

## RESEARCH ARTICLE

# CONTACTO: A Social Networking Site for Supported-Employment Interventions for People With Intellectual and Developmental Disabilities

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**ABSTRACT** The main objective of this work is to determine whether social networks can be used to improve self-management skills in people with Intellectual or Developmental Disability (IDD) given the high rate of acceptance of such tools among them. The proposed methodology applies an employment-based intervention to evaluate whether social network services help improve self-management skills. A fit-for-purpose social networking service is built, and different evaluation mechanisms are applied to determine the degree to which users with IDD could use the tool without assistance. The working hypothesis is that in order to ensure the usability of the implemented tool, users (with and without IDD) should be involved throughout the whole software development cycle, following a co-design methodological approach. Results demonstrate that this methodological approach leads to high satisfaction and motivation rates. In terms of effectiveness and efficiency, results demonstrate that the tool is useful and usable for people with IDD. It can therefore be concluded that social network services built having users with IDD at its center will help improve their self-management skills. The main implication of this research is that when using social network services as a tool to support interventions, special attention should be paid to previously evaluating the usability and motivation rate as a measure of how autonomously the person with IDD can use the tool. Nevertheless, further research is needed to determine the impact that such tools can have on other types of intervention.

**INDEX TERMS** Assistive technologies for cognition, intellectual or development disabilities, self-management, interventions, employment, usability.

## I. INTRODUCTION

Online social networks have become an essential element of our daily life and it is hard to imagine an aspect of our society that it is not represented by a social network platform. The new communication possibilities brought about by

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the development of the Internet and online social networks have therefore radically changed the way social interactions and markets were conceived [1]. According to Eurostat [2], 57% of people in the EU in the period of time 2013-2020 participate in social networks. In people aged 16-24 the percentage reaches an 88%. It is uncertain, however, how extended it is the use of internet and social media among people, of any age, with Intellectual and Development

Disabilities (IDD) [3]. There is indeed evidence that the use of social media is widely spread among young people with IDD and positive experience are being drawn from this use [4]. In fact, a recent study conducted in the UK [5] that explored the use of internet and online social networks during the COVID-19 pandemic, reported benefits in the dimension of social connections and new opportunities.

Although the spectrum of intellectual and developmental disabilities is very wide among individuals suffering from them, it is agreed that, according to [6] people with IDD experience significant limitations in both intellectual functioning and adaptive behaviour thus impacting on their social and practical skills. For this reason, most of the interventions addressed to people with IDD are intended to improve independence and self-determination. These skills are indeed among two of the major benefits promoted by the use of technology and social media [7]. According to Bruns and Moe [8] online social networking is based on asynchronous communications which is very suitable for people with IDD as they feel less pressured to respond. More importantly, social media networks, like Twitter, put the focus in short messages prioritizing content over grammatical correctness [9]. This new way of communication favour those with literacy issues [10].

Despite the major opportunities that online social networks bring about to people with IDD, important barriers also exist that prevent a more extended use of interventions based on such tools. These barriers are mainly due to poor literacy and communication skills and accessibility problems [3]. Nevertheless, little research has been conducted so far on how to adapt interfaces and interaction schemes of popular online social networks, other than applying existing guidelines such as *Design for all* [11], [12], [13]. Issues such as the sign up or log in process might represent a difficult hint to be overcome by people with IDD [14]. Given the email address is the *digital passport* [15] for accessing online social networks, it is very revealing that only 18% of people with IDD have one [15]. Accessibility obstacles also encompass issues such as access to internet or to a computer. There is evidence that people with IDD are less likely to have a computer or have access to internet than others without disability [10], [16].

These are not the only barriers people with IDD have to face, as unemployment rate (18.3%) almost double that of general population (9.9%) according to [17]. This is a problem given the benefits that can be obtained from integrating people with IDD into the labor market [18]. Employment is addressed as an intervention for improving the quality of life of people with IDD [19]. This is indeed among the primary goals pursued for people with IDD because of its positive psycho-social and economic benefits [20].

The use of professional social networking sites, among which LinkedIn is the most popular one [21], is becoming the common practice for recruiters and both, those looking for a job and those that already have one [22]. This field is gaining attention and different studies are being conducted to assess the impact that the use of such tools has on career promotion [23], [24]. Aspects such as the number of con-

tacts, number of recommendations, or the profile photograph, are used to assess the career benefits derived from the use of such tools [25]. Nonetheless, despite the benefits that social networking sites like LinkedIn has on employment and career promotion and the importance that integrated-employment interventions has on people with IDD [26], little is known about how to extrapolate that to the field of employment-based interventions for people with IDD.

One of the skills pursued by the different interventions addressed to people with IDD is self-management. According to Browder and Shapiro [27] self-management refers to the different practices that an individual employs to manage his/her own behaviour (self-delivered prompting, self-monitoring, self-recording, and self-delivered consequences). Self-management skills therefore lead to minimizing the need for external support. In this sense, there is an increasing interest about how online social networks could be employed to support interventions intended to promote self-management. Nevertheless, little is known about this fact and researchers like [28] call for further research on the use of social media technologies as a powerful tool to assist individuals with disabilities seeking employment. The main obstacle to carry out such study is the lack of online social networks that are made fit-for-purpose for people with IDD. In fact, the workaround implemented by researchers like [28] is to resort to employment specialists assisting individuals with IDD in using existing networks (Facebook, Twitter, and LinkedIn). Ideally, this type of studies should be carried out with tools that were usable and useful for people with IDD (and people without it) so that the tool does not interfere in the ultimate goal of the study, as it is to determine whether online social networks can be used to improve self-management skills in people with IDD.

The objective of this study is therefore to provide a tool for supporting employment-based interventions that it is not only usable but also useful for both people with or without IDD, to determine whether social networks can be used to improve self-management skills.

This study is motivated by the interest that online social networks stir among specialists in the context of employment-based interventions in people with IDD. Due to the lack of fit-for-purpose online social networks for people with IDD and the identified limitations of existing tools, the authors of this papers understand it is necessary to implement a tool that minimizes the need for external assistance. In this sense, to ensure the usability of the implemented tool, users (with and without IDD) should be involved throughout the whole software development cycle, following a co-design methodological approach. The significance of this study lies in the knowledge it provides regarding the role online social networks can play in promoting self-management skills in people with IDD. This knowledge will enable more and better-informed interventions which eventually will improve the quality of life of people with IDD.

The novelty of this work is twofold. On the one hand it contributes to understanding whether only social network

can be used to improve self-management skills in people with IDD. On the other hand, it does so by providing a fit-for-purpose technology that minimizes the need for assistance as it is built considering the person with IDD at the center. To the best of the author's knowledge, it is the first study that uses a fit-for-purpose tool for people with IDD, which ensures usability and usefulness. The developed tool, known as CONTACTO, is designed to resemble a professional social networking, like LinkedIn, intended for people with IDD. The tool focuses on empowering autonomy and self-management skills, and hence, CONTACTO should overcome the major barriers faced by people with IDD when using technological solutions. A co-design methodology is followed [29] so that people with IDD and those responsible for assisting them during the interventions are involved throughout the design process.

The paper is organized as follows. First, Section II reviews the most relevant works in the field of the use of technology for people with IDD. Special attention is paid to existing methodologies for software development for people with IDD. Section III describes the method proposed here to evaluate the proposed working hypothesis as well as the description of how it has been employed for the implementation of the CONTACTO tool. A three-stage methodology is proposed in which first, the system and its requirements are stated, then, the system is implemented and finally, the system is evaluated. The description of these three stages are included as subsections. Section IV presents the results obtained from the evaluation of the system which, eventually, determines the user acceptance of the proposed technology. Several metrics are employed to evaluate the platforms, including usability and motivation to use the platform. The results obtained for these metrics are discussed and analysed in Section V. Finally, Section VI presents the main conclusions obtained from the evaluation of the proposed working hypothesis.

