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Training work-related social skills in adults with Autism Spectrum Disorder using a tablet-based intervention

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ABSTRACT

While multiple studies suggest that social skills are considered as essential in promoting employment, literature highlights a deficit in these skills among workers with Autism Spectrum Disorder (ASD) for whom difficulties in communication and social interaction are often reported. In this article, we explain how we used a User-Centered Design to identify and define in detail the work-related social skills that need to be trained. The aim was to develop social scenarios to train work-related social skills relevant for people with ASD using a digital app on a tablet. Participatory Design in our study included a needs analysis with questionnaires and interviews, as well as focus-groups and workshops with professionals of several disability employment services and workers or job seekers with ASD. Sixty-six social scenarios were written and 28 social skills were identified as relevant. This approach allowed us to design a tablet-based intervention which is an intelligent system by design since its content and structure target the social skills which require training for users with ASD.

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User-centered design; social skills; tablet-based intervention; Autism Spectrum Disorder

1. Introduction

The International Convention on the Rights of Persons with Disabilities mentions in Article 27 "Work and Employment" the following: "States Parties recognize the right of persons with disabilities to work, on an equal basis with others; this includes the right to the opportunity to gain a living by work freely chosen or accepted in a labor market and work environment that is open, inclusive and accessible to persons with disabilities." However, people with Autism Spectrum Disorder (ASD) have a very low employment rate (Johnson et al., 2020; Solomon, 2020). This can have consequences for them because employment and mental health are strongly linked. In addition to the intrinsic value of work or meaningful daily activity, employment represents an opportunity for financial independence, social inclusion, and social status (Jahoda et al., 2008). Individually, not finding employment can negatively impact socioeconomic status, quality of life, and mental health (Wanberg, 2012). With the transition to employment comes increased autonomy which has important implications for emotional well-being (Wehmeyer et al., 1996). Work also confers social status and can provide an opportunity to form meaningful social relationships for the individual (Jahoda et al., 2008).

Deficits in social skills are central to ASD (Williams White et al., 2006). People with ASD may have difficulties in the use of communication for social purposes and difficulties in modulating behavior in response to context (ICD-10, World Health Organization, 2019). They may have difficulty in attributing emotions, thoughts, and feelings to other people spontaneously; lack responsiveness in interpersonal relationships; display difficulties in developing attachments; lack reciprocity

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in social relationships (DSM-V, American Psychiatric Association, 2015). All these criteria cover a wide range of skills and abilities that can be defined and trained independently. Moreover, ASD is a spectrum and large inter-individual differences are observed.

Social skills can be defined as behaviors needed to be competent in social situations and that enable the establishment of harmonious social relationships (Gresham & Reschly, 1987; Grover et al., 2020). Socialization deficits are a major source of difficulties, regardless of cognitive or language abilities, because they do not spontaneously disappear with development. Moreover, social skill difficulties and the distress they cause may increase with age as the social environment changes and becomes increasingly more complex (Williams White et al., 2006). This is particularly the case when entering the work environment, whether in ordinary or sheltered employment. In the workplace environment, several social skills are cited by workers with ASD as barriers for finding and keeping a job, in particular difficulties in communicating with employers and coworkers (Hendricks, 2010).

Psychosocial rehabilitation and social skills interventions are often designed to help people with disabilities improve generic social behaviors (Bellack, 2004; Reichow & Volkmar, 2010) such as: expressing positive feelings, listening to others, making requests, and expressing unpleasant feelings. Some of these general interventions can be applied in the workplace to develop more specific social skills related to work (Hedley et al., 2017). Interventions for workers with disabilities are increasingly being developed using new technologies (Burke et al., 2013; Cullen et al., 2017; Gentry et al., 2012; Hill et al., 2013). Technologies such as tablets used in multiple studies are appealing for people with cognitive disabilities (e.g., ability to repeat tasks and easily correct errors) (Benton et al., 2012). Tablets are also easy to use and present multiple benefits including portability, customization, accessibility, and affordability (Hong et al., 2017). Tablet-based interventions can be accessible to people with disabilities and they have already proven their relevance in research conducted with people with ASD (see Muñoz et al., 2012).

