



Technological Approaches to an Inclusive Digital  
Society: A Literature Survey

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# 1 Introduction

Currently, we have entered an era of technological ingenuity; tools such as Artificial Intelligence (AI), Machine Learning (ML) and especially the internet, have in large changed the way in which we see the world. It is now easier than ever to connect with families over long distances, make cross continental friendships, and more. Social media platforms such as LinkedIn and Twitter allow for professional development and networking from the comfort of your home, and video calling has made it possible for people regain a semblance of in-person communications across the globe - something that was not previously possible not too long ago. All these innovations in technology, should have, in theory, allow people to feel closer together. Yet, we're in a period where loneliness, depression and social isolation is on a high; this is particularly true for the elderly [9] and people with disabilities [21]. In the cases of the elderly, it is often common that they do not know how to effectively use technology like smartphones confidently [26]. This becomes an issue when important systems such as general practice surgeries resort to using software applications to book general check ups and health appointments. There is an implicit assumption there that all people who own smartphones are experts at navigating them when this is often not the case amongst the elderly.

Another way in how people are ostracised from society comes from the sheer cost of technology. Whilst it is common for most people to have smartphones, there are often people who cannot afford to have one (in particular, people who are living below the poverty line). For immigrants - who typically have less wealth than residents - they are much less likely to own smartphones. This is particularly important in the context of EU migrants since the events of Brexit meant that additional documentation is required for work, mortgages, loans and more. Traditionally, this would involve some form of paper documentation however now it is a completely online system. This new system requires a user to log on to the home office portal, generate a "share code" which lasts a total of 90 days for the employer, bank office, or otherwise to check their credibility. Thus, in this case, for EU migrants to be active members of the society in the UK, they *need* to have access to a way in which they can connect to the internet; be it from a traditional desktop computer or a smartphone, both of which are not always affordable nor do people like the elderly are adept enough at using technology and thus excluding them.

As we have briefly explored here, there are many ways in which people can be excluded from taking part within this digital society. In some sense, it is a multi-faceted problem that has many layers and affects people at varying degrees. Although it works for most people, there are still many demographics that are affected by the way in which we develop technologies and we must be more careful about how we create and implement such tools in the future. In this report, we explore the approaches that current researchers have taken to make a more inclusive digital society.

## 1.1 The Survey

This survey explores and review on the ways in which current research has used technological interventions to create a more inclusive digital society. To do this, we explore this through the lens of “**Precarity**,” “**Well-being**,” and “**Civic Participation**.” This report also then further segments the strategies used by comparing the methods used for interventions in both the Global North and the Global South through a systematic literature review which is then analysed through the lens of content analysis. We believe that this is important for understanding how technology can - in a lot of instances - perpetuate existing inequalities and that they can be perpetuated in many different ways. Not only this, but often times these problems interlink and this becomes even more complex when accounting for different cultural contexts such as the case between countries in the Global North to the countries in the Global South.

## 2 Precarity, Well-being and Civic Participation & the Digital Age

In Section 1.1 we mention *Precarity, Well-being and Civic Participation* as the lenses for identifying the methods in which researchers address the problems present in the current digital society. In this section, we’ll discuss the importance of each of these aspects and why they are important for creating a more inclusive digital society.

### 2.1 Precarity in the Digital Age

The term ‘Precarity’ refers to the idea of someone being within a constant state of persistent insecurity in the context of income, employment, housing or other resource access. One such example of how this affects people is in the study by Berg [8] which looked at Hamburg-based refugees. When most services moved online during COVID-19, it became clear that these people were effectively unable to effectively participate as a member of society due to their lack of access to digital resources.

Another way in which Precarity can rear its head in society is due to the innovations in technology. One area that is of concern for people is that of automation. There are a significant number of people who are concerned that once technology improves, they may be out of a job, thus putting them into a precarious situation [32]. Even in the scenario where people do not completely lose their jobs, people may end up being needed to be re-trained and there could be a lot of labourers that could suffer due to employment migration [31]. Despite lots of technology being beneficial for a lot of people, additional care needs to be placed in how it is implemented to avoid these sorts of problems, especially since in the UK, there are a lot of people who are struggling with the cost of living crisis and are just about making ends meet with their current jobs [17].