## II. PREVIOUS WORK

The use of online social media or social networks is considered to be very beneficial for individuals with IDD as it contributes to their development of social identity and self-esteem as well as for enjoyment [4]. Still, there is a large percentage of individuals that despite using technology (tablets or smartphones) do not use social media [7]. The work in [30] compares the use and access of social media of neurotypical adolescents and those with learning or intellectual disabilities. In terms of the percentage of adolescent with their own smartphone, 100% of neurotypical adolescent owned a smartphone in comparison with a 75% of teens with IDD. In terms of access to social media 95% of neurotypical adolescent use social media in comparison with only 50% of those with IDD. The main reason for this limited access and use of social media is the parent restriction according to [10], [31]. This lead to the digital exclusion of people with IDD what limit the benefits they could potentially receive from the use of digital technologies [32]. For this reason, efforts like the one presented in this work, are still

needed to achieve the *online social inclusion* stated by [33] mainly ensuring secure spaces and usable technologies.

One of the reasons that have been pointed out behind this reduced use of social network services is the fear to the inherent risk related to the cyberspace [34], particularly for vulnerable groups. The study in [31] analyses the safety perception of young people with learning disabilities when using online services. Although this study concludes that young individuals with IDD feel confident about their knowledge of online safety their parents did have serious concerns about online risks. In fact, emotional distress has been reported as the most common risks derived from the use of online services in people with IDD, according to [35].

It seems obvious that if online social inclusion is sought, stringent mechanisms should be in place to guarantee safety and ethics. In this sense, there are already efforts on this line, such as the work in [33] that proposes a framework to design online social media platforms for individuals with IDD. However, it is currently unknown what mechanisms should be implemented in existing platforms so that safety for individuals with IDD could be ensured although current research, such as the works of [32] and [36], works on destigmatising the use of internet and online social network in people with IDD. Another approach, as the one presented in [28] advocates for the use of existing social media platforms such as LinkedIn, Facebook, and Twitter, with the employment specialist providing assistance and supervision. This evidences that either because of the risks or due to the complexity of the interaction mechanisms of such platforms, most users with IDD find extremely difficult to use these platforms on their own.

Nonetheless, there is a lack of consensus, from the state of the art, on whether the online social inclusion should be carried out by building isolated online social networks that ensure security and safety, as stated in [33], or whether to resort to well-known platforms, along with employment specialists, as argued by [28]. The work presented here understands that inclusion must be adopted from the early stages of the design process, implementing an inclusion-by-design approach. For this reason, this work has opted for building a new social media platform fit-for-purpose. This tool is intended to leverage the increase in self-esteem and autonomy in the process of an employment-based intervention, seeking to minimize the need of support from the employment specialist. By doing so, CONTACTO contributes to the online social inclusion of people with IDD by providing an online social networking site that it is usable and secure. In order to achieve this goal, the tool is co-designed with the main stakeholders (people with IDD, employment specialist, or associations). Furthermore, previous works have already identified the main risks and difficulties found by people with IDD when using technologies [10], [31], [32], [36].

Involving users with IDD in a software co-design process is something relatively novel although some previous works have already explored its use, as in [29], [37], and [38]. Co-design ensures, as stated in [29], that requirements and

needs of the users, in this case involving users with IDD, will be successfully reflected in the design, therefore leading to usable tools and succeeding in the user engagement. Apart from involving users with IDD in the design process, there are other mechanisms that help ensuring the usability of the system. In this sense, there are several design principles that have been long in place to ensure accessibility for users with IDD [39], [40], [41]. These approaches mainly adopt an ability-based design, meaning that the focus is on the abilities rather than on the limitations. These design principles, as well as the principles of co-designed, have been considered to ensure the usability of resulting system. Furthermore, stringent security mechanisms have been considered to address the safety and security issues, specially those related to data privacy.

User acceptance and perceived usefulness have been tools previously employed to assess the success of an assistive technology-based intervention. The work in [42] assess motivation to perform physical activity based on the use of system fit-for-purpose to avoid the lack of user-friendliness found by existing exergames. The work in [43] presents a user interface to train memory skills in children with intellectual disability. The success of the proposed tool is evaluated in terms of usability, likability and potential for adoption. Similarly, the work in [44] assesses technology-aided interventions in terms of its usability level. Similarly to what it is being done in the state of the art, the success of the intervention to improve self-management skills is going to be measured in terms of the tool usability and motivation to use the tool.

### III. METHODS

The research work presented in this paper is intended to co-develop and evaluate a fit-for-purpose social networking site that supports employment-based interventions for people with IDD. To this end, a three-stage methodology is proposed inspired in [42], that at the same time is based on the design cycle of computer science presented in [45]. The first stage is devoted to the system and user requirement specification. The second stage undertakes the design and implementation of the system. During the third the system is evaluated. The methodology proposed here differs from the work in [45] and [42] in that the principles of agile methodologies are also incorporated within the stages. In this sense, users are involved from the first stages of the software development cycle, in short-duration cycles, that produce prototypes the user can evaluate and provide feedback that retrofits the development cycle. The use of an agile methodology is a the base of the co-desing principle and pursues ensuring future user acceptance as well as improving system usability.

#### A. CONTACTO: SYSTEM OVERVIEW

The work in [46] presents a systematic review of the different vocational interventions intended to improve employment outcomes for people with disability. Among the different interventions the one known as Individual Placement and Support (IPS)/Supported Employment (SE) has recently been gaining attention, in particular for people with

severe mental illness [47]. Despite the need for tools supporting employment-based interventions for people with disabilities, as stated in [48], the scarce literature found to the date suggest that no major contributions have been made in this field. The use of social media has proven to be a powerful tool for such purpose [28], but the challenges found in existing platforms (LinkedIn, Twitter, or Facebook) by people with IDD limit their autonomy to use such platforms.

CONTACTO is proposed as a tool, which is specifically devoted to SE for people with IDD, taking into consideration the participation of the SE professionals and the organisations that provide placements for employment and also training courses. The system therefore supports three main roles, namely:

- 1) Candidate: This is the role of an individual with IDD who goes through a SE intervention. This intervention might also involve training courses.
- 2) Reference role: This role is played by the SE professional that assist the candidate during the intervention. This person might also provide support on the placement where the SE is taking place.
- 3) Supervisor: This is a system administration role. This role is supposed to be held by an Information Technology staff member.
- 4) Organisation: This role is played by the different organisations providing both employment and training offers for people with IDD.

Figure 1 outlines the different purposes for candidates to use the platform. One of the main uses of CONTACTO is to provide a candidate profile, as a *Curriculum Vitae*, in which they can state their training and learning experiences. This will help human resource services when identifying those candidates that better fit the available positions. Furthermore, there is an implicit benefit in encouraging candidates to keep their profile updated. Autonomy is worked in this way, as the tool has been designed following a simple interface and language, minimizing the need for support while including new merits. Figure 2 shows the profile of a candidate.