User-Centered Design (UCD) is an iterative design process in which designers focus on users and their needs in each phase of the design process. The HCI mantra "know your user" implies various UCD methods in which designers consult users about their needs and aspirations, empathize with them and establish requirements. Participatory Design (PD) is a particular form of UCD in which users have a deeper impact on the design by being involved as partners (Muller, 2007): users not only inform the design process but are engaged in design choices. The involvement of users with disabilities can be complex due to their difficulties in social interactions. When direct participation is difficult, the involvement of caretakers and practitioners becomes essential (Benton & Johnson, 2015).

The low employment rate of people with ASD still suggests difficulties in their access to employment, particularly regarding social skills deficits. The aim of our project is to design an intervention adapted for people with ASD and their special needs, particularly in terms of social skills. This article describes the approach we defined and applied for designing a new tablet-based intervention to improve work-related social skills. We used a PD approach to identify the social interaction situations which were relevant for our users in the workplace environment. Once identified, these social interaction situations were detailed into social scenarios which will be implemented in a digital app on a tablet. This social skills training aims to ease the transition between sheltered workplaces and ordinary companies for workers and job seekers with ASD.

2. Method

2.1. *Participants*

Seven French disability employment services were involved as partners in this study. These services offer different types of interventions for people with disabilities in their career path. Professionals working in these services may be disability employment advisors, disability employment coordinators, vocational rehabilitation counselors, job coaches, educators, psychologists and occupational

therapists. They have expertise in work-related transitions and support the professional and personal development of people with disabilities from the definition of their professional project to access to qualifications and employment. Their missions are multiple. They provide psychological support and employment counseling. They offer supported employment schemes for securing career paths. They promote the employment of people with disabilities in sheltered environments and they support the integration of people with disabilities in ordinary companies.

As explained below, the study was conducted in two steps (Step 1 and Step 2). In Step 1, 11 workers or job seekers with disabilities participated in the study: they were young adults or adults with ASD, with or without associated intellectual disability. Fifteen professionals from the disability employment services also participated. In Step 2, we conducted four workshops. Twelve participants were involved per workshop, mixing workers or job seekers with ASD and professionals from the disability employment services.

2.2. *Procedure*

The digital app that will be used for the training program consists of quizzes that the participants must answer. Called Social Handy,[1] the current app allows training in everyday situations that are described in the form of scenarios and for which several answers are proposed. The participant must then select a correct answer, i.e., the right behavior to adopt according to the situation presented. A new version of the app will be built to include the content developed during our study as well as customization possibilities. The construction of this new version will be done with the participation of the partners according to the PD method. To this end, a needs analysis was first conducted amongst the disability employment services.

In Step 1, semi-structured interviews were conducted to understand context and identify and specify users' needs. This first analysis was carried out using questionnaires and interviews with professionals from the disability employment services. Workers or job seekers with ASD were also interviewed. This initial analysis allowed us to identify problematic situations with social interactions in the workplace environment and the work-related social skills that needed to be trained and implemented in the training program.

In Step 2, we conducted focus-groups and workshops to engage a co-construction of social scenarios for the training program. The content of the workshops was oriented according to the analysis of the interviews and questionnaires. In the first workshop, professionals were asked to report on social situations involving the social skills of workers with ASD and then to imagine new social scenarios from experiences and needs expressed during Step 1. In the second and third workshops, new social situations were defined by professionals and workers or job seekers with ASD based on the output of the first workshop. They were asked to write social scenarios and then to imagine all possible behaviors in response to the social scenarios they had proposed, whether appropriate or not (e.g., how the worker should or should not behave). The fourth workshop aimed to classify all the social scenarios written in the different social skills. Finally, all the participants were asked to review all scenarios and behaviors for a final validation. The flowchart of the process is displayed in Figure 1.