## 2.2 Well-being in the Digital Age

Within this digital era, another area of concern when discussing inclusivity in this digital society is that of well-being. In the context of this review, we think of well-being being closely related to their health; both physical health and mental health. It is often found/observed that they are interlinked; improving your mental health can subsequently improve your physical health. One aspect that often correlates with a decrease in mental health is loneliness. In fact, 52% of people in the UK have experienced feelings of loneliness so far this year which is a 6% increase since 2020, which indicates that these feelings of loneliness have not declined past the pandemic according to the Office of National Statistics<sup>1</sup>. In this digital age, we find that research into loneliness has been increasing drastically over the last 20 years [23]. In addition, there are more people searching on search engines such as Google about loneliness. Although the validity of using search engines is questionable, a study by Knipe et al [20] there is an association between google searches and people who self-report experiencing loneliness giving some semblance to the idea of using google searches as a method of data gathering.

This exploration of loneliness is important since it effects groups of people unequally. This was especially apparent during the COVID pandemic. One such example was the situation with nurses during COVID. They found that nurses were experience both high levels of burnout and loneliness throughout that period [39]. Outside of particular professions, research has also found that particular demographics such as the LGBTQ communities experienced the effect of loneliness more than their cis-hetero counterparts [19]. Additionally, it is known that older people are more likely to experience loneliness more compared to younger people [10]. These aspects are important to consider especially since we know that technology has the ability to help people feel connected and thus less lonely [11, 40].

## 2.3 Civic Participation in the Digital Age

Civic Participation is an important aspect of inclusivity. In the context of this review, we can think of civic participation as the ways in which the public partake or *participate* within society and local communities. This is important since as we progress further into this digital age with tools such as the internet, there appears to be a trend towards younger people showing signs of apathy and lack of interest with involves themselves with politics and society [6]. However, from a different viewpoint, we could look at how, in fact, young children who are considered by traditional society as withdrawn, do in fact, have strong and interconnected societies; they are just largely virtual [38]. One of the biggest as to why such virtual societies exist is due to social media and gaming platforms that allow people from across the world to share their interests and ‘band together’ on places such as ‘Twitch,’ ‘Discord,’ ‘Twitter,’ ‘Tiktok’ and more. This leads us to think and ponder on what Civic Participation begins to look like in

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<sup>1</sup><https://tinyurl.com/mntjjfhr>

the digital age, especially since a lot of society is now trending to an all digital world.

## 3 Methodology

### 3.1 Research Aim and Questions

The aim of this report is to understand the following:

- What are the different methods researchers have used to create a more inclusive digital society?
- What are the differences in the methods used for creating an inclusive digital society between the Global South and the Global North?

To provide insight into these questions, we have the constructed the following research questions:

**RQ1:** What are the different methods researchers have used to tackle the issue of **Precarity** for creating an inclusive digital society?

**RQ2:** What are the different methods researchers have used to tackle the issue of **Well-being** for creating an inclusive digital society?

**RQ3:** What are the different methods researchers have used to tackle the issue of **Civic Participation** for creating an inclusive digital society?

**RQ4:** Are there any differences in the methods used between the Global North and the Global South in tackling these issues?

RQ1-RQ3 will give us insight a holistic insight into the methods that researchers have been using the create a more inclusive digital society and RQ4 will then further expand on this by breaking down the how the Global North and the Global South have tackled these issues on the whole and also by category which will gives us additional insight into how we should develop future technological interventions in the future should we truly want to be inclusive.

### 3.2 Research Methodology for the Literature Review

Our review methodology is based ton the ‘PRISMA’ strategy as defined in the works of Moher et al [27]. Figure 1 shows a flow diagram of the PRISMA strategy along with the full breakdown of the number of papers, starting from the identification process through the search and subsequent screening processes. In the following section each stage of the strategy is explained in detail.