CONTACTO has been designed as a meeting point for candidates, seeking training or job opportunities, and organisations, offering both jobs and training. Organisations can adopt an active role in the platform looking for candidates whose profile fits their needs. In this sense, they can look for specific profiles and contact the candidate or the reference role that supervises that candidate. Organisations can also adopt a more passive role, just posting an offer, and waiting for candidates to show their interests, and then selecting among those who have shown interest. The platform offers candidates a functionality to subscribe through alerts sent via email to offers that fit their profile, based on interests, location, whether they imply a job offer or just training, etc. Candidates, when interested in a specific offer, can notify the organization about their interest. Furthermore, they can select the offers *they like*, so that the system profiles the user based on the offers that have been *liked*. Figure 3 shows the interface

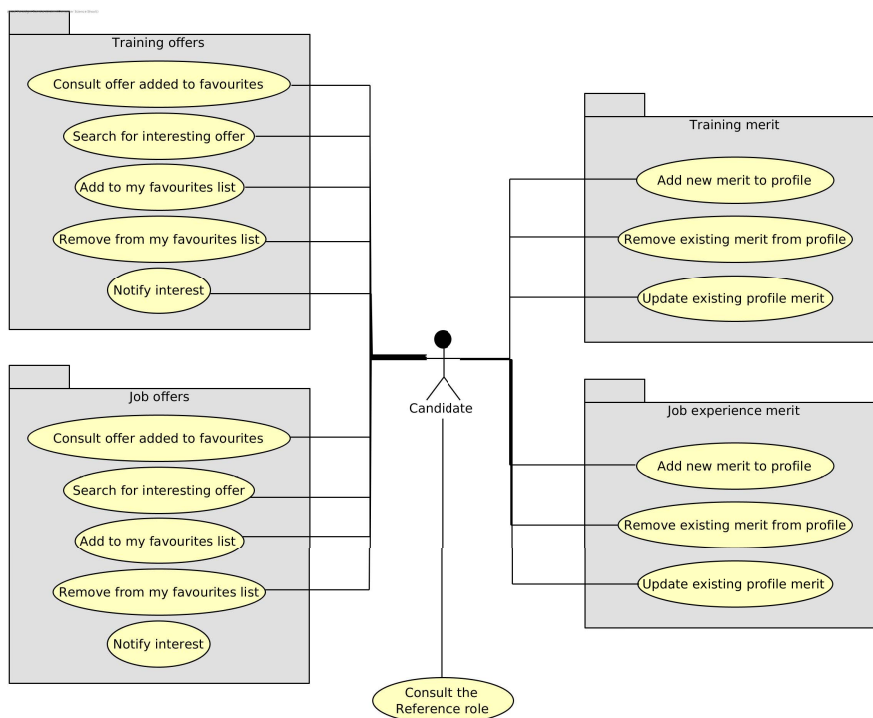


FIGURE 1. Candidate use case diagram.



FIGURE 2. Curriculum Vitae of a candidate.

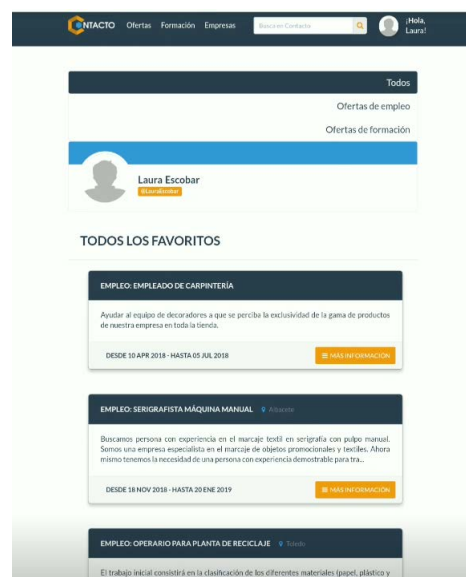


FIGURE 3. Interface showing the offers marked as favourites by a candidate.

the candidates see with all the offers they have marked as favourite.

One of the most important functionalities of CONTACTO is that it provides direct access to the reference role. There is a button candidates can pressed whenever they need assistance from their reference role. The reference role will be notified and will contact the candidate. The reference role can also work as an intermediary when he/she detects a job or training

offer that can be of relevance for any of the supervised candidates. The offer can be directly notified to a candidate. This functionality ensures that candidates have not missed and opportunity while their autonomy is being encouraged. Candidates are encouraged to notify their interest in an offer in an autonomous way, requesting or receiving help only when needed.

Figure 4 summarizes the interaction that the reference role has with candidates and the actions supported by system. The reference role assists candidates during the complete SE intervention. This involves assisting candidates in preparing their profile, periodically check offers and make applications when there is an offer that matches their interests. To assist candidates in this process, CONTACTO provides reference roles with a functionality to create alerts based on the interests of their supervised candidates. When an offer comes out that fits the profile of one or several of the supervised candidates, the reference role sends them the alert, via email. Figure 5 shows the interface the reference role uses to send an offer to a group of candidates.

The functionality provided to the reference role extends those provided to a candidate, as both, candidate and reference role, need access to the same information and, whenever necessary, the reference role can provide additional input to the candidates. The reference role, for instance, can edit the information of the candidate's profile. This functionality is intended for revision purposes. Candidates are encouraged to create and update their profiles, but when supervision or assistance is needed, this functionality allows the reference role to directly correct the information, without the candidates having to share their credentials with the reference role.

CONTACTO provides organisations a platform they can use to search for a specific profile, without having to post an offer. Moreover, it also works as a platform in which available positions or training courses are announced and open to be applied for by candidates. Figure 4 summarizes the interaction that the organization has with the system. The only difference between a job and a training offer is the detail provided with the offer. Figure 7 shows the interface for accessing the list of candidates that have stated their interest in a particular offer. Furthermore, the offer can be updated or removed, when it is no longer available.

Finally, the supervisor role, as described in Figure 8, is more a system administration role and, for this reason, the type of interactions are mainly limited and related to user account management.

## B. THE CONTACTO ARCHITECTURE

The second stage of the proposed methodology consists in the implementation of the proposed system. Figure 9 outlines the proposed architecture with the different technologies employed in the implementation.

It has to be highlighted that in the proposed architecture, NGINX features (high performance and load balancing) have been used to handle API traffic, thus functioning as an API gateway.

The proposed platform can be accessed via a web browser but also using the App available in the Android Play Store.

## C. USABILITY EVALUATION

Finally, the third stage of the proposed methodology addresses the system evaluation. This evaluation is employed,

at the same time, as an indicator of the success of the proposed tool for SE interventions.

The guidelines established in the ISO/IEC 9126-4 standard and revised in 2016 by the ISO/IEC 25022 standard have been taken as a reference for the evaluation of the system usability. This standard recommends measuring usability attending to the three following features that are part of the definition of usability proposed by the ISO 9241-11 standard:

- *Effectiveness* defined as “the accuracy and completeness with which users achieve specified goals” or the number of tasks that the users have been able to complete, taking into account the errors they have made in order to reach the specified goal.
- *Efficiency* defined as “the resources expended in relation to the accuracy and completeness with which users achieve goals” or the time or effort spent by the user to complete the proposed task or objective.
- *Satisfaction* defined as “freedom from discomfort, and positive attitude to the use of product” or the level of personal comfort with the task performed.

### 1) EFFECTIVENESS

The evaluation of effectiveness ( $\epsilon$ ) will be carried out through observation and will be calculated by means of the *completion rate*. It is also interesting to count the number of errors in the execution of each task.

$$\epsilon = \frac{N_{ts}}{N_{tu}} \cdot 100(\%) \quad (1)$$

where  $N_{ts}$  is the number of task completed successfully and  $N_{tu}$  is the total number of task undertaken.

### 2) EFFICIENCY

On the other hand, the evaluation of efficiency requires measuring the time it took the user to complete the task. In addition, it has to be determined whether the task has been completed successfully or not. Efficiency can be calculated either as efficiency based on time or as the overall relative efficiency.

*Time-Based Efficiency* ( $\eta_t$ ) is obtained as follow:

$$\eta_t = \frac{\sum_{j=1}^R \sum_{i=1}^N \frac{n_{ij}}{t_{ij}}}{NR} \quad (2)$$

where  $N$  is the total number of tasks (goals),  $R$  is the number of users,  $n_{ij}$  is the result of task  $i$  undertaken by user  $j$  (if the user successfully completes task then  $n_{ij} = 1$ , else  $n_{ij} = 0$ ),  $t_{ij}$  is the time spent by user  $j$  to complete task  $i$  (if the task is not successfully complete, then the time is measured till the moment the user quits the task).

