high school. All participants and support staff had lunch or a snack together before, during or after every design activity depending on the time of the activity. The following participants took part (Table 2):

3.3.2. The second participant group

The second group participated in three (1–3) design activities, which lasted one hour each. The aim of the project was introduced to the group during a lecture, and as a first step the design elements and the use of icons were discussed (1). During the second activity (2), the group participated in a prototype testing session on a computer. Participants gave feedback on mapping of interests. In the final design activity (3), the participants took part in a digital design activity using Zoom and Miro (due to the Covid-19 pandemic). The participants gave feedback on how elements of progress, gamification and rewards could be incorporated into the tool. All design activities took place in a classroom at the high school. The following participants took part (Table 3):

The following support staff participated in the design project and this study (Table 4):

The first and second author participated in all design activities with both groups. The first author participated as an observer and the second author participated as a facilitator. As some design techniques can draw upon cognitive and sensory abilities that may not be including when designing with people with intellectual disabilities, modifying the techniques beforehand and in situ facilitation was important throughout the design activities (Raman and French 2021). Therefore, the first and

Table 2. Overview of participants in the first participant group.

Name	Age	Gender	Number of design activities	Number of interviews	Relevant characteristics	Technology experience
Eric	18–22	Male	6 (1-4 and 6-7)	5 interviews	Can write and read. Prefers drawing and being creative.	Has a smartphone and computer. Plays computer games.
Hege	18–22	Female	7 (1-7)	6 interviews	Can write. Has trouble reading.	Has a smartphone and computer. Plays games on a console and used YouTube regularly.
Beate	18–22	Female	7 (1-7)	6 interviews	Can read and write. Well spoken.	Has a smartphone and computer. Active on social media.

Table 3. Overview of participants in the second participant group.

Name	Age	Gender	Number of design activities	Number of interviews	Relevant characteristics	Technology experience
Andreas	16–20	Male	3 (1-3)	2 interviews	Can read and write. Likes drawing.	Has a smartphone and computer. Plays games on the computer and uses YouTube.
Tom	16–20	Male	3 (1-3)	2 interviews	Can read and write. Does not like drawing.	Has a smartphone and computer. Plays games on a console and uses YouTube regularly.
Marit	16–20	Female	3 (1-3)	2 interviews *	Can read and write.	Has a smartphone and computer. Active on social media and uses YouTube regularly.
Andrine	16–20	Female	3 (1-3)	2 interviews *	Can read and write.	Has a smartphone and computer. Active on social media. Did not play games.

Note: *Did not wish to be recorded.

second authors were involved in planning, coordinating, structuring, and facilitating the sessions. During the design activities we provided explanations, clarified ideas and opinions, facilitated consensus, and enabled the design progress. The university students, who participated as support staff, were Bachelor students in IT and Information Systems at the University and were involved in the design activities to map and test how gamification elements could be incorporated in the self-reflection tool. The participants' teachers had a purely supportive and observational role throughout the design activities.

3.4. Data collection

The data collection took place where the design activities were held, either at the groups' school or at the university. All participants had the opportunity to have a proxy or teacher present during the interviews and design activities. During the interviews, participants were asked to evaluate their experience of the participation. The questions were open-ended to allow for in-depth exploration. For instance, participants were asked which activities they liked, in what ways, if any tasks were challenging, and how they could be improved. Sigstad and Garrels (2018) recommendations such as repeating, rephrasing questions, silence and encouraging prompts, and summarising responses were used to facilitate and improve the quality of the interviews. The interviews lasted for between 20 and 35 minutes each. The interviews were audio-recorded and later transcribed by the first author. For two participants who did not want to be recorded, handwritten notes were taken during the interviews. The observation of participants focused on descriptions of the context, their behaviour, nonverbal communication, and the interaction between facilitators and group members. A field note template was used to record and structure the field notes during and shortly after the observations.

The researchers also collected reflective notes from participating teachers, facilitators, and the designer. These notes were sent via e-mail to the first author directly after the design activities. Reflective notes were used to collect information about the tasks during the workshops, and the teachers', facilitators', and designers' perceptions and experiences of the design activities.

Table 4. Overview of support staff.

Support staff	Role	Number of reflective notes	Participated in activities
Tor	Designer	4	Group 1, activity 1–4 & 6-7. Group 2, activity 3
Mina ¤	Teacher	5	Group 1, activity 1–7
Martin ¤	Teacher	3	Group 2, activity 1–3
Ole	Facilitator	2	Group 2, activity 1 & 2
Joakim	University student*	2	Group 1, activity 5. Group 2, activity 1
Jaran	University student*	1	Group 1, activity 5. Group 2, activity 1
Per	University student*	1	Group 2, activity 1
Marius	University student*	1	Group 2, activity 1

Note. *Role of a university student focusing on gamification ¤ The school teachers of the participants in The first and Second participant groups.

3.5. Data analysis

Thematic analysis (Braun and Clarke 2006) was used to analyse individual and group interviews, notes from the participant observations, and reflective notes from the supplementary sample. Thematic analysis supported flexibility and assisted to identify, organise, and report patterns in the data (Braun and Clarke 2006). It also facilitates a rich description of the data (Braun and Clarke 2006). In this study, the data analysis was first conducted through a data-driven inductive process, and then through a deductive process. The analysis consisted of six phases as per Braun and Clarke's (2006) recommendations. Firstly, the recordings were listened to repeatedly, and then transcribed by the first author. The transcriptions were read and re-read several times to ensure familiarisation, whilst noting down initial thoughts. The data, including interview transcripts, field notes and reflective notes, was then coded, with a data-driven approach based on the participants' descriptions of experiences during participation in the design activities. The codes were discussed by all authors to reach a consensus, and consequently themes

were developed. The themes were then reviewed and discussed by the authors. Themes were deductively analysed with a focus on the theoretical categories of competence, autonomy, and relatedness. The participants were not involved on the academic side of the research process (e.g. verification of analysis and findings). An example of a thematic analysis is presented (Table 5).

3.6. Rigour and quality

The trustworthiness and quality of case studies can be assessed through construct validity, internal validity, external validity, and reliability (Yin 2017). Construct validity, which corresponds closely to confirmability in qualitative research (Riege 2003), involves identifying the correct operational measures for the concepts being investigated (Yin 2017). To enhance construct validity, we have used multiple sources of evidence and triangulated data collection methods against one another. To establish a chain of evidence, interviews were recorded, and field notes and observations were documented and stored.

Internal validity, which is the parallel construct to credibility (Riege 2003), seeks to establish a causal relationship (Yin 2017). To enhance internal validity, we present thick descriptions and information drawn from the interviews with the participants. Other measures such as triangulation and the longitudinal manner of participant observations were taken to ensure internal validity. External validity, which is similar to transferability in qualitative research or generalisation in quantitative research (Riege 2003), involves assessing whether and how the findings in the case study are generalisable beyond the immediate study through analytical generalisation (Yin 2017). In the current study, external validity is enhanced through analytic generalisation and the use of Ryan and Deci's Self-determination Theory. The scope, context and results are described in detail to allow readers to assess the potential of transferability to other or similar settings. Reliability, which is similar to the notion of dependability (Riege 2003), involves showing that the study can be repeated with the same results and that the procedures used in the case study are consistent (Yin 2017). In this study, reliability is enhanced by documenting procedures and maintaining a chain of evidence during the research process. As recommended by Yin (2017) the data collected was effectively organised in a case study database. Key recourses such as notes, audio from interviews, field notes are all anonymised and saved in a storage cloud provided by the University and the data management software programme NVivo was used to organise the data during analysis. Moreover, all the authors continually communicated about methodological decisions thorough the research process to safeguard against biases.