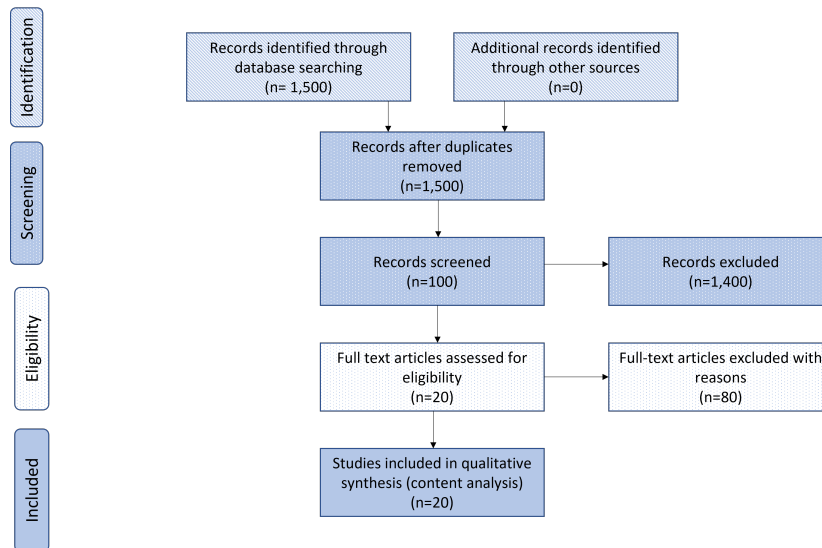


Figure 1: PRISMA Flow Diagram ([27]) describing the search methodology used in this study. In the diagram the number of papers remaining and/or excluded at each stage of the process is reported.

### 3.2.1 Development of Review Protocol

The review protocol was developed to achieve the following:

- Maximise the literature covered.
- Include and identify related work classified as studies (case studies, experiments and others)
- Gather and synthesize significant data from the studies pertaining to the research questions which were defined in Section 3.1.

This protocol specifies the search strategy, inclusion and exclusion criteria, data extraction and the method of synthesis.

### 3.2.2 Identification of Scope

It is understood that the area we are covering is vast. Digital inclusivity is a widely research topic from the psychological aspect to the technical and implementation aspect. For this reason, we have created a set of inclusion and exclusion criteria to accurately define our scope. The inclusion criteria were:

- Papers which were peer-reviewed.
- Papers which were written in English.

- Papers that were classified as a study and not a report, book chapter or abstract.
- Papers working with any and all participants.
- Papers which resulted in a technological intervention for the purpose of digital inclusiveness.
- Papers which referenced digital inclusiveness and/or technology within the title or abstract.

The exclusion criteria were:

- Papers was not available through university services.
- Papers not in the ACM pr IEEE Digital Libraries.

### **3.2.3 Search for Relevant Studies**

The search process was carried out in one step which was to search some databases. For this review, we selected the ‘ACM’ and ‘IEEEExplore’ databases. These databases were selected for our interest in exploring the technological interventions made for digital inclusivity. The following search string was used for all databases: (Technology AND inclusive digital society) OR (Technology AND inclusive AND (digital OR society)). These terms were selected since they are the core words when discussing digital inclusive societies. At this stage, there were a total of 380,125 papers that appeared in the initial search. For this study, there was no limit to on how old a paper could be for it to be included within the study.

Due to time limitations and the manual labor of evaluating that many papers, I, as the individual researcher, decided to scan through the first 1,500 papers (750 from the ACM and 750 from the IEEE DL) to provide an accurate sample for the review. Thus, this review is not exhaustive but a representation of the literature and all conclusions from this paper will be drawn with that in mind. During this process, the titles and abstracts of papers were checked. If the papers adhered to the inclusion and exclusion criteria listed above, the paper was then downloaded into a folder as a pdf document for analysis. After completing this process, 100 papers remained. The final search was completed on 9th August 2023.

### **3.2.4 Critical Appraisal**

The focus of the critical appraisal was on relevance (papers classified as an experiment, case study or studies that used a technological intervention to make a more inclusive digital society), rigor (appropriate research describing scope, methods, execution and research context) and credibility (conclusions based on analysis and reasoning). The critical appraisal was led by the author. After the appraisal process, only 20 out of the 100 papers remained.

### 3.2.5 Data extraction

At this stage, data from the papers was extracted by reading through the papers in full detail. For data gathering, it was deposited into an Excel Spreadsheet. The data collected was the following: Title, Database, Country of Deployment, Global North or Global South, Target Demographic, Intervention Tool, Intervention Approach, Parity, Well-being and Civic Participation.