The following formula is used to calculate the *overall relative efficiency* ( $\eta_r$ ):

$$\eta_r = \frac{\sum_{j=1}^R \sum_{i=1}^N n_{ij} t_{ij}}{\sum_{j=1}^R \sum_{i=1}^N t_{ij}} \cdot 100(\%) \quad (3)$$

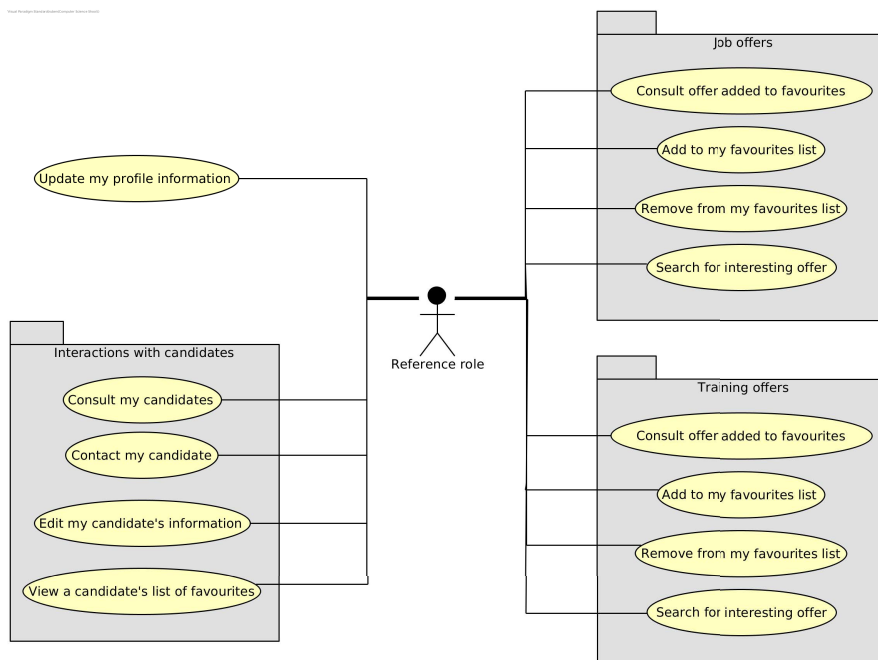


FIGURE 4. Reference role use case diagram.

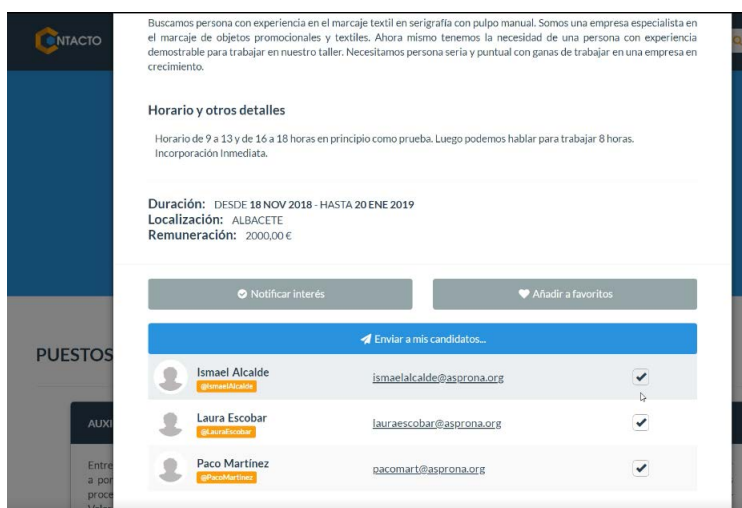


FIGURE 5. Interface showing the functionality to send an offer to certain candidates.

### 3) SATISFACTION

Finally, the evaluation of satisfaction is done through two questionnaires. One of the questionnaires will be used to determine user satisfaction at the task level (Task Level Satisfaction), and the other to assess user satisfaction with the tool (Test Level Satisfaction).

There are numerous standardized questionnaires to evaluate user satisfaction, but in the case this study the *Single Ease Question* (SEQ) has been selected to evaluate satisfaction at the task level and the *Software Usability Scale* (SUS) to evaluate user satisfaction with the use of our application. The SEQ questionnaire was carried out when the user finished the task, indicating the degree of difficulty that they had

perceived while carrying out the task. Therefore, the user responded with an item on a likert scale from 1 (very easy) to 7 (very difficult) to the only question in the questionnaire which is “In general, the task was...”.

The SUS questionnaire was carried out when the user finished the test, indicating the general impression they had regarding the use of the tool. The user rates with an item on a likert scale from 1 (strongly disagree) to 5 (strongly agree) each of the 10 questions that are included in the questionnaire.

### 4) CONTEXT OF USE

To meet the definition of the ISO 9241-11 standard, in addition to evaluating usability through these three dimensions

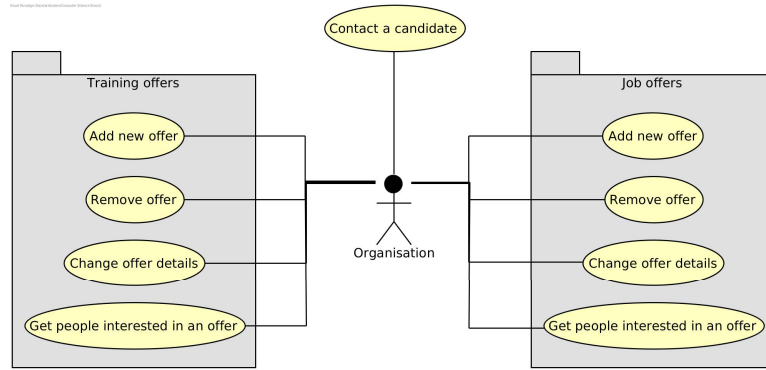


FIGURE 6. Organisation use case diagram.

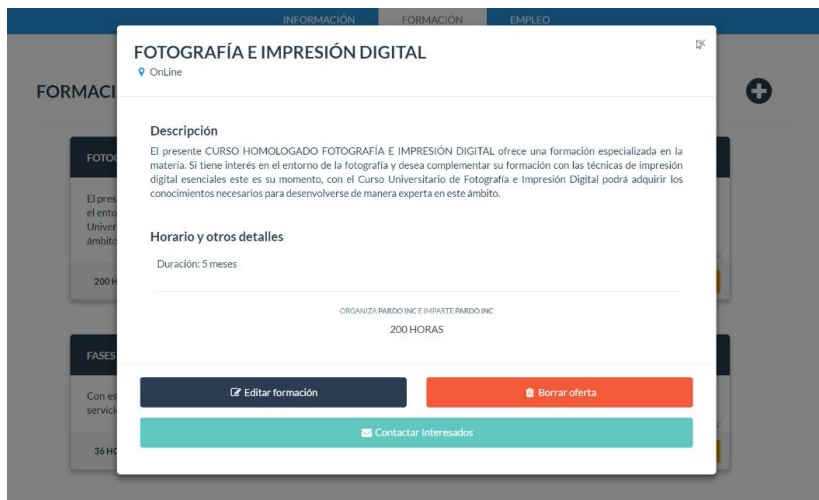


FIGURE 7. Training offer posted by an organisation.

(effectiveness, efficiency and satisfaction), we should take into account the context of use of the tool. For this reason, within this context it is important to define the characteristics of the users who will use the tool, the tasks or activities proposed by the tool and the environments in which the tool will be used.

CONTACTO is a social network addressed to professional and career promotion aspects focused on people with intellectual and developmental disabilities (IDD). However, as stated above, there are other roles interacting with the application. Table 1 summarizes the different roles and their associated tasks.