3.7. Ethical considerations

The study's ethical approval was provided by the Norwegian Centre for Research Data (648227) and the Faculty's Ethical Committee at the University. All participants received and signed an adapted voluntary informed consent form. In addition, their parents or guardians were informed and asked to consent. The consent form was designed in a manner that allowed the participants to choose whether they wanted to be recorded. They received easy-to-read information about the study and the purpose of the project. They were informed about anonymity and that they could withdraw at any point, even after the interviews. Throughout the study, the researchers and teachers looked for signs that could indicate that the young adults no longer wanted to participate. Parents or guardians were also asked to observe and inform the researchers of indications that the young adults did not wish to participate. The support staff also received and signed a consent form and could withdraw at any point. During the introduction of the project the researchers talked about why the participants were asked to be part of the project. We talked about how a design process, informed by user needs, could enhance the design and that technology development is an iterative process where difficulties with the design can be encountered. Throughout the entire project we had a dialogue with the participants' proxies and other

Table 5. Examples of a thematic analysis.

Data Extract	Coded for	Main theme	Category
'In the beginning I did not know what to do, […] But after a while I learned how to navigate (using the app). I now know how to go back to the overview and backwards to see what I answered'.	Learning new skills, knowledge of technology.	Enhancing skills and knowledge.	Competence
'By participating and being part of this, I can contribute with my ideas help create the app. And it may then help others like me who may need assistance in getting work. […] Instead of just sitting at home'.	Contribute to important technology, help others (Meaningful participation).	Sense of meaningfulness.	Relatedness

stakeholders to ensure that the expectations of the design process and design activities were realistic.

The design activities took place during school hours as the self-reflective tool is planned to be used in school hours as part of the mapping process in the transition from school to work. In addition, the design sessions were described as a positive addition to the ongoing curriculum by the involved teachers. The workshops were not set up after school due to challenges with transport and collision with leisure activities. As it is important that participants are comfortable and relaxed during design activities it is recommended that they take place in locations that are familiar to the participants (e.g. at their homes or schools) (Robb et al. 2021).

4. Results

The inductive data analysis resulted in six themes describing what motivates participation in a technology design process. The themes were deductively analysed, and five of the six themes were categorised within the three basic psychological needs categories in Ryan and Deci's (2002) Self-Determination Theory. *Influencing the designed technology and the design activity* was identified within the category of autonomy. Within the competence category, *enhancing skills and knowledge,* and *a sense of self-efficacy* were identified. Furthermore, *developing social relationships* and a *sense of meaningfulness* were identified within the relatedness category. Lastly, a *sense of enjoyment* was categorised as an additional theme outside of the three categories of psychological needs of the Self-Determination Theory.

4.1. Autonomy

4.1.1. Influencing the designed technology and the design activity

The participants described that it was important for them to influence both the designed technology and the design activities. Moreover, they described that it was important *how* their contribution was incorporated in the technology design. They described situations where they had been actively taking part in decision-making, and later seen that their opinions had been included in the design. The following example illustrated the importance of involvement in decision making:

> Hege: I gave feedback. For example, I gave feedback about a button on the app. They had one button, but I suggested to change that and have two.
>
> Researcher: Great, so were you listened to [by the researchers]?
>
> Hege: Yeah, they listened to what I had to say, and then they tried to include my suggestion in the app. That is what they usually do, they get our suggestions and then include them in the app, and then we try and test the app.
>
> Researcher: So, can you remember if any of your suggestions have been included in the app?
>
> Hege: Actually, I have given a suggestion about smiley faces. And the suggestion was included, and we have even tested it on the app. I really hope that the smileys are included in the app if it gets released.
>
> Researcher: So, it's important for you that your suggestions are included?
>
> […] Hege: Yes.
>
> Researcher: And if they are to be excluded?
>
> Hege: Well, it would be kind of sad because we have participated many times and have given a lot of feedback and suggestions. If we participate, we want to be listened to. That's why we participated. If you don't listen to us, then you can just make the app yourselves.

The importance of influencing the technology was elaborated on by Eric. When asked about important factors during participation, he stated: 'It was important that our ideas were included and that the people making the apps let us decide. It means a lot'. As illustrated here, the participants felt acknowledged because they were listened to.

The theme of influencing the design was also identified by teachers in the reflective notes. Mina wrote,

> The students liked participating, and they were very interested in the process and how far you have gotten in developing [their ideas in] the app. […] I can see that they are very proud when they have an idea and that it [idea] is written down

Tor confirmed the importance of influencing the design. He wrote, 'it is important that the students' experience being seen and taken seriously. That they feel like they can influence the development of something they can use'.

The participants mentioned the importance of being able to influence the design activity, for instance during design activity workshops. When asked about the decision making, Eric stated,

> I think we have been given the opportunity to make decisions. I remember we had to draw or something like that. Or actually, we were supposed to write, but I wanted to draw instead. And everybody was fine with it. Not everyone is usually fine with us drawing instead of writing. It is important that people respect my choice when I want to work differently. As long as I try, it should be fine.

He later elaborated: 'It is difficult for me to write, and I get to contribute more if I can draw. It is different because at school I have to write. Here, I can draw if I prefer, and that's why I enjoy participating here'.

4.2. Competence

4.2.1. Enhancing skills and knowledge

While the design activities had predictable and known tasks such as writing and collaborating, the participants mentioned that they also learned new skills and enhanced their knowledge. For example, when asked if they had learned new skills, Hege stated,

> You learn a lot (when participating in design). It's like school. You learn a lot in both places. You learn a lot of new things, and you get help when you need it in both places. But it's a little more interesting in design activities. Because at school you have classes and subjects and all that. But here it's all about what interests you, and you are allowed to do more as you wish.

The students described using their skills in different ways during the design activities. However, they also described learning new skills such as using technology (tablet), how to give feedback, and how to search online. This is illustrated by the following example. When asked about skills, Beate responded, 'I have learnt how to express myself on the Internet. Also, I have learnt how to navigate in apps and how to use the suggestions (i.e. interests) that come up'. This quote was given after a design activity in which the participants tested adding information and mapping interests in the prototype of the tool.

The participants described enhanced knowledge in two main categories: knowledge about technology and knowledge about technology design processes. Speaking of enhanced knowledge about technology, Andreas said, 'participating in these workshops and activities have made me realise how difficult it is to design technology. And now I know more about apps and how they work on iPhones and iPads'. The participants described gaining knowledge about the technology design process. When asked about the process, Marit stated, 'I already use many apps on my phone and play many games at home. But I did not know how they were designed. But now I know more of how apps and such things are made'.

4.2.2. Sense of self-efficacy

During the design activities, participants used many of the same skills as in school. According to them, this led to feelings of predictability and security. When asked about what the design activities consisted of, Andreas stated, 'Well, we mostly do usual things, like writing down ideas, reading instructions, brainstorming and discussing our ideas. So, it is not that difficult to participate'. Moreover, they described that participating in design activities led to feelings of confidence. As illustrated by Beate, 'sometimes you do not know if your idea is good or not. But here you learn that often even if you thought your idea was bad, it might actually be really good'. Confidence was mentioned in reflective notes gathered from teachers that participated in the design sessions. During the project, it was observed that some participants seemed bored and not engaged. One example was a student who did not wish to participate in parts of the workshops or activities. However, when activities were in line with his interests, such as the gamification workshop, he was engaged and gave feedback on both the tested games and other games he had tried during leisure activities. For instance, Joakim, a university student, stated: 'They were all very active in giving feedback and were interested in playing and trying the games we tested' and the teacher, Martin reflected on the same situation: 'One of the students was very engaged. It surprised me that he was involved in some of the tasks. He usually expresses himself as little as possible in class'.