### 3.2.6 Synthesis

We employed a content analysis strategy to evaluate the literature, as defined by Elo and Kyngäs [13]. Content analysis is a research method that provides a systematic and objective means of describing and quantifying phenomena within a collection of papers. This approach is a systematic and repeatable process [22] thus making it a suitable choice for this particular review. In particular, we chose to conduct an inductive content analysis methodology. This approach was selected to reduce the risk of author bias. This methodology was followed by not making any inference of meaning during the review, but instead using the literal text to dictate the themes in the paper [7].

## 4 Results

In this section, we will present the some general information before delving into the research questions. The results are based on the PRISMA strategy above. After following this methodology, we were left with a total of 20 papers in which we conducted the content analysis for all the research questions from RQ1 to RQ4. The results section is structured as follows: Firstly, we will discuss some general results found from the analysis. Then, we will discuss the general overview with respect to the research questions RQ1, RQ2 and RQ3. Finally, we will address RQ4 by observing the differences between the Global North approach and the Global South approach.

Before we present the results, we specify the methodology approach for discerning if a paper was focused on Precarity, Well-being or Civic participation. As an attempt to isolate papers for analysis, we took the approach of analysing papers based on their research goals and motivating factors. We believe that this was the best way to isolate the difference between the intended goal of the paper compared to the impact the intervention had. We chose this method since (as will be discussed in detail in the Discussions segment) the outcomes of the paper in some cases affected multiple categories (e.g. Parity and Well-being).

### 4.1 General Results

From the review, we found the following in terms of all the papers concerning demographics for the review. The first result is that of the demographic audience which can be found in figure 2. We found that, in terms of demographics or target audience, the most popular demographic were those with disabilities,



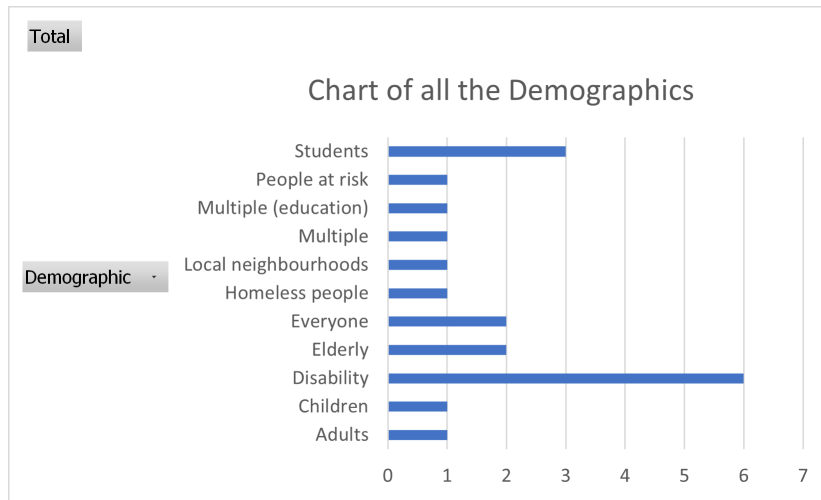


Figure 2: A bar diagram representing all of the target demographics from all the analysed papers.

namely physical disabilities, hearing disabilities or visual disabilities at 30% of all papers. Followed by that, we found that the second most popular demographic were students which consisted of 20% of all the papers.

Another result was the distribution of tools used for the interventions. They can be found in Figure 3. We found that the single most popular category were Computers or Laptops (labelled as ‘PC’) at 25% which was then followed by Mobile devices at 20%.

The final general result that we will discuss here can be found on figure 4 which concerns the method of intervention (for example, an app deployment, a remote deployment of some physical hardware, a traditional user study format, etc). The most notable method of deployment was of some form of software development which accounts for 40% of all papers. The categories for this will be discussed further in the discussions section.

## 4.2 RQ1: What are the different methods researchers have used to tackle the issue of Precarity for creating an inclusive digital society?