2.3. *Material*

During Step 1, semi-structured interviews were conducted with the professionals of the disability employment services. They first had to complete questionnaires about the functioning of their services (sector of activity, size of the organization, main tasks of workers with ASD, main accommodations for workers, types of interactions with workers). Afterwards, they had to describe a typical worker's day to help us identify differences and similarities in the way people with

[1] https://auticiel.com/application/social-handy/?lang=en&lang=en

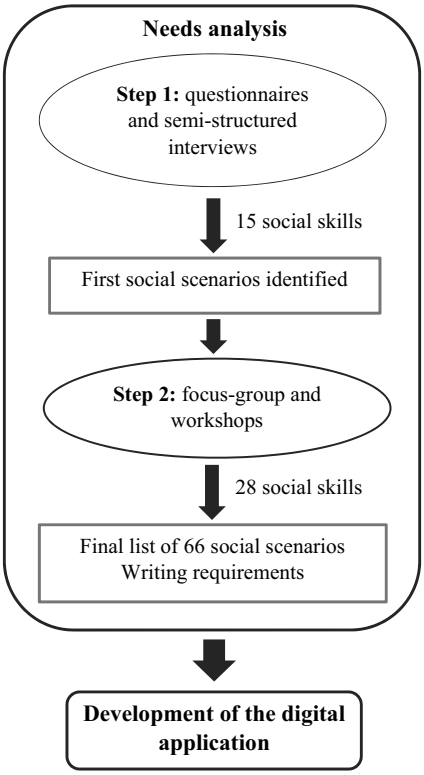

Figure 1. Flowchart of the process.

disabilities are cared for in the different services. They were also asked about their use of digital tools to assess familiarity with them. Finally, a discussion on social skills was initiated based on a questionnaire inspired by the list of work-related social skills proposed by Agran et al. (2016). Professionals had to score each social skill on a scale from 0 (low importance of the social skills in employment settings) to 5 (high importance of the social skills). On their side, people with ASD were asked about their work situation and the social context in the workplace. Questions about work demands and capabilities were inspired from the SATIN questionnaire (Health and well-being at work questionnaire, Grosjean et al., 2017). Participants had to rate themselves on a visual scale from 0 (very hard) to 10 (very easy). Then, they were engaged in a discussion about basic needs satisfaction in the workplace environment (inspired by the Basic Needs Satisfaction at Work Scale (Deci et al., 2001)). Participants had to answer questions about autonomy, competence, and relatedness. Items of the scale can be found in Appendix. Motivation was also considered (e.g., "what do you like in your job?"). Finally, participants were also asked about their use of digital tools.

In Step 2, several working methods were used to facilitate the workshops. At the beginning of the first workshop, a reminder of the objectives of the project was given. A first discussion was organized around the experiences of each participant. A subgroup discussion was planned in order to allow professionals from the different disability employment services to discuss their respective experiences. Then different social scenarios based on social skills identified in Step 1 were presented to the subgroups who had to propose other similar situations based on their own experiences. The same scenarios were presented to all subgroups. The workshop ended with a joint presentation of the new scenarios. In order to inform the design of the social skills training part of the app, we asked the participants some questions about the format (fonts, presence of pictures or videos, colors …) and content (presence of text, illustration of the text, number of answers …). During the second and

third workshops, the new list of social scenarios was presented to them. They were asked to read each scenario again, to change the wording if necessary, and to propose acceptable and unacceptable behaviors in response to the scenarios. Small groups were formed to work on the same scenarios at different times, so that one group could annotate the proposals made by another group in order to make the social scenarios more relevant and acceptable to all participants. More specific questions regarding the display of social scenarios on the app were put to the whole group, for example about writing in the first or third person. Suggestions were made to illustrate the scenarios with photos (or videos) to add context to the use of the app. In the last workshop, the participants had to read over the social scenarios and the proposed behaviors a last time to validate all of them. The group was then split in two. Each group had to classify the scenarios into a list of social skills. At the end of the exercise, the groups were reversed and were asked to check the other group's proposals. A first demonstration of the app with the participants' suggestions was proposed in order to get their feedback.