However, the participants also described a sense of self-efficacy (ability to cope) as the design activities made them feel competent, and they were viewed as experts throughout the design activities. Eric stated, 'It was important that when we had ideas, we were listened to. You never said that the idea or suggestion was bad. And that made me feel good about the ideas I had'. Also, the data indicated that it was important that they were helped when they did not master or understand given tasks. As illustrated by the following example from the interview with Eric,

> Researcher: During the activities, did you experience situations you found difficult?
>
> Eric: Yes, sometimes there were things that were difficult.
>
> Researcher: Do you have an example?
>
> Eric: Yes, it was, for example, when we were playing Mario cart and eating, then there was a question I did not understand [on the consent form]. Then a researcher came and just explained to me what it was about. [Because] I have some difficulty understanding what I read. It is a lot easier when people read to me. If I do not understand, they give an example. And then it's like … ok then I understand what they meant.
>
> Researcher: What do you think about that?
>
> Eric: It is important. And that is why I liked it here because I could always get help when I needed or did not understand.

Participants described that taking part in the design activities was daunting at first, but as they learned about the design activities and got to know the designer and researchers, it became fun. For instance, Eric stated,

> At first it was daunting when we were asked to participate. I did not know much about design. So, I just jumped into it. But after the first time, I realized that everything went well, and it's really just fun to participate

This was confirmed in reflective notes gathered from teachers that participated in the design sessions. For instance, Mina wrote, 'I think that the humour and the informal setting in the workshops contribute to creating an environment where the students are relaxed. They then dare to talk and present their opinions and desires'.

4.3. Relatedness

4.3.1. Developing social relationships

Participation in the design activities led to the development of relationships between the participants, the researchers, and the design team. Throughout the design process, participants built social relationships with researchers and the designer through social interaction. When asked about the social part of design activities Eric said, 'We know you [the researchers] well now because you have been here every time we have had design activities. I think it would be very strange if new people came instead of you. And we also have lunch and talk about other things like games with you'. This corresponds with the observations during the design sessions, where participants and researchers had conversations about topics not related to the design workshops, such as leisure activities. In addition, when a researcher or designer was absent, participants reacted with non-verbal cues such as shaking of the head and shoulder shrugging and asked why.

The participants described that the social interactions in the design activities were different from their interactions in other settings. The social relationships that had been built over time led to confidence and trust, which subsequently led to them expressing themselves more freely. They expressed that they experienced the relationship with the researchers as collaborative. For instance, when asked about collaboration, Beate said, 'if new researchers came, it would be difficult to communicate at first. I think … some of us have some things we struggle with, and when you are here over time, you know a little more about it than others'.

Participants also developed social relationships amongst each other. The social relationship between the participants led to collaboration and the opportunity to elaborate on each other's ideas. Furthermore, they expressed that it was important to participate as a group and not individually with researchers. When asked about the other participants, Tom stated, 'it is important that the others [students] also are here. Because we can work together and build upon each other's ideas. […] I think I like working with them more than I would alone'. It was observed that the students would give each other a 'thumbs up' in encouragement and clap for each other in appreciation during the design activities.

4.3.2. Sense of meaningfulness

The participants described that an essential element of participation was that it was meaningful. This was characterised by contributing to the design of technology that has the potential of helping other people with intellectual disabilities in the community. This is illustrated by Hege, when asked if she felt that participating was important, she stated,

> Yes, because if you struggle with something in your everyday life, maybe the app we are creating can help you. Many people like me struggle with writing [a cv], and if they use the app it may help them. It can make it easier for people

This suggests that participation in design activities led to feelings of contributing to a larger community and society.

The participants viewed the technology as something they could use too; not just others. This is illustrated by Andrine, who stated, 'I think it is important to participate because I think that it [the app] is something that I can use myself. So, I hope that the app gets developed and I can use it when applying for a job'.

4.4. Sense of enjoyment

The participants described their participation in the design activities as enjoyable. During the design activities, there was laughter, engagement, and shared lunch. It was often observed that participants and researchers were engaging in small talk and banter during the design activities and breaks. Non-verbal cues such as smiling laughing were observed. The participants described that elements connected to their interests and preferences were important for their enjoyment. For instance, when Andreas was asked about the length of the design activity, he stated, 'I wouldn't mind if we used more time because this is more fun than school classes'. He then elaborated, 'It is more exciting here. It is more fun to work with technology and creating the app than to have math class'.

Furthermore, the tasks carried out during the design activities were also described as enjoyable. For instance, after the fifth design activity, which centred on gamification, Beate said, 'well, the most exciting part of the day was getting to try many different games'. She elaborated, 'I like playing games at home, so it fits me well to try games here as well'. This was confirmed by the reflective notes from the teacher who participated. Mina wrote, 'the part about games was of course extra motivation for the students. It was clear that the students had a lot to contribute with in that part [of the design activity]'. She also elaborated, '[…] I think participation in the design activity was enjoyable and engaging for the students'. Participants also mentioned that activities during breaks and having lunch with the researchers and the designer made the design activities more enjoyable. As illustrated by Hege, 'it was fun participating today, we got to test the app, and have free lunch as well'.

While enjoyment was prominent during the design activities, boredom and non-engagement did occur. It was observed that a participant did not wish to participate in some activities. For instance, Tom was observed pulling up his jumper over his face when asked for suggestions on how to map interests. Moreover, there were observations of lack of interest and losing focus (e.g. turning away from the task, talking to others about other subjects, observing others outside) when lacking immediate assistance during certain activities.

5. Discussion

Studies have highlighted the importance of user involvement of people with intellectual disabilities in design activities (e.g. Benton and Johnson 2015; Robb et al. 2021). However, there is a lack of research on motivation (Hansen and Iversen 2013) and participation benefits (Benton and Johnson 2015) in design activities. Furthermore, few studies have specifically focused on people with intellectual disabilities (Raman and French 2021). This study aimed to explore what motivates young adults with intellectual disabilities to participate in technology design activities. In particular, we investigated how the participants' experiences relate to the fulfilment of autonomy, competence, and relatedness during participation. Our study suggests that *influencing the designed technology and the design activity*, *enhancing skills and knowledge*, *experiencing a sense of self-efficacy*, *developing social relationships*, and *experiencing a sense of meaningfulness* can lead to the fulfilment of the need for autonomy, competence, and relatedness. Our findings show that these elements are important motivational factors in design activity participation for young adults with intellectual disabilities. In addition, *enjoying the activities* seems motivating.

5.1. Importance of autonomy

User involvement in design processes is essential as people with intellectual disabilities are best situated to communicate their needs and suggest how to improve technological solutions. Moreover, meaningfully involving the stakeholders in the design activities reduces the possibility of non-use of technology (Ghanouni et al. 2020). Providing participants with real power during design processes (Robb et al. 2021) is also in line with the wish of individuals with disabilities, who have repeatedly stated that they want self-determination and control over their lives (Stancliffe 2001). The findings in this study emphasise the significance of *influencing the designed technology and the design activities*. This ability to influence is connected to autonomy, which occurs when people feel that they have a choice and can control activities (Niemiec and Ryan 2009). When the need for autonomy is satisfied, people are more likely to engage and persist with activities. While people with intellectual disabilities often lack autonomy (Petner-Arrey and Copeland 2015), this study suggests that when participants have the opportunity to influence a design activity and contribute to creating a solution for a problem, participation in design processes can lead to autonomy. The possibilities of shared decision-making, contribution of experiences, and engagement during design activities (Robb et al. 2021) make autonomy a critical concept to consider in design activities with people with intellectual disability.