### 4.2.1 Methodology

To evaluate the research question, we identified the framing of the paper, identifying keywords such as ‘the goal of this paper is’ or ‘the purpose of this study is’ to identify what the goal of their paper was. Furthermore, we looked at the framing of the paper and in particular identified the motivation for their paper. If these were not present, we then scanned their ‘motivation’ or ‘introduction’

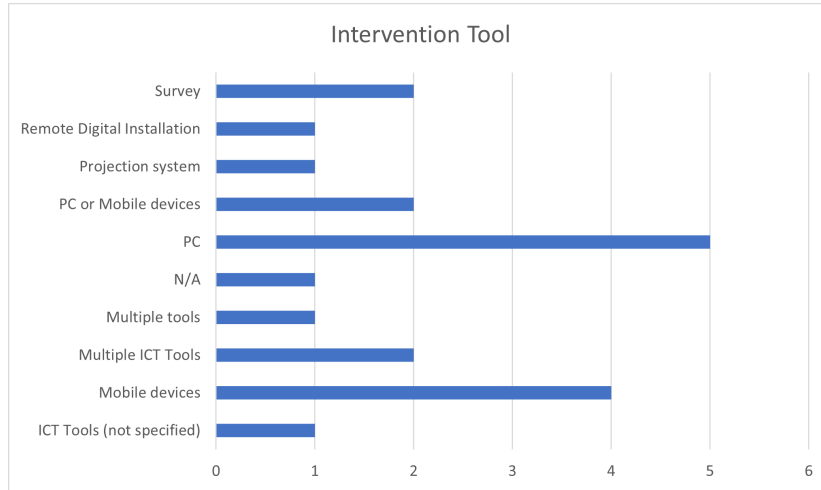


Figure 3: A bar diagram representing the intervention tools used from all the analysed papers.

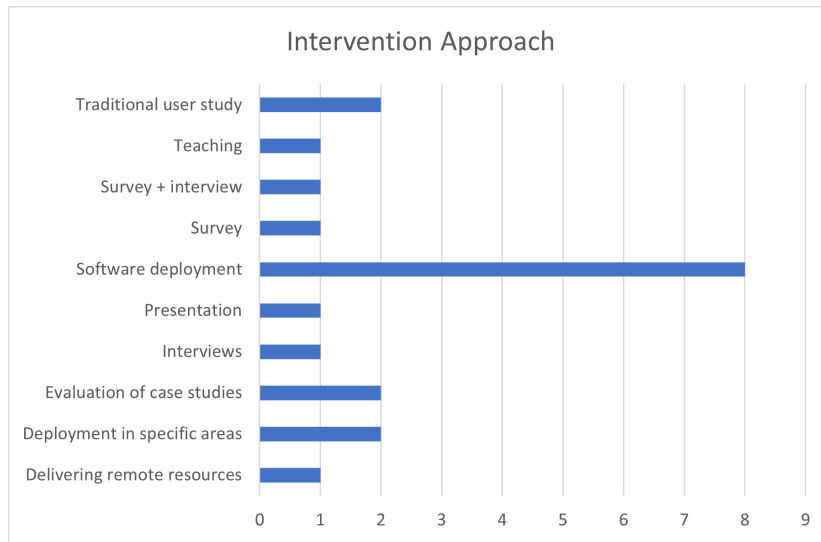


Figure 4: A bar diagram representing the intervention approach used from all the analysed papers.

sections to determine the goal of their paper. For example, the paper by Pavia et al [30] wished to tackle the issues that the homeless face in terms of being involved in society. Namely, how they are socially excluded and often are unable to attain jobs or consistent housing. Thus they developed a mobile app to assist this demographic to self-manage their problems and develop their own network that they could communicate with and receive notifications for their most prevalent issues (e.g notifications about places that are free for them to stay, family contacts and more). Another example is in the paper by Foko et al [14] which tries to address difficulty that people from rural areas in South Africa have in terms of having access to the internet and education. Their solution to this was to deploy a standalone fixed platform that people would be able to access which is connected to the internet and had other tools such as tablets and other digital devices.

From this, we identified 3 main categories pertaining to Precarity which can be seen in Figure 5 for their distribution. The 3 categories were:

- Access to internet.
- Homelessness and employment.
- Monetary issues.

From the 20 papers, 5 of them primarily chose to tackle Precarity as their primary issue.

#### 4.2.2 Results

In the following section we define the different categories as well as provide examples of papers that fit the criteria.