3. Results

3.1. *Step 1: semi-structured interviews*

3.1.1. *Perspective from the professionals*

All the professionals from the disability employment services work in the support and integration into employment of people with disabilities. Depending on the service, they can either aim at integration in the sheltered environment or in the ordinary environment. They also aim to maintain disabled workers in employment. The smallest structure had five professionals to support 39 workers. The largest organization had 65 employees and supported around 3,000 people with disabilities. The interactions between the professionals and the people with disabilities were varied: support for professional projects, identification of the person's skills and abilities, regular follow-up meetings, group workshops on social skills, support in companies, simulated interviews, diagnoses, and evaluations, etc.

Digital tools were already used in most services, for example in workshops for professional development or as a communication tool. Support in the use of digital tools was also favored for administrative procedures. The professionals were relatively favorable to the implementation of a digital tool in their services given its advantages: accessibility and ease of use. Professionals also explained that the recent development of digital technology in the workplace suggest that they should encourage people with disabilities to learn and master those new tools. Digital tools are also seen as a means to develop the person's autonomy and to promote communication. It is also essential to compensate for certain difficulties of workers (reading or writing difficulties). However, some professionals pointed out that it was important to ensure that the worker had full control of the tool and that it should not hinder initiative-taking.

The analysis of the professionals' responses allowed us to identify the social skills inspired by the article by Agran et al. (2016) which appeared to be the most relevant for supporting people with disabilities. Results were obtained after averaging the response of the 15 professionals. Table 1 displays the means and standard deviations of the perceived importance of social skills in the workplace environment for people with ASD. The classification of these social skills by professionals makes it possible to target the most important skills to be trained in our study.

3.1.2. *Perspectives from the workers with disabilities*

Considering the 11 people with ASD who were interviewed, seven of them were looking for a job, two were on an internship and two were employed. Most of them had been in the labor market for about ten years. Their tasks were varied: food packaging, storekeeper, canteen worker, administrative tasks, unloading trucks. Their days were generally organized to anticipate their tasks. People in employment or on an internship followed the precise instructions given to them at the beginning of the day or week. Their work was checked at the end of the day. All respondents report having

Table 1. Importance of social skills.

Social skill	*M*	*SD*
Arriving at work on time (punctual)	4.93	0.25
Not using objectionable language or gestures	4.93	0.25
Refrains from inappropriate touching of others	4.86	0.35
Seeking clarification for unclear instructions	4.80	0.41
Talking about personal problems at inappropriate times	4.73	0.45
Using social amenities (please, thank you)	4.73	0.45
Notifying supervisor when assistance is needed	4.73	0.45
Interacts well with customers/clients	4.60	0.50
Using weak excuses when late or absent from work	4.53	0.74
Responding appropriately to critical feedback	4.46	0.63
Responding appropriately to job-related emergencies	4.46	0.63
Arguing with co-workers or supervisors	4.46	0.83
Listening without interrupting	4.33	0.48
Uses appropriate conversational skills (e.g., making eye contact, appropriate volume)	4.33	0.72
Finding necessary information prior to performing the job	4.20	1.01
Carrying out instructions needing immediate attention	4.20	0.77
Acknowledging what others are saying (eye contact, saying yes or right)	4.00	0.75
Works as a member of a team, if appropriate	3.86	0.99
Providing job-related information to other employees	3.86	0.74
Talking to co-workers instead of working	3.80	1.08
Offering help to co-workers	3.73	0.70
Show initiative	3.53	0.83
Expressing appreciation to coworkers	3.53	0.83
Solve problems	3.46	1.12
Working or producing at rates that equal or surpass company expectations	3.40	0.91
Working at job continuously without disruptions	3.06	1.09