The participating members of the study group reported receiving support and guidance throughout the design activities as important. Despite depending on help and facilitation during design activities, they experienced autonomy. A possible explanation is that people with intellectual disabilities experience few opportunities for autonomy and may not feel inclined or empowered to influence the setting or environment (Wehmeyer and Shogren 2017). An opportunity to influence the design process and the technology provides a valuable opportunity for the development of a sense of autonomy even though the participants need support and guidance. As supported by Frielink, Schuengel, and Embregts (2018), this study shows that people can depend and rely on other people for help and still experience autonomy. Still, according to Chinn and Pelletier (2020), it is important that people with intellectual disabilities exercise greater authority and influence in decision making in design processes.

Moreover, in line with our study, participants with intellectual disabilities should not be limited to certain roles having limited influence on the final solution (Chinn and Pelletier 2020). Our findings suggest that people with intellectual disabilities can be more motivated to participate in design activities if they see that their contribution is viewed and considered valuable by the design team and the research team.

While autonomy in technology design activities with people with intellectual disabilities is important, tensions between facilitators or designers and the participants can occur. Action design research stresses the principle of mutually influential roles among the different participants (Sein et al. 2011). Researchers and facilitators may offer and bring theoretical knowledge and technological advances to the process, and participants bring practical knowledge and lived experiences. These contributions may be complementary, or in some cases compete with one another (Sein et al. 2011). In this study, our findings suggest that it is important to reflect and collaborate with the participants in decision making as not being listened to can lead to diminished motivation. While having a voice and a choice can support the need for autonomy (Niemiec and Ryan 2009), it does not guarantee that the participant can influence the design activity or the designed technology. For instance, participants with better communication or writing abilities may have higher chances of influencing the decision making in the design process and the design outcome. Therefore, as suggested by earlier literature (Safari, Wass, and Thygesen 2021), providing an overview of the importance of the participants' involvement and suggestions without overcommitting is important to avoid disappointment. Tensions regarding excluded ideas and expectations to the designed technology can also be managed by focusing on the design process as a whole, rather than solely on the final solution (Safari, Wass, and Thygesen 2021).

The results show that it was experienced as *meaningful* to contribute to a technology that may help the participants themselves and other people in the community. The sense of meaningfulness described by the participants may provide a sense of relatedness as the participants describe contributing to a tool that can help others in the community. This finding is in line with Deci and Ryan (2002), who refer to relatedness as having a sense of belongingness with other individuals and being part of a community. Relatedness can therefore be understood as a sense of belonging both at a micro-level and a macro-level. Participation in design activities may fulfil the need for relatedness at a macro-level as the participants experience contributing to a larger community. Our findings suggest, when possible, informing the participants about why they are invited to participate, and what they are contributing to, can give the participants a sense of relatedness and ownership. In turn, such a sense of ownership to the process and the solution can motivate participants in design activities (van Rijn and Stappers 2008).

5.2. Facilitation and participation over time

The findings in this study suggest that participation in design activities over time was influential in the fulfilment of several psychological needs. For instance, participants stated that collaborating with the same designers and other participants over time was essential in the development of social relationships. Repeated interactions and frequent contact with the same people are considered important in forming social bonds and in fostering a sense of belonging (Baumeister, Leary, and Steinberg 1995). The present study raises the possibility that the participants were motivated to take part in the design activities as the activities facilitated for and offered lasting, frequent, and pleasant social interactions over time. The *development of social relationships* was an influential motivating factor for participation in design activities. Frielink, Schuengel, and Embregts (2018) state that the need for relatedness refers to feeling connected and taking, and being taken, care of by other people. Some interpersonal activities require a greater need for relatedness in order to maintain intrinsic motivation, as opposed to solitary activities (Deci and Ryan 2002). One can argue that design activities with people with intellectual disability is a context that may require the fulfilment of the need for relatedness to maintain intrinsic motivation.

In the current study, participating with co-students, teachers, and facilitators throughout design activities was described as more fun than participating alone. Indeed, people with intellectual disabilities are among the most socially excluded groups (Xu et al. 2014) and participate less in social and leisure activities than people without disabilities (Badia et al. 2013). It is possible that the participants were motivated to participate due to the opportunity to develop new social relationships and social skills. As a socially excluded group (Xu et al. 2014), socialising with new people outside their primary and secondary social groups over time may be a motivating factor. While social benefits such as making new friends have been reported as an outcome in design activities (Raman and French 2021), our study suggests that social relationships led to confidence and trust, which subsequently led to more outgoing behaviour and expressing themselves more freely.

In terms of influencing the design and design activities, the duration of the project may have influenced the participants' fulfilment of the need for autonomy. The participants witnessed their ideas being incorporated into the designed technology as opposed to if they had only participated once or been presented to the solution without providing input. In line with earlier studies, genuine participation and empowering the participants in creativity and decision-making is essential (Raman and French 2021) and can motivate the participants to participate further.

The participants described a *sense of self-efficacy* as the design activities made them feel competent and confident. Ryan and Deci (2002) state that competence is not necessarily an attained skill or capability, but rather a sense of confidence in one's own mastery, which is, in turn, is essential for motivation. Our study suggests that the participants were motivated to participate over a period of time because they felt able to cope with the tasks given and encouraged by the positive feedback throughout the design activities. Consequently, the design activities allowed the participants to use their skills and enhance their capabilities through involvement and engagement. Moreover, in line with our findings, earlier studies on co-designing technologies with people with intellectual disabilities have stressed the importance of incorporating the competencies of the participants (representative practical skills from their participation in life activities) (Bayor et al. 2021). On the other hand, while a competency-based design approach can empower and enhance the skills of people with intellectual disabilities (Bayor et al. 2021), it can also cause tensions between the participants and the designers or facilitators. The process of mapping competencies, abilities and need for additional support when tailoring the design activities can be time-consuming and demanding for designers and facilitators. However, our findings suggest that the sense of self-efficacy that occurs when participants can use their skills and abilities can lead to engagement and motivation. This accords with Niemiec and Ryan (2009), who state that a central notion in participation is that people engage with and value the activities they understand and master. Indeed, the participants expressed that it was necessary to have support when unable to master a given task. This finding suggests that it is vital to find the right match between the tasks and the participants' abilities as experiences of incompetence or failure can lead to lack of confidence and thereafter less motivation.

However, design activities should also challenge, test, and expand the participants' capabilities (Dent-Spargo 2018). While the tasks during the design activities were predictable and known, the design activities were situated in a different setting with different requirements than the participants were used to. Still, we found that in design activities with people with intellectual disabilities, it can be difficult to both challenge the participants and ensure predictability. However, working longitudinally with few participants led to an in-depth understanding, which contributed to necessary knowledge on facilitating mastery while also challenging the participants. For instance, some participants needed more time to process before answering or partaking tasks. Therefore, with this knowledge of the participants' use of time, we were able to facilitate and not rush the participant during decision-making or during creative thinking. Moreover, we were able to differentiate when the participant needed facilitation (e.g. support or explanation) or simplification of a task and when the participant was thinking or visualising. The knowledge on facilitating mastery while challenging the participants is in line with the conditions for flow, which is the sweet spot between not being too easy, as it then becomes boring, and not being too hard, as it might cause frustration or anxiety (Nakamura and Csikszentmihalyi 2009). When in flow, a person is in an intrinsically optimal state and is intensely engaged in an activity while excluding all other thoughts (Nakamura and Csikszentmihalyi 2009). While design activities with people with disabilities are often limited to one-off sessions, our study suggests that participation over time may profoundly enhance skills and knowledge and foster motivation through the fulfilment of the need for competence.