##### **Papers tackling the issue of internet access with respect to Parity**

For this section, only papers that had a *primary* focus on tackling the issue of internet access were accepted. For example, the paper by Foko et al [14] satisfies this condition as their paper was framed around tackling the problems that rural areas in South Africa have in terms of accessibility to the internet. To combat this, they deployed standalone ICT systems across the rural areas in South Africa.

##### **Papers tackling the issue of homelessness and employment with respect to Parity**

For this section, only papers that had a *primary* focus on tackling the issue of homelessness and employment. For example, the paper by Paiva et al [30] satisfies this condition as their paper was framed around the issues that the homeless that Portugal have. In particular, they discuss the issues that the homeless have in procuring housing and how that affects their ability to get employment and regain their standing within society. To tackle this issue, they developed a web-based management system that worked on either computers or smartphones for the homeless to categorise what they needed

the most help with. For example, the system could flag up problems that the participants could have with regards to issues like housing, cleanliness, medicine and more.

The paper distribution can be seen in figure 5. In total, there were 5 papers which were tackling the issue of Parity, with 2 papers specifically tackling the issue of accessibility to the internet, 1 paper discussing the problem of homelessness and 2 talking about monetary issues within the context of parity.

Row Labels	Count of Precarity
Access to internet	2
Homelessness + employment	1
Monetary issues	2
(blank)	
<b>Grand Total</b>	<b>5</b>

Figure 5: A table representing the total precarity from all the analysed papers.

### 4.3 RQ2: What are the different methods researchers have used to tackle the issue of Well-being for creating an inclusive digital society?

To evaluate the research question, we identified the framing of the paper, identifying keywords such as ‘the goal of this paper is’ or ‘the purpose of this study is’ to identify what the goal of their paper was. Furthermore, we looked at the framing of the paper and in particular identified the motivation for their paper. For example, the paper by Sin et al [34] satisfies this condition as they discuss how the elderly (as a demographic) are excluded in terms of mobile design leads them to feeling socially isolated and makes them feel reliant on other to complete tasks such as managing their bank account through mobile banking since they do not have a support network to help them through any technical problems they may have. Thus they used an intervention by developing a communication app that would allow them to talk to others and decrease the feeling of loneliness and social isolation.

Overall, we identified categories for Well-Being which can be seen in Figure 6 and the categories were:

- Communication.
- Empathy.
- Independence.

- Loneliness.
- Safety.

For this section, there was only one individual paper for each theme. we will briefly discuss each theme and why they were kept separate here and not combined. For example, the theme of ‘independence’ and ‘loneliness’ were quite similar in terms motivation. As mentioned above, the paper by Sin et al [34] has the elderly as the primary demographic and discusses how they are typically excluded from the digital world leaving them socially excluded. This framing is very similar to the paper by Vidal [36] and they also use the elderly as their demographic. However, in the paper by Vidal, their focus is on their ability to be independent users within the digital community, whereas the paper by Sin et al focuses more on the feeling of how they felt lonely and socially excluded, which lead to different approaches. Where Sin et al prioritised creating an app as a tool for them to improve their feeling of social inclusion and connectedness, Flavia focus on giving them digital freedom and teaching the elderly on a free course how to effectively use computers.

There were a total of 5 papers which tackled the issue of well-being within the digital society.

<b>Row Labels</b>	<b>Count of Well-Being</b>
Communication	1
Empathy	1
Independence	1
Loneliness	1
Safety	1
(blank)	
<b>Grand Total</b>	<b>5</b>

Figure 6: A table representing the total Well-Being from all the analysed papers.

#### 4.4 RQ3: What are the different methods researchers have used to tackle the issue of Civic Participation for creating an inclusive digital society?

To evaluate the research question, we identified the framing of the paper, identifying keywords such as ‘the goal of this paper is’ or ‘the purpose of this study is’ to identify what the goal of their paper was. Furthermore, we looked at the framing of the paper and in particular identified the motivation for their paper. For example, the paper by Liu, Bacon and Wilson-Hinds satisfies this as their paper is motivated by the problems that the visually impaired have in terms of navigation. In particular, going to new places or using computers to do things such as ordering train tickets or getting a timetable for all the buses. In essence, they have many different tasks they may need to do across a number of different environments and although some tools exist for some of those difficulties, it is often across a number of different systems and can be sometimes difficult to access. Thus this paper instead proposes a tool that they could use which a tactile button-based system which changes the tools for the type of support someone needs as well as for the different environment that they are in.