experienced situations that are awkward or can cause problems in carrying out their tasks. Examples given were: changing offices, heavy administrative work, tensions between colleagues, problems in understanding instructions, problems in communicating with the manager, not daring to ask for clarification right away. Most of them knew how to reach the professionals who support them in case of difficulties. Difficulties in understanding instructions was a recurring problem (seven out of 11), especially before starting a new task. All of them stated that they had no difficulty in being punctual or in knowing their working hours. Even though most of the interviewees stated that they were able to establish good relationships at work, they sometimes encountered difficulties when interacting with colleagues (eight out of 11) or with their superior (six out of 11). Even though it can be difficult, the respondents said that they generally pay attention to the rules of politeness. Only three participants said they had ever had serious conflicts with colleagues or managers. Finally, nine out of 11 people said that they have difficulty expressing their wishes and desires in relation to their work.

Work demands and capabilities of the participants with ASD were evaluated with items from the SATIN questionnaire (Grosjean et al., 2017). Results are displayed in Table 2. Control of emotions appears to be the most challenging demand for the participants. Difficulties about thinking or attention span are also noted.

Items from the Basic Psychological Need Satisfaction at Work Scale (Deci et al., 2001) were used to discuss with the participants. In the area of *competence*, all participants felt competent. They felt that they could still progress and acquire new skills. They were generally satisfied with their work but were not able to say whether others find them good at their job (five out of 11). Concerning the area of *autonomy*, people generally did not feel constrained in their work and rather were free to decide for themselves how to work. However, they found it difficult to have a sense of being free to be themselves at work and to express their ideas and opinions. Concerning the area of *relatedness*, getting along with people at work can be difficult and they may have the sensation of being left alone sometimes. They did not consider their coworkers as friends. They rather considered there are not many people at work that they are close to. In terms of motivation, they reported they like to work

Table 2. Items of work demands and capabilities (SATIN questionnaire, Grosjean et al., 2016).

	M	SD
Regarding the physical efforts you have to make, you find that your work is:	7.24	1.72
In terms of the amount of thinking or attention you have to give, you find your work to be:	5.90	2.99
Concerning the efforts you have to make to control your emotions (not getting angry, not "cracking up," getting along with others…), you find that your job is:	5.63	3.39
In terms of the knowledge or skills you need to use, you find your work to be:	6.86	2.68
Faced with the demands of your job, your physical abilities are:	6.54	2.70
When faced with the demands of your job, your thinking or attention span is:	6.26	1.50
Faced with the demands of your work, your ability to control your emotions (not to get angry, not to "snap," to get along with others…) is:	4.75	3.21
To meet the demands of your job, your knowledge or skills are:	6.75	2.34

because it is challenging and stimulating. Working allows them to get out of the house and see people. Work demands imply to find solutions, to be creative and to interact with people. But they found some interactions stressful and they supported constraints and deadlines badly. Some physical factors could also impact their motivation: tiredness, heavy materials, staying up.

All respondents had a smartphone and a computer and used them regularly (several times a week). Six of them also owned a tablet, which is less used. They used these digital tools to: search the internet, watch videos, play games, listen to music, communicate, use social networks, and manage their schedule. They did not report any difficulties in going online and feel comfortable with these tools. In the context of work, very few of them used digital tools. Four of them used them for administrative activities (scanning, writing, filing, delivery notes, invoicing). They would like to work more with digital tools because they felt that it makes life at work easier.

3.2. *Step 2: workshops and focus-groups*

After the analysis of the results obtained in Step 1, focusing on the users and their needs, we defined the content of the four workshops. The main objective of the workshops was to co-construct about 60 relevant social scenarios for the digital training app. Each workshop had sub-objectives to achieve this final objective.