5) PROCEDURES

To carry out the study, an evaluator and an observer were required. The evaluator was in charge of presenting, conducting the test and explaining the different instructions and supervising each step. On the other hand, the observer was in charge of following up the test with the objective of having redundancy in the collected information.

To evaluate effectiveness, as stated in III-C1, the testing method is used through observation and evaluation of

TABLE 1. Role-based task for the usability study.

Role	Tasks
Supervisor	(S1) Create Reference Role (S2) Create Organization Role (S3) Create Candidate Role (S4) Edit Password (S5) Deactivate User (S6) Delete User
Reference role	(R1)Reset Password (R2) View Assigned Candidates (R3) Send My Candidates an Offer (R4) Notifying Interest in an Offer (R5 )Bookmark an Offer (R6) View My Favorites
Candidate	(A1) Reset Password (A2) Create Training (A3) Create Experience (A4) Consult your Reference role (A5) Search for an Offer (A6) Notifying Interest in an Offer (A7) Bookmark an Offer (A8) View My Favorites
Organization	(O1) Reset Password (O2) Create a Job Offer (O3) Create Training

performance with the aim of counting the tasks that were successfully completed and detecting and counting errors while



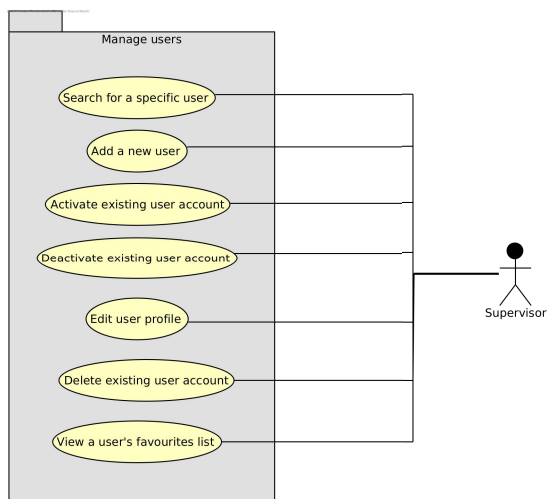


FIGURE 8. Supervisor use case diagram.

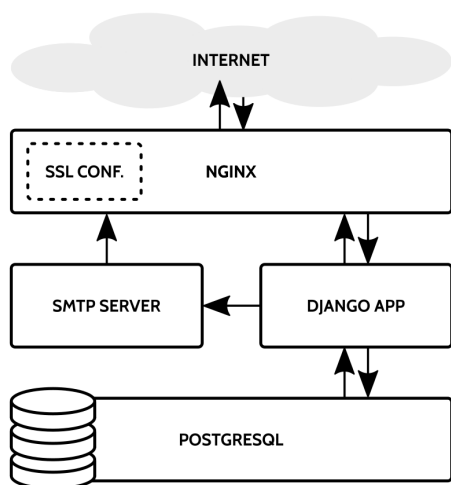


FIGURE 9. System architecture outline.

performing each task. In the evaluation of efficiency, as stated in III-C2, in addition to using the methods and techniques mentioned above, the time of each task was controlled and it was requested to think aloud to collect feedback. Finally, the evaluation of satisfaction was carried out using the scales previously presented III-C3 and the interview.

When the test begins, the evaluator introduces the participant to the test that they are about to undergo. Thus, the usability test is divided into 3 parts. The first part consists in reading the information sheet and signing the consent form; the second part is the completion of each task and completion of the SEQ scale at the end of each task; and the third part is the completion of the SUS scale. Table 1 shows the tasks by role. As it can be observed, each role has assigned tasks that corresponds to their user role. For each of these tasks, it will be taken into account whether or not the participant finished the test, the time spent on each task and the detection and number of errors. The participant determines whether or not they have finished the task, and can even finish the test at any

time. For some particular participants, the supervision of a professional was required to reinforce the explanation of the test.

All assessments were carried out in an office belonging to the ASPRONA association, in order to avoid participants having to travel. The room was equipped with a laptop for the participants to perform the test and another laptop for the evaluator to manage the whole process. The observer also had a support laptop to take notes.

#### D. ASSESSMENT OF THE MOTIVATION FOR USING THE PLATFORM

After studying the usability of the tool, we evaluated the motivation of users to use CONTACTO. This measure also determines the system acceptance and willingness to use the propose technology. To perform this evaluation, the *Intrinsic Motivation Inventory* (IMI) questionnaire [49] is proposed, with a selection of 26 questions adapted to this study.

The original questionnaire is composed of 45 items divided into 7 subscales [49]: interest/enjoyment, perceived competence, effort/importance, pressure/tension, perceived choice, value/utility and relatedness.

According to Ryan [50] and Deci [51], the subscale that best defines the measurement of intrinsic motivation is interest/enjoyment although perceived competence is considered to be a closely related subscale. In addition, perceived choice can provide us with a positive predictor of both self-reported and behavioral measures of intrinsic motivation. On the other hand, we have the pressure/tension subscale that is handled as a negative predictor of intrinsic motivation. The effort/importance subscale is a separate variable and will therefore be used in some items if relevant. In some cases it is also important to take into account whether the experience is considered useful for the subjects, and for this, the value/utility subscale is employed. Finally, the relatedness subscale is used in studies that take into account interactions between people.

The inclusion or exclusion of specific subscales does not seem to have any impact on the others, and even the order of the items seems to be insignificant according to the aforementioned studies [50], [51]. Another fundamental aspect in the development of this questionnaire is redundancy, as the items of the subscales overlap significantly, but this fact is irrelevant to the participant due to the random way in which the items are presented.

For our study we selected 26 items from the original IMI questionnaire whose classification and categorisation of items is based on the self-determination theory used in numerous studies. With the help of ASPRONA professionals, the subscales listed in the following table were selected. For the selection of the subscales and the respective items, the information to be obtained in the study was taken into account, as well as the users to whom the questionnaire was addressed. Thus, the aim was to obtain feedback on the interest generated by the use of the application, the value or usefulness they find in it or the importance of having such an application.

Additionally, it is considered that they feel capable of using it and choose to use this application among others that exist without feeling any kind of pressure.

Following the authors of the self-determination theory, the IMI items have been randomly arranged. The evaluation of each item is in a range between 1 (not true at all) and 7 (very true). There are 5 reverse-scored items and, in those cases, the value indicated by the user is subtracted from 8 to obtain the final score for that item.

Each of these volunteers responded to the IMI a few minutes after completing the usability tests, and answered each of the questions in the questionnaire under the supervision of the evaluator and the observer.

### E. SAMPLE DESCRIPTION

The evaluation of the proposed social networking site is performed on the basis of both the usability and motivation aspects. To this end, users with different roles participating in the employment-based intervention are involved: such as the people with IDD, those designing and supporting employment-based intervention, and the organisations in which such interventions are being developed. This research has been developed in collaboration with ASPRONA,<sup>1</sup> an association located in Albacete (Spain). This association provides integral support for people with IDD and their families, focusing among other aspects in the area of labour integration. This association follows a person-centered approach designing individualized support plans.

People from this association were considered for inclusion when meeting all the following criteria:

- Be an active role in an employment-based intervention (either as a candidate, organization, or employment specialist).
- Be technology literate, in the sense that technological tools such as smart phones or tables are used on a daily basis.
- For those individuals with IDD, it is also required that they live in a city with organizations providing training or job offers, so that they can apply for the advertised positions.
- For those individuals with IDD, it is also required that their referent role participates in the experiment.

On the other hand, the following exclusion criteria were considered:

- Any criteria that, in the opinion of Asprona's professionals, should prevent their participation in the study.

Due to the broad diversity of people with IDD [42], this research is addressed to those participants who have already been proposed for employment-based interventions and with individual support plans already designed. Moreover, due to the technology-based nature of the intervention, it was also necessary that participants were familiar with technology and, more specifically, with the use of smartphones.