From the analysis, we identified 6 main categories for Civic Participation which can be seen in Figure 7. The categories are:

- Access to banking.
- Access to education.
- Access to employment.
- Access to transport.
- Assistance with work tasks.
- Engagement with the local community.

##### 4.4.1 Results

In this section we will discuss the results. For the categories that have multiple papers in them, we will discuss examples and why they fit that particular category.

**Papers tackling the issue of accessibility to education with respect to Civic Participation.** Papers were placed in this category primarily if they addressed the problem of accessibility to education under the context of assisting people to effectively participate within society. For example, the paper by Abosi, Emereole and Adjepon-Yamoah [1] satisfy this as their paper explores the difficulties that the deaf suffer in trying to communicate with others in Ghana. The issues they have in terms of communication means that often deaf people can end up being illiterate or struggle in education. To tackle this problem, the researchers intervened by creating a speech-to-text interface to transcript

speech. Additionally, this system comes with a Ghanaian sign language system to improve sign language literacy allowing for two-way communication between the abled and the deaf, allowing them to better participate within society.

**Papers tackling the issue of requiring assistance for their work tasks**

Papers were placed in this category primarily if they addressed the issues that people may have in their workplace. For example, the paper by Aziz et al [4] satisfies as this paper is motivated by the issues that those with physical disabilities have in creative spaces. In particular, those that have a problem in their work of creating graphical assets which is typically motor intensive. By this, we mean that these tools are typically physically demanding and assume that people will be able to physically to a keyboard and mouse. Thus, the researchers intervene by creating a series of applications that take a users voice as input, giving them control. For example some of the functionality allowed participants to move images, resize them or even rotate them with just their voice. This allows those with physical impairments to continue to effectively complete their work, thus including them within society.

In total, there were 13 papers which had a focus towards Civic Participation with 7 of them focusing on improving access to education.

Row Labels	Count of Civic Participation
Access to banking	1
Access to education	7
Access to employment	1
Access to transport	1
Assistance with work tasks	2
Engagement with the local community	1
(blank)	
<b>Grand Total</b>	<b>13</b>

Figure 7: A table representing the total well-being from all the analysed papers.

**4.5 RQ4: Are there any differences in the methods used between the Global North and the Global South in tackling these issues?**

From the 20 papers total, there were 10 papers that were from the global north and 10 from the global south. In Figure 8 we see a breakdown of the demographic choice for the studies with respect to the Global North and Global South. There are no real predominant focus in either papers from the Global North or the Global South.

Demographic	Total
<b>North</b>	<b>10</b>
Children	1
Disability	3
Elderly	1
Homeless people	1
Local neighbourhoods	1
Multiple (education)	1
People at risk	1
Students	1
<b>South</b>	<b>10</b>
Adults	1
Disability	3
Elderly	1
Everyone	2
Multiple	1
Students	2
<b>Grand Total</b>	<b>20</b>

Figure 8: A table comparing The Global North and the Global South by Demographic Choice



Figure 9 shows a breakdown of the intervention tools used with respect to the Global North and Global South. Within this category, we find that there is no clear distinction between the north or the south. However, we do note that in both the North and South, they often use mobile devices such as smart tablets or smartphones. If they are not using those, then they will also use computers. If we were to combine the categories that included either a computer or mobile device, then that accounts for a total of 7 out of 10 papers within the Global North and 6 papers out of 10 for the Global South, suggesting that those tools are the intervention tool of choice regardless of if they are in the North or the South.

Intervention Tool	Total
<b>North</b>	<b>10</b>
Mobile devices	2
Multiple ICT Tools	1
Multiple tools	1
PC	2
PC or Mobile devices	2
Projection system	1
Remote Digital Installation	1
<b>South</b>	<b>10</b>
ICT Tools (not specified)	1
Mobile devices	2
Multiple ICT Tools	1
N/A	1
PC	3
Survey	2
<b>Grand Total</b>	<b>20</b>

Figure 9: A table comparing The Global North and the Global South by choice of Intervention Tool

Figure 10 shows a breakdown of the intervention approach used with respect to the Global North and the Global South. In both cases, the preferred method of approach appears to be the use of Software deployment. However, this appears to be a more prominent method in the Global North compared to the Global South, appear to use more varied methods.