3.2.1. *Workshop 1*

The first workshop was a first meeting between nine different professionals of five different disability employment services, which allowed them to identify the differences of support in their respective services. We identified 15 main themes during the interviews conducted in Step 1: Misunderstandings, Misunderstanding of instructions, Difficulty in understanding instructions/intention, Not enough explanation, Difficulty being sure of what to do before starting, Conflict with a colleague, Conflict with a supervisor, Difficulty in establishing good relationships at work, Difficulties in knowing how to interact with colleagues, Difficulties in knowing how to interact with a superior, Difficulties in dealing with politeness, Problems with working hours, Problems with breaks, Difficulty asking for help, and Difficulty expressing wishes and desires. Fifteen social scenarios were presented to illustrate these 15 social skills themes. The participants were divided into three sub-groups to work on each of the 15 themes in turn. They were asked to read the proposed social scenarios and then discuss similar situations from their experiences. To encourage discussion, participants were asked questions after reading each scenario: Is this a situation you have already encountered? Does this situation happen often to the people with ASD you supervise? Why is this situation problematic? Do you have any other examples of similar situations? Other examples of situations you have already encountered? At the end of the workshop, 54 drafts of social scenarios were collected.

A discussion on the architecture of the app was also initiated. Participants were asked to express their views on the contents. The first criteria given by the participants for the development of the app

were: the scenarios should be short, easy to understand with simple words, and it should be available for people who cannot read (synthetic voice).

3.2.2. *Workshops 2 and 3*

Three people with disabilities and 13 professionals participated in these workshops. The aim of the second and the third workshops was to move from a draft scenario to a properly written social scenario. The aim was also to find all the possible behaviors in response to all the 54 scenarios, i.e., to write down all the behaviors that a person can display in each social situation, whether these behaviors are adequate or not. This work was carried out in 4 subgroups so that each scenario was reviewed several times in order to make it more relevant and acceptable to all participants. For example, to illustrate the social skill "Ask for help appropriately when needed," two social scenarios were defined following our PD approach: "During an internship in a company, you do not know which supervisor you should contact when you encounter a problem with your tasks" and "Your job coach asks you to research job descriptions for your next appointment but you do not know where to look for the information." For each of these scenarios, multiple behaviors were listed, some identified as socially adapted (e.g., "I ask to have a regular manager in the company;" "I ask my job coach where to find the information") and some identified as maladjusted (e.g., "I do not ask for help;" "I refuse to do the work").

More specific questions about the development of the contents of the app were discussed in the group: should the first person, the third person, a first name… be used? How should the situation be presented (audio, video, text…)? How should a question be described in relation to a scenario: new video, just text, image…? How many right answers/wrong answers to display? How to validate the success of the quiz: when all the right answers are selected or when at least one right answer is selected? After this discussion, the choice was made to write the scenarios in the first person. Photos should illustrate all the answers but social scenarios can be illustrated with videos to give even more context. It should be possible to offer several correct answers. The user would need to select at least one correct answer to validate the success of the quizzes. Regarding customization possibilities: the app should be able to offer explanations to the answers according to the participant's profile, a level of difficulty should be configurable (e.g., increase the difficulty of a scenario by changing the contextual elements), and it should be possible to add one's own social scenarios on the app. Finally, a basic assessment of social skills should be available when the app is first used to determine the level of difficulty for each scenario according to the participant's profile.

3.2.3. *Workshop 4*

In this workshop, nine professionals and one worker with disabilities were present. The 54 social scenarios written with all their behaviors (adapted and maladjusted) were offered for a final review. These elements had to be ready to be implemented in the digital app by the end of the workshop. For a better understanding, a first demonstration of the app with the participants' suggestions on one example scenario was proposed. Further feedback was received following this demonstration: ensure that the vocabulary is consistent across all situations and make it clear that an answer is right or wrong.