<sup>1</sup><https://asprona.org>

According to the systematic review presented in [52], the sample sizes of similar interventions greatly vary from one study to another, from a minimum of 1 subject to a maximum of 57. In fact, more than 50% of the surveyed studies have less than five participants. Despite being limited in terms of the potential generalization of the findings, the sample size is similar those found in the state of the art for similar interventions. Moreover, according to [53], in qualitative research, data needs to be collected until saturation occurs. Saturation occurs when there are no new issues raising after a certain amount of ideas have already been stated. In this sense, when there are no new data or ideas, there is no need to continue broadening the sample size [54].

Initially, the sample consisted of 32 volunteers. Within this sample we differentiated 22 volunteers for the role of candidate and 10 volunteers for the other roles and who participated with a more expert opinion regarding the field in which the CONTACT application will provide its service. Of those 22 participants in the candidate role, 3 were excluded because they did not want to participate in the study, so our sample was reduced to 19 in that role. Subsequently, 2 volunteers did not meet the inclusion criteria, 4 were excluded from the test by determination of their reference roles and 1 finally declined to participate in the test, as Figure 10 depicts. Finally, 12 volunteers with the role of Candidate with different levels of disability were used to carry out this study, of which 8 were male and 4 were female with an average age of 25 years.

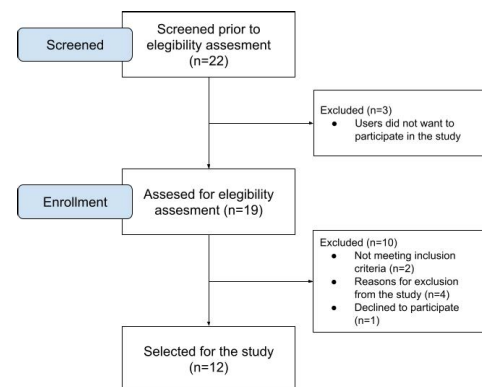


FIGURE 10. Flowchart of recruitment process.

As this application involves other users associated with this process, it was necessary to collect information on the tasks proposed for the other roles in order to obtain feedback from the point of view of the professional in charge of candidates (referent roles), from the main organisation that proposes job offers and internships to candidates from the ASPRONA association, and from the association's supervisors.

The tests were carried out by alternating roles in order to avoid procedures or responses conditioned by the previous user's performance. On the other hand, different tasks were selected within the platform to find out, in a qualitative way, what they thought of the proposed environment for the search for internships and employments.

The sample comprising the roles that form part of the supervision of the job and internship search process was initially composed of 10 volunteers, of which 3 were supervisors, 5 were reference roles and 2 were organisers. All of them fulfilled the inclusion criteria, but finally, the sample was reduced to 7 volunteers because they could not attend the day of the tests, leaving the sample composed of 2 supervisors, 4 reference roles and 1 organiser, of which 5 were women and 2 were men with an average age of 36 years old.

Each volunteer is identified with a test participant ID. In Table 2 the IDs related to their role are detailed.

TABLE 2. Participant ID - Role.

Participant ID	Role
1	Supervisor
2	Supervisor
3	Organization
4	Reference role
5	Reference role
6	Reference role
7	Reference role
8	Candidate
9	Candidate
10	Candidate
11	Candidate
12	Candidate
13	Candidate
14	Candidate
15	Candidate
16	Candidate
17	Candidate
18	Candidate
19	Candidate

It should be noted that for the evaluation of the motivation to use the platform, all volunteers from all roles participated in the application of the selected subscales.

#### IV. RESULTS

After conducting the tests with ASPRONA’s volunteers, the following results were obtained in the usability and motivation evaluation.

##### A. USABILITY

The obtained data on the effectiveness of the use of the tool is reflected in the completeness rate shown in Table 3. It can be observed how, out of the 19 volunteers, 15 completed all the proposed tasks. The 4 participants who did not complete their tasks belong to the “Candidate” role provided in Table 2. Out of these 4 candidates, only 1 had problems with more than one task.

Furthermore, the analysis of the number of errors committed by candidates in the tasks they were assigned, shows that, in general, the average number of errors per task was low, as Figure 11 illustrates. It was found that the tasks in which users made most of the mistakes were in “Reset Password”, “Consult your Reference role” and “View My Favourites”. This low error rate suggests that most people with IDD will be able to use of the tool in an autonomous manner. Further

TABLE 3. Completion Rate.

Participant ID	Tasks Completed Successfully	Total Task Undertaken	Completion Rate
1	6	6	100%
2	6	6	100%
3	3	3	100%
4	6	6	100%
5	6	6	100%
6	6	6	100%
7	6	6	100%
8	8	8	100%
9	7	8	87.5%
10	5	8	62.5%
11	8	8	100%
12	8	8	100%
13	8	8	100%
14	8	8	100%
15	7	8	87.5%
16	8	8	100%
17	8	8	100%
18	8	8	100%
19	7	8	87.5%

research is also needed to determine the causes of failing to complete the three aforementioned tasks. If the reason is due to a poor design, appropriate actions will be carried out to amend them. If the reason is due to the lack of familiarity with this type of tasks, training actions can be organised to reinforce those tasks they are less familiar with.

Regarding efficiency, refer to Table 6, it is observed how there are three tasks from Table 1, namely: “Reset Password”, “Create Training” and “Create Experience”, which show a low time-based efficiency. This result suggests that candidates have to dedicate more time to find their way through this task, as shown in the Figure 14. On the other hand, it is also observed that the tasks with the lowest percentage of overall relative efficiency are “View My Favourites”, “Reset Password” and “Search for an Offer”. This implies that these tasks were not even completed by some users.

In order to summarize the obtained results: Tasks A1, A4, and A8 are those more prone to errors. It is necessary to evaluate whether the reason of these failures is due to a poor system interaction design or just because the complexity of the task cannot be successfully addressed by most of the people with IDD. Tasks A2, A3, and A1 are those that require more time from the users. In this sense, further analysis is required to determine whether these tasks could be split or simplified in order to reduce the time spent completing them. Finally, tasks A1, A5, and A8 are the ones with the worse overall relative efficiency. Task A1 (reset password) obtains bad results in the three metrics. It suggests the need to reorganize that task in such a way that it is more feasible by people with IDD to complete it.

Finally, as shown in figure 12 and in Table 4, users evaluate all tasks performed above 4.83 in average. The tasks that obtained the lowest scores were “Reset Password”, “Consult your Reference role” and “View My Favorites”. It seems that the same tasks that obtained low results in the previously analyzed metrics are the same with which users are less

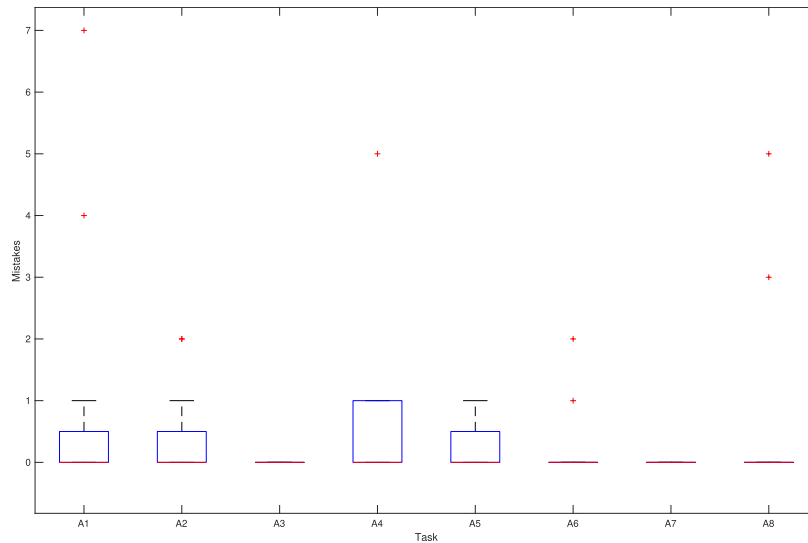


FIGURE 11. Mistakes per Task for the Candidate role.

satisfied. This reinforces the need for alternative mechanisms that support the task of resetting password, contacting the reference role, or retrieving the offers marked as favourites.