5.3. The importance of enjoyment

Our study indicates that it is crucial to ensure that design activities are enjoyable, as they can, in turn, influence the motivation and level of engagement. While participation was daunting at first, the participants described *enjoying the design activities* after a while. For instance, our participants reported enjoying the activities when experimenting with new tasks, testing technology, and in interactions with others. The participants described that the design activities led to a sense of enjoyment and matched their interests and preferences, which is, according to Benton and Johnson (2015), the minimum positive outcome such activities should have. Having fun is important to people with disabilities, but this tends to be overlooked (Brereton et al. 2015).

One can argue that the sense of enjoyment described by the participants is connected to the fulfilment of the three basic psychological needs (autonomy, competence, and relatedness). Earlier studies have reported a relation between the satisfaction of basic psychological

needs and enjoyment (e.g. Ryan, Rigby, and Przybylski 2006; Tamborini et al. 2010). While defining enjoyment as the fulfilment of the three basic psychological needs is incomplete – autonomy, competence and relatedness have been found to serve as a predictor of enjoyment (Tamborini et al. 2010). In line with Schepers, Dreessen, and Zaman (2018), enjoyment in design activities can be a direct user gain and also relate to additional gains, such as stepping out of the comfort zone and developing a sense of self-esteem. Our study suggests that creating an enjoyable experience, and fulfilling the need for autonomy, competence and relatedness, may be essential for motivating participants with intellectual disabilities in design activities. In addition, in terms of ethical considerations, enjoying the design activities is a central factor as ensuring beneficence is important when designing with people with intellectual disabilities.

5.4. Limitations

This study has limitations that need to be considered. The current study has a limited number of participants. However, the number of participants and interviews is deemed sufficient for a small project (Braun and Clarke 2013) and were longitudinal. Moreover, it is essential to acknowledge that people with intellectual disabilities are not a homogenous group and that the design project and activities were tailored to participants with certain abilities and age range. Therefore, the participants' capabilities, age, interests and technology experience may have contributed to their experiences and motivation to participate. The second author participated in the design activities as a facilitator, and the first author as an observer in all the design activities. While the roles of the researchers did provide information that would otherwise be inaccessible, it may also have an impact on the results of this study. The context of this study, including the design activities and the designed technology may also have contributed to the experiences and motivation to participate. The current study explored the participants' motivation of participation in technology design activities, a possible limitation is that we did not compare these motivational aspects to other settings in their daily life. Lastly, a possible limitation to our study is that we did not involve the participants on the academic side of the research process (e.g. verification of analysis and findings).

5.5. Implications for practice

We suggest that given the importance of in-depth knowledge on the participants' abilities and capability to facilitate the fulfilment of the basic psychological needs, it is vital that researchers and designers invest time, are interested in forming a relationship with the participants on their own terms, and understand their needs throughout participation. Consequently, participation in design activities should contribute to fulfilling the Convention on the Rights of Persons with Disabilities (2007), proclaiming people's fundamental right to make their own choices, participate and being included. Lastly, while our study indicates that design activities should be facilitated to match the capabilities of the participants, it also indicates that it is necessary to challenge the participants. As organising and conducting design activities with people with intellectual disabilities can be time-consuming, we suggest contextual preparation and emphasising on in-situation facilitation rather than one size fits all approaches. Moreover, having a competency-based design approach in both design activities and designed technology (Bayor et al. 2021) may be less time-consuming.

6. Conclusions

This case study shows that competence, autonomy, and relatedness are important motivational factors for participation in technology design activities for young adults with intellectual disabilities. Findings in this study show that several of the factors that may lead to the fulfilment of the basic psychological needs were initiated because the participants participated over a period of time. As facilitation throughout participation is linked with in-depth knowledge and understanding of the participants' needs, our study suggests that participation in a longitudinal manner may be particularly important for people with intellectual disabilities. This study suggests that to motivate people with intellectual disabilities in design activities, designers and practitioners should implement strategies that aim to improve and fulfil the persons' basic psychological needs of autonomy, competence, and relatedness. Our findings show that influencing the designed technology and the design activity, enhancing skills and knowledge, experiencing a sense of self-efficacy, developing social relationships, and experiencing a sense of meaningfulness can contribute to motivation. Moreover, enjoying the activities was also identified as an essential motivational factor in design activities. There is a need for further research on motivation in different design contexts, different populations, and both on longitudinal and short-term design activities. Moreover, more research on barriers that prevent the fulfilment of autonomy, competence and relatedness in technology design activities is needed.

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Authors' contributions

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References

Badia, Marta, M. B. Orgaz, M. A. Verdugo, and Ana M Ullán. 2013. "Patterns and Determinants of Leisure Participation of Youth and Adults with Developmental Disabilities." *Journal of Intellectual Disability Research* 57 (4): 319–332.

Bano, Muneera, and Didar Zowghi. 2015. "A Systematic Review on the Relationship Between User Involvement and System Success." *Information and Software Technology* 58: 148–169.

Baroudi, Jack J, Margrethe H Olson, and Blake Ives. 1986. "An Empirical Study of the Impact of User Involvement on System Usage and Information Satisfaction." *Communications of the ACM* 29 (3): 232–238.

Baumeister, Roy F., Mark R. Leary, and Robert J. Steinberg. 1995. "The Need to Belong: Desire for Interpersonal Attachments as a Fundamental Human Motivation." *Psychological Bulletin* 117 (3): 497–529. doi:10.1037/0033-2909.117.3.497

Baxter, Pamela, and Susan Jack. 2008. "Qualitative Case Study Methodology: Study Design and Implementation for Novice Researchers." *The Qualitative Report* 13 (4): 544–559.

Bayor, Andrew A, Margot Brereton, Laurianne Sitbon, Bernd Ploderer, Filip Bircanin, Benoit Favre, and Stewart Koplick. 2021. "Toward a Competency-Based Approach to Co-Designing Technologies with People with Intellectual Disability." *ACM Transactions on Accessible Computing* 14 (2): 1–33. doi:10.1145/3450355.

Benton, Laura, and Hilary Johnson. 2014. "Structured Approaches to Participatory Design for Children: Can Targeting the Needs of Children with Autism Provide Benefits for a Broader Child Population?" *Instructional Science* 42 (1): 47–65. doi:10.1007/s11251-013-9297-y.

Benton, Laura, and Hilary Johnson. 2015. "Widening Participation in Technology Design: A Review of the Involvement of Children with Special Educational Needs and Disabilities." *International Journal of Child-Computer Interaction* 3: 23–40. doi:10.1016/j.ijcci.2015.07.001.

Benton, Laura, Hilary Johnson, Emma Ashwin, Mark Brosnan, and Beate Grawemeyer. 2012. "Developing IDEAS: Supporting Children with Autism within a Participatory Design Team." In *CHI '12: Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, Texas USA*, May 5-10, 2012, 2599–2608. New York: Association for Computing Machinery. doi:10.1145/2207676.2208650.

Börjesson, Peter, Wolmet Barendregt, Eva Eriksson, and Olof Torgersson. 2015. "Designing technology for and with developmentally diverse children: A systematic literature review." In *Proceedings of the 14th International Conference on Interaction Design and Children, Boston, Massachusetts* June 21–24, 2015, New York, NY, Association for Computing Machinery 79-88. doi:10.1145/2771839.2771848.