The final task in this workshop was to classify all the social scenarios written in the different social skills. The aim was to check whether the situations written according to the first list of social skills (workshop 1) were classified in the same place and to classify all the new situations to see the total number of social skills worked on through the scenarios. The proposed classifications of social skills were based on existing lists from the literature (Agran et al., 2016; Caldarella & Merrell, 1997; Cottraux et al., 2015). In the end, the 54 scenarios were categorized into 22 social skills.

3.2.4. *Workshop 5*

As a result of the classification exercise in workshop 4, it appeared that some of the social skills considered important during the Step 1 interviews did not have a dedicated social scenario. Therefore, a final workshop was offered to professionals to specifically draft social scenarios to address these social skills. This workshop was conducted by videoconference with six professionals. Twelve new scenarios were written to illustrate six new social skills.

3.3. *Development of the digital app*

The work carried out in this study according to PD made it possible to write 66 social scenarios which illustrate 28 social skills. As the original app Social Handy consists of quizzes that the participants must answer by choosing the right behavior, about 400 behaviors adapted or not in response to the social scenarios were also written. The objective was to train people with ASD with those scenarios using the app. The app first displays a list of the five main themes of social skills (see Table 3).

Table 3. List of the 28 social skills identified during the co-design workshops (translated from French).

THEME 1: Managing and expressing emotions
"In the workplace, your skills in managing and expressing your emotions may be challenged by your colleagues, your supervisor, or your boss."
- Skill 1: Expressing feelings when wronged
- Skill 2: Responding appropriately to teasing
- Skill 3: Staying calm when things go wrong
- Skill 4: Expressing your desires
- Skill 5: Expressing difficulties

THEME 2: Respecting the work environment/Carrying out professional tasks
"In your workplace you may be confronted with work situations in which you have to interact with your boss, colleagues, or supervisor in order to carry out the task you have been given."
- Skill 1: Asking for clarification when instructions are unclear
- Skill 2: Asking for help appropriately when necessary
- Skill 3: Informing superiors when help is needed
- Skill 4: Prioritize tasks requiring immediate attention
- Skill 5: Finding the necessary information before starting work
- Skill 6: Respond appropriately to work-related emergencies

THEME 3: Respecting the rules of politeness
"Your etiquette skills may be tested in interactions with your boss, co-workers, or supervisor."
- Skill 1: Listening without interrupting
- Skill 2: Respecting the rules of politeness
- Skill 3: Accepting limits
- Skill 4: Not using unconvincing excuses for being late or absent from work

THEME 4: Interacting with others
"In your workplace you may be confronted with work situations in which you have to interact with your boss, colleagues, or supervisor."
- Skill 1: Initiate a discussion
- Skill 2: Joining an ongoing activity or group appropriately
- Skill 3: Avoiding conflict with colleagues
- Skill 4: Avoiding conflict with superiors
- Skill 5: Introduce yourself to new people
- Skill 6: Participating in discussions
- Skill 7: Knowing when to talk about personal problems
- Skill 8: Responding appropriately to critical comments

THEME 5: Adapting to others and dealing with the unexpected
"In your workplace, your coping skills may be tested and you need to adapt your behavior to different situations."
- Skill 1: Functioning well in the face of obstacles
- Skill 2: Compromising with others when appropriate
- Skill 3: Handling sensitive interactions
- Skill 4: Offer help to colleagues when needed
- Skill 5: Adapting to new situations

These themes were chosen by grouping similar social skills. Working by theme allows for short training sessions and makes it easier to navigate the tablet. In each theme the participant can navigate through the different social skills. All social skills are illustrated by at least one social scenario. Some social skills are illustrated through several scenarios as the social skill can be found in a variety of social situations (e.g., up to 12 scenarios for the social skill "Asking for clarification when instructions are unclear"). As a social situation may reflect different problems, some scenarios can illustrate two different social skills (e.g., the scenario "My boss decides to change the tasks that were described in my contract. I don't like the new tasks that are imposed on me" involves the social skill "Avoiding conflict with superiors" and the social skill "Functioning well in the face of obstacles"). Access to the list of themes and social skills allows more personalized work with each ASD participant according to the social skills that are difficult for him. Finally, in order to adapt to the specific needs of each user with ASD, accessibility options are available on the digital tablets: color contrasts, type of voice synthesis and speech rate.