It is important to highlight that, according to Figure 13 and Table 6, the majority of the users consider that tasks were affordable, as the average of their answers in the SEQ questionnaires are above 4. The results of the SUS questionnaires also show positive results, as shown in Table 7, with 47% of the volunteers who took the tests considering the usability of the application as Excellent, 21% as Good, 11% as OK and the remaining 21% as Poor. It seems possible that the negative results are due to flaws in the design of the tool, which is why during the test we collected feedback from the participants to obtain information for possible improvements in the application.

Qualitative results were also collected during the evaluation, as summarized underneath:

- In the “Reset Password” task, there were some candidates who were not able to easily find the user’s configuration in order to reset their password. One of them, while searching for such option, made a mistake ending up in a system logout.
- When performing the “Consult your Reference role” task, one of the candidates commented that the positioning of the reference role name, within the interface, was not intuitive.
- Two participants found non-intuitive the proposed way to “Search for an Offer”. They tried to list the job offers and did not use the search engine to find the job offer they were interested in.
- Some comments or proposals that were made about the task of “Notifying interest in an Offer” were that instead of “I like” it should be “I am interested” and that more information about the offer should appear, such as the duration of the contract, requirements and some feedback about the status of the offer.

TABLE 4. Efficiency and Satisfaction per Task.

Task ID	Time Based Efficiency (goals/min)	Overall Relative Efficiency (%)	SEQ
A1	0.70	74.93%	5
A2	0.38	100%	5.17
A3	0.46	100%	5.42
A4	2.31	100%	4.83
A5	2.47	83.47%	5.75
A6	3.70	100%	5.58
A7	6.55	100%	6.33
A8	6.11	65.36%	4.83

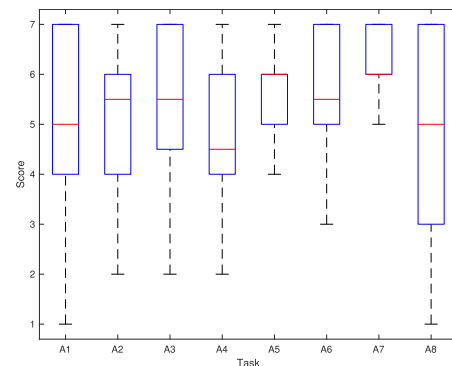


FIGURE 12. SEQ per Task for the Candidate role.

- For the “View my Favorites” task, one user considered the way to view favourite offers and training courses was non-intuitive.

**B. MOTIVATION TO USE THE PLATFORM**

The results obtained in terms of motivation to use the proposed digital solution are extracted from the 26-question IMI questionnaire answered by the 19 volunteers (all roles) who evaluated the system. Table 8 shows the mean values and standard deviations of the scores obtained for each of the subscales evaluated in the questionnaire.

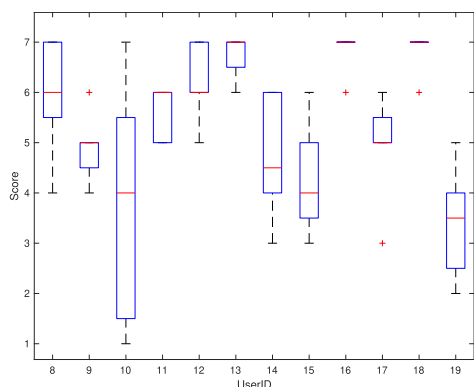


FIGURE 13. SEQ per User for the Candidate role.

TABLE 5. Efficiency and Satisfaction per User(for the Candidate role).

Participant ID	Time Based Efficiency (goals/min)	Overall Relative Efficiency (%)	SEQ
8	4.39	100%	6
9	1.23	98.3%	4.88
10	0.52	74.9%	3.75
11	1.71	100%	5.63
12	3.60	100%	6.25
13	2.26	100%	6.75
14	3.25	100%	4.75
15	1.08	76.3%	4.25
16	3.54	100%	6.88
17	1.39	100%	5
18	10.01	100%	6.88
19	1.04	96.5%	3.38

TABLE 6. Efficiency and Satisfaction per User(for the Supervisor, Organization and Reference role).

Participant ID	Time Based Efficiency (goals/min)	Overall Relative Efficiency (%)	SEQ
1	3.72	100%	6.67
2	1.24	100%	5.33
3	0.81	100%	7
4	5.29	100%	6.67
5	5.31	100%	6.83
6	6.77	100%	6.17
7	5.33	100%	6

It can be observed that the standard deviations of most of the subscales are low, which means that the volunteers who completed the questionnaire ranked each of the subscales very similarly. The subscales with the most dispersed data are “Perceived Competence” and “Pressure/Tension”, although the standard deviation values are not very high either. On the other hand, it should be noted that the mean value of almost all the subscales are above 4. This means that the obtained results are higher than the mean value of the scoring scale that goes from 1 to 7. The only subscale that is below this mean value is “Pressure/Tension” which has a mean value of 2.47.

The best evaluated subscale is the “Effort/Importance” subscale, which means that they think they would dedicate their abilities to use the tool, and even consider that using the tool well is very important to them. They also

TABLE 7. Individual’s SUS score.

Participant ID	SUS score	Adjective rating
5	100	Excellent
3	97.5	Excellent
13	95	Excellent
2	92.5	Excellent
4	92.5	Excellent
6	90	Excellent
1	87.5	Excellent
18	87.5	Excellent
16	85	Excellent
7	72.5	Good
9	72.5	Good
12	72.5	Good
11	70	Good
14	67.5	OK
19	57.5	OK
10	55	Poor
8	52.5	Poor
17	47.5	Poor
15	45	Poor

think that they are quite capable of using the tool, as “Perceived Competence” is the next best-rated subscale, and even the average obtained in “Value/Usefulness” indicates that they consider this application useful or see an added value in using this digital solution in the development of their activity. In addition, the next highest scoring subscale, “Interest/Enjoyment”, indicates that these volunteers have an interest in or enjoy using the tool.

The obtained score in the Perceived choice indicates that they would choose this application among others to carry out the different tasks they need to do for the development of their activity.

Finally, the Pressure/Tension subscale is the one that obtained the lowest score, which means that the volunteers who underwent the test did not experience moments of pressure or tension when performing the different tasks.

V. DISCUSSION

This study addresses the question of whether online social networks can be used to improve self-management skills, in the context of an employment-based intervention, for people with IDD. The results show that, despite having considered employment specialists providing assistance during the intervention, as suggested by [28], most users with IDD managed to complete all the proposed tasks. In fact, only one user with IDD shows difficulties in performing more than one task. In terms of motivation, the results obtained in perceived competence suggest that users find themselves capable of using the tool. In the overall, results demonstrate that a fit-for-purpose online social network can be used to support interventions addressed to improve self-management. The results supporting this conclusion are discussed in this section.

Similarly to the works in [42], [43], and [44] the success of the proposed technology is measured based on its user acceptance and perceived usefulness. More specifically, usability is measured in terms of effectiveness and efficiency.