Braun, Virginia, and Victoria Clarke. 2006. "Using Thematic Analysis in Psychology." *Qualitative Research in Psychology* 3 (2): 77–101. doi:10.1191/1478088706qp063oa.

Braun, Virginia, and Victoria Clarke. 2013. *Successful Qualitative Research: A Practical Guide for Beginners*. New York: SAGE.

Brereton, Margot, Laurianne Sitbon, Muhammad Haziq Lim Abdullah, Mark Vanderberg, and Stewart Koplick. 2015. "Design After Design to Bridge Between People Living with Cognitive or Sensory Impairments, Their Friends and Proxies." *CoDesign* 11 (1): 4–20. doi:10.1080/15710882.2015.1009471.

Caton, Sue, and Melanie Chapman. 2016. "The use of Social Media and People with Intellectual Disability: A Systematic Review and Thematic Analysis." *Journal of Intellectual and Developmental Disability* 41 (2): 125–139.

Chinn, Deborah, and Caroline Pelletier. 2020. "Deconstructing the co-Production Ideal: Dilemmas of Knowledge and Representation in a co-Design Project with People with Intellectual Disabilities." *Journal of Intellectual & Developmental Disability* 45 (4): 326–336.

Cinquin, Pierre-Antoine, Pascal Guitton, and Hélène Sauzéon. 2020. "Designing Accessible MOOCs to Expand Educational Opportunities for Persons with Cognitive Impairments." *Behaviour & Information Technology* 40 (11): 1101–1119. doi:10.1080/0144929X.2020.1742381.

Collins, James C, Joseph B Ryan, Antonis Katsiyannis, Mitchell Yell, and David E Barrett. 2014. "Use of Portable Electronic Assistive Technology to Improve Independent job Performance of Young Adults with Intellectual Disability." *Journal of Special Education Technology* 29 (3): 15–29. doi:10.1177/016264341402900302.

Deci, Edward L, Rosemary Hodges, Louisa Pierson, and Joseph Tomassone. 1992. "Autonomy and Competence as Motivational Factors in Students with Learning Disabilities and Emotional Handicaps." *Journal of Learning Disabilities* 25 (7): 457–471. doi:10.1177/002221949202500706.

Deci, Edward L, and Richard M Ryan. 1985. *Intrinsic Motivation and Self-Determination in Human Behaviour*. New York: Plenum.

Deci, Edward L, and Richard M Ryan. 1991. "A Motivational Approach to Self: Integration in Personality." In *Nebraska Symposium on Motivation: Vol. 38. Perspectives on Motivation*, edited by R. Dienstbier, 237–288. Lincoln: University of Nebraska Press.

Deci, Edward L, and Richard M Ryan. 2000. ""The" What" and" why" of Goal Pursuits: Human Needs and the Self-Determination of Behavior."." *Psychological Inquiry* 11 (4): 227–268.

Deci, Edward L., and Richard M. Ryan. 2002. "Overview of Self-Determination Theory: An Organismic Dialectical Perspective." In *Handbook of Self-Determination Research*, edited by Edward L. Deci, and Richard M. Ryan, 3–33. Rochester, NY: University of Rochester Press.

Deci, Edward L, and Richard M Ryan. 2012. ""Motivation, Personality, and Development Within Embedded Social Contexts: An Overview of Self-Determination Theory."." In *The Oxford Handbook of Human Motivation*, edited by R. M. Ryan, 85–107. England: Oxford University Press.

Dent-Spargo, Rosie. 2018, Sep 3. "Using Self-Determination Theory to Support co-Design Activities." In *CEUR Workshop Proceedings. CC-TEL 2018: Co-Creation in the Design, Development and Implementation of Technology-Enhanced Learning*, edited by A. Piotrkowicz, R. Dent-Spargo, S. Dennerlein, I. Koren, P. Antoniou, P. Bailey, T. Treasure-Jones, I. Fronza, and C. Pahl, 1–10. Leeds: CEUR Workshop Proceedings. http://ceur-ws.org/Vol-2190/CC-TEL_2018_paper_2.pdf.

Fangen, Katrine. 2010. *Deltagende Observasjon*. Bergen: Fagbokforlaget.

Frauenberger, Christopher, Judith Good, and Alyssa Alcorn. 2012. Challenges, opportunities and future perspectives in including children with disabilities in the design of interactive technology. In *IDC '12: Proceedings of the 11th International Conference on Interaction Design and Children, Bremen, Germany,* June 12-15, 2012, 367–370. New York, NY, Association for Computing Machinery. doi:10.1145/2307096.2307171.

Frielink, Noud, Carlo Schuengel, and Petri JCM Embregts. 2018. "Autonomy Support, Need Satisfaction, and Motivation for Support among Adults with Intellectual Disability: Testing a Self-Determination Theory Model." *American Journal on Intellectual and Developmental Disabilities* 123 (1): 33–49. doi:10.1352/1944-7558-123.1.33.

García-Catalá, M. T., M. C. Rodríguez-Sánchez, and E. Martín-Barroso. 2020. "Survey of Indoor Location Technologies and Wayfinding Systems for Users with Cognitive Disabilities in Emergencies." *Behaviour & Information Technology*, 1–25. doi:10.1080/0144929X.2020.1849404.

Garrels, Veerle, and Hanne Marie Høybråten Sigstad. 2019. "Motivation for Employment in Norwegian Adults with Mild Intellectual Disability: The Role of Competence, Autonomy, and Relatedness." *Scandinavian Journal of Disability Research* 21 (1): 250–261. doi:10.16993/sjdr.639.

Ghanouni, Parisa, Tal Jarus, Jill G Zwicker, and Joseph Lucyshyn. 2020. "An Interactive Serious Game to Target Perspective Taking Skills among Children with ASD: A Usability Testing." *Behaviour & Information Technology* 40 (16): 1716–1726. doi:10.1080/0144929X.2020.1776770.

Green, Julie M, Elizabeth M Hughes, and Joseph B Ryan. 2011. "The use of Assistive Technology to Improve Time Management Skills of a Young Adult with an Intellectual Disability." *Journal of Special Education Technology* 26 (3): 13–20.

Guha, Mona Leigh, Allison Druin, and Jerry Alan Fails. 2010. "Investigating the impact of design processes on children." In *IDC '10: Proceedings of the 9th International Conference on Interaction Design and Children, Barcelona, Spain*, June 9 - 12, 2010, 198–201. New York, NY: Association for Computing Machinery. doi:10.1145/1810543.1810570.

Hansen, Elin Irene Krog, and Ole Sejer Iversen. 2013. "You are the real experts! Studying teenagers' motivation in participatory design". In *IDC '13: Proceedings of the 12th International Conference on Interaction Design and Children*, June 24-27, 2013, 328–331. New York, NY: Association for Computing Machinery. doi:10.1145/2485760.2485826.

Hendriks, Niels, Karin Slegers, and Pieter Duysburgh. 2015. "Codesign with People Living with Cognitive or Sensory Impairments: A Case for Method Stories and Uniqueness." *CoDesign* 11 (1): 70–82. doi:10.1080/15710882.2015.1020316.

Iversen, Ole Sejer, Christian Dindler, and Elin Irene Krogh Hansen. 2013. "Understanding Teenagers' Motivation in Participatory Design." *International Journal of Child-Computer Interaction* 1 (3-4): 82–87. doi:10.1016/j.ijcci.2014.02.002.