4. Conclusion and future directions

The objective of this study was to define and develop social skills training content for a digital app relevant to workers with disabilities. In order to respect the principle of User-Centered Design, several steps were necessary to first identify the needs of the participants and then co-construct with them the future contents of the app.

The interviews conducted during Step 1 allowed us to analyze lists of social skills found in the literature regarding their relevance for people with ASD. The three lists used (Agran et al., 2016; Caldarella & Merrell, 1997; Cottraux et al., 2015) are not exhaustive of all the behaviors that seem relevant for our participants, especially in the work environment. Our list of social skills presented in Table 3 seems to offer a set of situations that are sufficiently varied to apply to all the social situations that workers with ASD may find themselves confronted with, despite the significant variability of work situations. A future study may be considered to verify the relevance and order of importance of these skills in other services for people with ASD. The interviews carried out with the professionals and the workers or job seekers with ASD during this first step, also allowed us to identify the specific skills that need to be trained in the tablet-based intervention.

The work done during the five workshops with the professionals of the disability employment services and the participants with ASD made it possible to create 66 social scenarios to illustrate 28 social skills relevant for them. This co-construction of scenarios according to PD enabled the development of relevant content to train work-related social skills. As suggested by the workshop participants, the 66 social scenarios were played by actors and videotaped. They were then implemented in the digital app on the tablet (Figure 2). Given the variety of profiles of people with ASD, one of the important points is to propose an app that allows adaptation according to the difficulties and resources of users. Suggestions from participants collected during the workshop aimed to make the app as suitable as possible for different user profiles, in addition to classic accessibility options. Among the customization options that would be interesting to implement, the future development of the app should propose several levels of difficulty. Depending on the initial level of the participant in social skills themes, we plan to propose more complex social scenarios by adding nuances in behaviors and social context. Eventually, as suggested by the participants in the workshop, the application should propose an evaluation of the participant's level in each of the themes in order to propose a level of difficulty suitable for training. Future directions include the proper evaluation of the effectiveness of this intervention in training work-related social skills in the disability employment services involving workers or job seekers with disabilities. Particular attention should be paid to the generalization of the participants' social skill progression and whether the training creates sustainable behaviors (Hong et al., 2018). Future directions should involve professionals from the different services to assess and practice in natural settings the 28 social skills we identified in this study.

Figure 2. Illustrative example of a social situation designed during the workshops.

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Appendix Basic Need Satisfaction at Work Scale (Deci et al., 2001)

(1) I feel like I can make a lot of inputs to deciding how my job gets done.
(2) I really like the people I work with.
(3) I do not feel very competent when I am at work.
(4) People at work tell me I am good at what I do.
(5) I feel pressured at work.
(6) I get along with people at work.
(7) I pretty much keep to myself when I am at work.
(8) I am free to express my ideas and opinions on the job.
(9) I consider the people I work with to be my friends.
(10) I have been able to learn interesting new skills on my job.
(11) When I am at work, I have to do what I am told.
(12) Most days I feel a sense of accomplishment from working.
(13) My feelings are taken into consideration at work.
(14) On my job I do not get much of a chance to show how capable I am.
(15) People at work care about me.
(16) There are not many people at work that I am close to.
(17) I feel like I can pretty much be myself at work.
(18) The people I work with do not seem to like me much.
(19) When I am working I often do not feel very capable.
(20) There is not much opportunity for me to decide for myself how to go about my work.
(21) People at work are pretty friendly toward me.