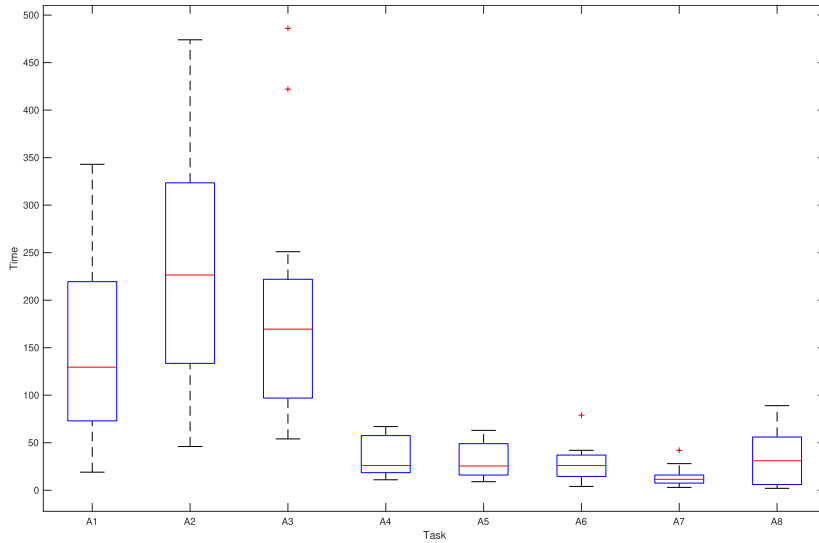


FIGURE 14. Time per Task for the Candidate role.

TABLE 8. Subscale findings of the Intrinsic Motivation Inventory questionnaire.

Subscales (n=19)	Number of items	Score (mean ± SD)
Interest/Enjoyment	7	5.55±1.02
Perceived Competence	2	6.03±1.32
Effort/Importance	2	6.05±1.07
Pressure/Tension	2	2.47±1.63
Perceived Choice	4	5.05±0.84
Value/Usefulness	9	6.01±0.76

The effectiveness measures to what extent the proposed tasks have been completely undertaken. In this sense, out of the 12 people with IDD that were involved in the study, only 4 had troubles completing all tasks. Among these four individuals, only one struggled in completing more than one task. On the other hand, efficiency measures the amount of time spent in completing a task. It can be observed how the task “Reset Password” stands out as a problematic one, both from the point of view of effectiveness but also regarding efficiency. This aspect confirms what Chang et. al stated in [33] about the challenges to privacy experienced by people with IDD when using online social media or what Shpigelman et. al discovered in [14] about the use of privacy settings. More specifically, according to the framework proposed in [33] and given the problems experienced by users with IDD when dealing with credential updates, a skill pre-assessment approach [55] needs to be implemented to overcome the limitations of those who needs assistance to ensure the cybersecurity of their account.

The case of the tasks “Consult your Reference role” and “View My Favourites” are also relevant as one involves the capability to seek for assistance whereas the other one is directly related to the self-management skill. These two tasks achieves poor results on effectiveness and efficacy. The work in [55] reports a difference in behaviour between male and female with IDD when it comes with hit the “Like” button on Facebook. This could explain the obtained results as the

use of this online social networks is greatly influence by the experience users have on interacting with existing networks like Facebook. Hitting the “Add to my favourites” button follows the same approach as that of Facebook. In this sense, eight out of the twelve individuals with IDD are males. This could explain that they are less familiar with the hit “Like” button and therefore they have more problems retrieving his favourite offers. Special training on this aspect could be planned to improve interactions with favourites offers. The case of the low performance achieved by the “Consult your Reference role” task is explained, after the qualitative analysis carried out during the interviews, due to a poor design that requires improvement.

The results obtained from the motivation analysis are in line with the previous studies that have assessed the impact that online social networks have on career promotion [23], [24]. In this sense, similarly to the results obtained for other well-known online social networks, CONTACTO users perceive it as a useful support for career promotion. More relevant are the obtained results with regards to the perceived competence, as this is directly related to self-management skills. In line with the conclusions of the systematic review performed in [52], self-management improves with targeted interventions. In this case, the perceived competence to use CONTACTO can be directly translated into a positive impact on self-management skills. This opens new and future lines of research to explore how these skills could be improved, over time, while using the tool by including new functionalities.

A. PRACTICAL IMPLICATIONS

There is a lack of consensus on whether online social inclusion should be carried out by adapting existing tools (such as LinkedIn, Facebook, or Twitter) or, on the contrary, by building new platforms specifically dedicated to people with IDD. Section II have identified works that support the use of

existing tools, with external support, such as the work in [28]. Other works, such as those of [32] or [36] promote the online social inclusion through the use of existing tools.

The practical implications of using existing tools, such as LinkedIn, rather than a fit-for-purpose one, such as CONTACTO, is that with existing tools the number of users, and therefore the number of opportunities and connections cannot be compared to the opportunities brought about by CONTACTO. Nonetheless, supported employment is very specific and the available positions should be closely analysed by the employment specialists to determine the profiles that could fit the offer. On the other hand, the data collected from a fit-for-purpose tool could be very relevant to identify trends, patterns, preferences, etc. In the long term, this knowledge could be useful to improve the assistance provided by the employment specialists, delegating some decisions to the tool, based on learnt patterns.

### B. THEORETICAL IMPLICATIONS

The analysis of the state of the art reveals that further research is still needed to determine the role that social media technologies can play in assisting people with IDD. This work contributes to filling this knowledge gap by studying whether online social networks could be employed for improving self-management skills through supported-employment interventions. This is a very specific questions that yet had not been addressed by previous works.

Self-management has been evaluated based on the extent to which individuals with IDD are capable and willing to use the CONTACTO tool. Results show high rates on usability and motivation tests as well as in the perceived competence to use the tool. The main theoretical implication of this work is that the high interest that people with IDD has on using internet and online social network could be used to purposes other than leisure. Supported-employment interventions can benefit from the use of online social network.

### C. SOCIETAL IMPLICATIONS

Societal implications are identified on the side of people with IDD and on the side of the employment specialists supporting them during the interventions.

The benefits of using internet and online social networks for people with IDD have already being demonstrated. This study goes one step further as it demonstrates that it also contributes to improve self-management skills when employed in the context of supported-employment interventions. Improvement in self-management directly impact on minimizing the need for external assistance what eventually improve the quality of life of people with IDD.

Concerning the societal implications of this study, it has to be highlighted the important role that employment specialists play in supported employment, which can be potentially enhanced by means of the presented tool, thanks to the improvement in efficiency and quality of the services provided. This might result as well in an increase in the number of users that can benefit from the proposed tool services.

## VI. CONCLUSION

The objective of this study was to determine whether online social networks could be employed for improving self-management skills through supported-employment interventions for people with IDD. Due to the barriers found by people with IDD when using existing tools like LinkedIn, and for the sake of ensuring their online social inclusion from the beginning, a fit-for-purpose social networking site was built and evaluated in terms of its usability and motivation to use it. Results demonstrate that self-management is improved by means of the CONTACTO tool, based on the obtained results regarding the usability, motivation and, more specifically, the perceived competence to use the tool.

This work brings about important practical, theoretical, and societal implications. Regarding the practical implications, the data collected from the interaction between users and job offers generates new opportunities for the adoption of data analytics, that can positively impact the decision-making processes and the development of new policies regarding the assistance provided to individuals with IDD. In terms of the theoretical implications, this work has contributed to fill the knowledge gap about how online social networks could support interventions for people with IDD. Finally, societal implications reveal the improvement in the quality of life of people with IDD as result of the improvement of their self-management skills.

Further research is required to determine whether this type of platform, based on online social network approaches, can be useful for other types of interventions addressed to people with IDD. Among the limitation of this work, it has to be noted that the impact on self-management has not been quantitatively measured in relation with the use of the CONTACTO tool. Further research is required to determine if this impact can be quantitatively measured and to determine how these skills could be improved over time by means of new functionalities. The sample size can also be considered an additional limitation of the study in order to generalize the conclusions. Nevertheless, the results and findings provide new and valuable knowledge to be considered in conjunction with other similar studies.

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