Katz, Idit, and Rinat Cohen. 2014. "Assessing Autonomous Motivation in Students with Cognitive Impairment." *Journal of Intellectual and Developmental Disability* 39 (4): 323–332. doi:10.3109/13668250.2014.934791.

Kittelsaa, Anna M. 2014. "Self-presentations and Intellectual Disability." *Scandinavian Journal of Disability Research* 16 (1): 29–44. doi:10.1080/15017419.2012.761159.

Kujala, Sari. 2003. "User Involvement: A Review of the Benefits and Challenges." *Behaviour and Information Technology* 22 (1): 1–16. doi:10.1080/01449290301782.

Lancioni, Giulio E, Nirbhay N Singh, Mark F O'Reilly, Jeff Sigafoos, Gloria Alberti, Valeria Chiariello, and Luigina Carrella. 2020. "Everyday Technology to Support Leisure and Daily Activities in People with Intellectual and Other Disabilities." *Developmental Neurorehabilitation* 23 (7): 431–438. doi:10.1080/17518423.2020.1737590.

Lancioni, Giulio E, Nirbhay N Singh, Mark F O'Reilly, Jeff Sigafoos, Gloria Alberti, Francesca Scigliuzzo, Mario Signorino, Doretta Oliva, Angela Smaldone, and Maria L La Martire. 2010. "Persons with Multiple Disabilities use Orientation Technology to Find Room Entrances During Indoor Traveling." *Research in Developmental Disabilities* 31 (6): 1577–1584. doi:10.1016/j.ridd.2010.05.004.

Makhaeva, Julia, Christopher Frauenberger, and Katta Spiel. 2016. "Creating creative spaces for co-designing with autistic children: the concept of a "Handlungsspielraum"". In *Proceedings of the 14th Participatory Design Conference, Aarhus Denmark*, August 15 - 19, 2016, 51–60. New York, NY: Association for Computing Machinery. doi:10.1145/2940299.2940306.

Mankoff, Jennifer, Gillian R Hayes, and Devva Kasnitz. 2010. "Disability studies as a source of critical inquiry for the field of assistive technology." In *ASSETS '10: Proceedings of the 12th International ACM SIGACCESS Conference on Computers and Accessibility, Orlando, Florida, USA*, October 25–27, 2010, 3-11. New York, NY: Association for Computing Machinery. doi:10.1145/1878803.1878807.

Mazzone, Emanuela, Janet C Read, and Russell. 2011. Towards a framework of co-design sessions with children. *In: Proceedings of INTERACT 2011 Lisbon, Portugal*, September 5-9, 2011, 632–635. Berlin, Germany: Springer. doi:10.1007/978-3-642-23768-3_100.

Mechling, Linda C. 2007. "Assistive Technology as a Self-Management Tool for Prompting Students with Intellectual Disabilities to Initiate and Complete Daily Tasks: A Literature Review." *Education and Training in Developmental Disabilities* 42 (3): 252–269.

Mechling, Linda C, and Nicole H Seid. 2011. "Use of a Hand-Held Personal Digital Assistant (PDA) to Self-Prompt Pedestrian Travel by Young Adults with Moderate Intellectual Disabilities." *Education and Training in Autism and Developmental Disabilities* 46 (2): 220–237.

Muller, Michael J., and Allison Druin 2012. "Participatory Design: The Third Space in HCI." In *Human Computer Interaction Handbook: Fundamentals, Evolving Technologies, and Emerging Applications*. 3rd Edition, edited by Julie Jacko, 1125–1154. Boca Raton: CRC Press.

Murphy, Joan, and Lois Cameron. 2008. "The Effectiveness of Talking Mats [r] with People with Intellectual Disability." *British Journal of Learning Disabilities* 36 (4): 232–241.

Nakamura, Jeanne, and Mihaly Csikszentmihalyi. 2009. "Flow Theory and Research." In *Oxford Handbook of Positive Psychology* (2nd ed), edited by S. J. Lopez, and C. R. Snyder, 195–206. New York: Oxford University Press.

Neidlinger, Kristin, Stephanie Koenderink, and Khiet P Truong. 2021. Give the Body a Voice: Co-design with Profound Intellectual and Multiple Disabilities to Create Multisensory Wearables. In *CHI Conference on Human Factors in Computing Systems Extended Abstracts (CHI '21 Extended Abstracts), Yokohama, Japan*, May 8–13, 2021, New York, NY, Association for Computing Machinery 1-6. doi:10.1145/3411763.3451797.

Niemiec, Christopher P, and Richard M Ryan. 2009. "Autonomy, Competence, and Relatedness in the Classroom: Applying Self-Determination Theory to Educational Practice." *Theory and Research in Education* 7 (2): 133–144.

Nota, Laura, Lea Ferrari, Salvatore Soresi, and Michel Wehmeyer. 2007. "Self-Determination, Social Abilities and the Quality of Life of People with Intellectual Disability." *Journal of Intellectual Disability Research* 51 (11): 850–865. doi:10.1111/j.1365-2788.2006.00939.x.

Petner-Arrey, Jami, and Susan R Copeland. 2015. "'You Have to Care.'perceptions of Promoting Autonomy in Support Settings for Adults with Intellectual Disability." *British Journal of Learning Disabilities* 43 (1): 38–48.

Piper, Anne Marie, Eileen O'Brien, Meredith Ringel Morris, and Terry Winograd. 2006. "SIDES: a cooperative tabletop computer game for social skills development." In *CSCW '06: Proceedings of the 2006 20th anniversary conference on Computer supported cooperative work, Alberta, Banff, Canada*, November 4 - 8, 2006, 1-10. New York, NY: Association for Computing Machinery. doi:10.1145/1180875.1180877.

Raman, Sneha, and Tara French. 2021. "Enabling Genuine Participation in co-Design with Young People with Learning Disabilities." *CoDesign*, 1–17. doi:10.1080/15710882.2021.1877728.

Riege, Andreas M. 2003. "Validity and Reliability Tests in Case Study Research: a Literature Review with "Hands-on" Applications for Each Research Phase." *Qualitative Market Research* 6 (2): 75–86. doi:10.1108/13522750310470055.

Robb, Nigel, Bryan Boyle, Yurgos Politis, Nigel Newbutt, Hug-Jen Kuo, and Connie Sung. 2021. "Participatory Technology Design for Autism and Cognitive Disabilities: A Narrative Overview of Issues and Techniques." In *Recent Advances in Technologies for Inclusive Well-Being: Virtual Patients, Gamification and Simulation*. Vol. 196, edited by Brooks Anthony, Sheryl Braham, Bill Kapralos, Amy Nakajima, Jane Tyerman, and Lakhmi C. Jain, 469–485. Dordrecht: Springer. https://doi.org/10.1007/978-3-030-59608-8.

Ryan, Richard M, and Edward L Deci. 2000. "Self-determination Theory and the Facilitation of Intrinsic Motivation, Social Development, and Well-Being." *American Psychologist* 55 (1): 68–78. doi:10.1037/0003-066X.55.1.68.

Ryan, Richard M, and Edward L Deci. 2017. *Self-determination Theory: Basic Psychological Needs in Motivation, Development, and Wellness*. New York: Guilford Publications.

Ryan, Richard M, C. Scott Rigby, and Andrew Przybylski. 2006. "The Motivational Pull of Video Games: A Self-Determination Theory Approach." *Motivation and Emotion* 30 (4): 344–360. doi:10.1007/s11031-006-9051-8.

Safari, Mugula Chris, Sofie Wass, and Elin Thygesen. 2021. "'I Got To Answer the Way I Wanted To': Intellectual Disabilities and Participation in Technology Design Activities." *Scandinavian Journal of Disability Research* 23 (1): 192–203. doi:10.16993/sjdr.798.

Sanders, Elizabeth B-N., Eva Brandt, and Thomas Binder. 2010. "A Framework for Organizing the Tools and Techniques of Participatory Design." In *PDC '10: Proceedings of the 11th Biennial Participatory Design Conference, Sydney, Australia*, November 29 - December 3, 2010, 195–198. New York, NY: Association for Computing Machinery. doi:10.1145/1900441.1900476.

Sanders, Elizabeth B-N, and Pieter Jan Stappers. 2008. "Co-creation and the new Landscapes of Design." *Co-design* 4 (1): 5–18.

Saturno, Cleiton Eduardo, Alejandro Rafael Garcia Ramirez, Mauro José Conte, Mísia Farhat, and Elaine Carmelita Piucco. 2015. "An Augmentative and Alternative Communication Tool for Children and Adolescents with Cerebral Palsy." *Behaviour & Information Technology* 34 (6): 632–645. doi:10.1080/0144929X.2015.1019567.

Schalock, Robert L, Ruth Luckasson, and Marc J. Tassé. 2021. *Intellectual Disability: Definition, Diagnosis, Classification, and Systems of Supports*. 12th Ed. Washington: American Association on Intellectual and Developmental Disabilities.

Schepers, Selina, Katrien Dreessen, and Bieke Zaman. 2018. "Fun as a user gain in participatory design processes involving children: a case study." In *IDC '18: Proceedings of the 17th ACM Conference on Interaction Design and Children, Trondheim, Norway*, June 19–22, 2018, 396–404. New York, NY: Association for Computing Machinery. doi:10.1145/3202185.3202763.

Sein, Maung, Ola Henfridsson, Sandeep Purao, Matti Rossi, and Rikard Lindgren. 2011. "Action Design Research." *MIS Quarterly* 35 (1): 35–56.

Shogren, Karrie A, Michael L Wehmeyer, Susan B Palmer, Graham G Rifenbark, and Todd D Little. 2015. "Relationships Between Self-Determination and Postschool Outcomes for Youth with Disabilities." *The Journal of Special Education* 48 (4): 256–267. doi:10.1177/0022466913489733.

Sigstad, Hanne Marie H, and Veerle Garrels. 2018. "Facilitating Qualitative Research Interviews for Respondents with Intellectual Disability." *European Journal of Special Needs Education* 33 (5): 692–706.

Sitbon, Laurianne. 2018. "Engaging IT Students in Co-Design with People with Intellectual Disability." In *Extended Abstracts of the 2018 CHI Conference on Human Factors in Computing Systems, Montreal QC, Canada*, Apr. 2018, New York, NY: Association for Computing Machinery 1–6. doi:10.1145/3170427.3188620.

Soresi, Salvatore, Laura Nota, and Michael L. Wehmeyer. 2011. "Community Involvement in Promoting Inclusion, Participation and Self-Determination." *International Journal of Inclusive Education* 15 (1): 15–28. doi:10.1080/13603116.2010.496189.

Spradley, James P. 2016. *Participant Observation*. Long Grove: Waveland Press.

Stancliffe, Roger J. 2001. "Living with Support in the Community: Predictors of Choice and Self-Determination." *Mental Retardation and Developmental Disabilities Research Reviews* 7 (2): 91–98.

Steen, Marc, Menno Manschot, and Nicole De Koning. 2011. "Benefits of co-Design in Service Design Projects." *International Journal of Design* 5 (2): 53–60.

Tamborini, Ron, Nicholas David Bowman, Allison Eden, Matthew Grizzard, and Ashley Organ. 2010. "Defining Media Enjoyment as the Satisfaction of Intrinsic Needs." *Journal of Communication* 60 (4): 758–777. doi:10.1111/j.1460-2466.2010.01513.x.

UN General Assembly. 2007, January 24. *Convention on the Rights of Persons with Disabilities: Resolution*. Adopted by the General Assembly, A/RES/61/106. https://www.refworld.org/docid/45f973632.html.

van Rijn, Helma, and Pieter Jan Stappers. 2008. "Expressions of ownership: motivating users in a co-design process". In *PDC '08: Proceedings of the Tenth Anniversary Conference on Participatory Design, Bloomington, Indiana, USA*, October 1–4, 2008, Indianapolis, IN: Indiana University, 178–181. New York, NY: Association for Computing Machinery. doi:10.5555/1795234.1795266.

Wass, Sofie, Lise Amy Hansen, and Chris Safari. 2020. "Designing Transport Supporting Services Together with Users with Intellectual Disabilities." In *15th International Conference on Design Science Research in Information Systems and Technology, DESRIST 2020, Kristiansand, Norway, December 2–4, 2020, Proceedings*. Vol. 12388, edited by Hoffman Sara, Oliver Müller, and Matti Rossi, 56–67. Cham: Springer Nature.

Wehmeyer, Michael L. 2005. "Self-determination and Individuals with Severe Disabilities: Re-Examining Meanings and Misinterpretations." *Research and Practice for Persons with Severe Disabilities* 30 (3): 113–120.

Wehmeyer, Michael L, and Nancy Bolding. 2001. "Enhanced Self-Determination of Adults with Intellectual Disability as an Outcome of Moving to Community-Based Work or Living Environments." *Journal of Intellectual Disability Research* 45 (5): 371–383. doi:10.1046/j.1365-2788.2001.00342.x.

Wehmeyer, Michael L., and Nancy W. Garner. 2003. "The Impact of Personal Characteristics of People with Intellectual and Developmental Disability on Self-Determination and Autonomous Functioning." *Journal of Applied Research in Intellectual Disabilities* 16 (4): 255–265. doi:10.1046/j.1468-3148.2003.00161.x.

Wehmeyer, Michael L, and Susan B Palmer. 2003. "Adult Outcomes for Students with Cognitive Disabilities Three-Years After High School: The Impact of Self-Determination." *Education and Training in Developmental Disabilities* 38 (2): 131–144.

Wehmeyer, Michael L, and Karrie A Shogren. 2017. "Applications of the Self-Determination Construct to Disability." In *Development of Self-Determination Through the Life-Course*, edited by Michael L. Wehmeyer, Karrie A. Shogren, Todd D. Little, and Shane J. Lopez, 111–123. Dordrecht: Springer. doi:10.1007/978-94-024-1042-6_9.

Wilson, Cara, Laurianne Sitbon, Margot Brereton, Daniel Johnson, and Stewart Koplick. 2016. "'Put yourself in the picture' designing for futures with young adults with intellectual disability." In *OzCHI '16: Proceedings of the 28th Australian Conference on Computer-Human Interaction, Tasmania, Launceston, Australia*, November 29 - December 2, 2016, 271-281. New York, NY: Association for Computing Machinery. doi:10.1145/3010915.3010924.

Xu, Yuanying, Jinglan Zhang, Roman Yagovkin, Simone Maniero, Phurpa Wangchunk, and Stewart Koplick. 2014. "Rove n' Rave™ Development: A Partnership between the University and the Disability Service Provider to Build a Social Website for People with an Intellectual Disability." In *OzCHI '14: Proceedings of the 26th Australian Computer-Human Interaction Conference on Designing Futures: The Future of Design, New South Wales, Sydney, Australia*, December 2 - 5, 2014, 531–534. New York, NY: Association for Computing Machinery. doi:10.1145/2686612.2686697.

Yin, Robert K. 2017. *Case Study Research and Applications: Design and Methods*. 6th ed. Los Angeles: Sage.