Figure 11 shows a breakdown of papers tackling the issues of precarity with respect to the Global North and the Global South. We find that in the Global North, the tackle the issue in terms of internet access and homelessness whereas the Global South also tackle internet accessibility, but also address issues pertaining to income.

Figure 12 shows a breakdown of papers tackling the issues of well-being with respect to the Global North and the Global South. In terms of Well-being, the Global North tackle on the issues concerning loneliness and safety, whereas the Global South tackle the issues of communication, empathy and independence.

Intervention Approach	Total
<b>North</b>	<b>10</b>
Delivering remote resources	1
Deployment in specific areas	1
Evaluation of case studies	1
Software deployment	5
Survey + interview	1
Traditional user study	1
<b>South</b>	<b>10</b>
Deployment in specific areas	1
Evaluation of case studies	1
Interviews	1
Presentation	1
Software deployment	3
Survey	1
Teaching	1
Traditional user study	1
<b>Grand Total</b>	<b>20</b>

Figure 10: A table comparing The Global North and the Global South by choice of Intervention Approach

Precarity	Total
<b>North</b>	<b>10</b>
Access to internet	1
Homelessness + employment	1
(blank)	8
<b>South</b>	<b>10</b>
Access to internet	1
Monetary issues	2
(blank)	7
<b>Grand Total</b>	<b>20</b>

Figure 11: A table comparing The Global North and the Global South by Precarity

Well-Being	Total
<b>North</b>	<b>10</b>
Loneliness	1
Safety	1
(blank)	8
<b>South</b>	<b>10</b>
Communication	1
Empathy	1
Independence	1
(blank)	7
<b>Grand Total</b>	<b>20</b>

Figure 12: A table comparing The Global North and the Global South by Well-Being

Figure 13 shows a breakdown of papers tackling the issues of civic participation with respect to the Global North and the Global South. In both the Global North and Global South, they have an interest in tackling issues pertaining to education. It then differs from there, namely the Global North tackles issues in terms of having assistive technologies to help people with their work, or to help people with disabilities (e.g. blind people) navigate the world and be more independent. The Global South focuses on improving peoples access to banking or their access to employment.

For the Global North, there was more of a vested interest in Civic Participation at 60% of papers addressing this issue. Then both Well-being and Precarity were at 20% each. For the Global South, Civic Participation was also the category with the majority at 40% of all total papers. Then both Well-being and Precarity had an even split of papers at 30% each.

## 5 Discussions

The aim of this review was to understand how current research has used technological interventions to create a more inclusive digital society through the lens of *Precarity, Well-being and Civic Participation*. Furthermore, we explore if there are any differences in the approaches between those in the Global North and those in the Global South.

Civic Participation	Total
<b>North</b>	<b>10</b>
Access to education	3
Access to transport	1
Assistance with work tasks	2
Engagement with the local community	1
(blank)	3
<b>South</b>	<b>10</b>
Access to banking	1
Access to education	4
Access to employment	1
(blank)	4
<b>Grand Total</b>	<b>20</b>

Figure 13: A table comparing The Global North and the Global South by Civic Participation

The format will be as follows, a brief discussion on any particular findings in each research question, followed by any interesting noteworthy findings after comparing with respect to the Global North and Global South. Following that, we will discuss these findings in within the context of all the other factors.

### 5.1 RQ1: What are the different methods researchers have used to tackle the issue of Precarity for creating an inclusive digital society?

Our results show that 25% of all papers address issues pertaining to Precarity. Specifically, 40% of papers within this category address the difference in terms of accessibility to the internet. Another 40% address problems pertaining to primarily monetary issues. Finally, the last 20% address the issue of homelessness. Additionally, when determining the differences between the Global North and South, the only notable difference is that the North chose to address the problem of homelessness, whereas the South wished to address the problem of money (e.g income to get access to digital devices).

### 5.2 RQ2: What are the different methods researchers have used to tackle the issue of Well-being for creating an inclusive digital society?

Our results found that 25% of all papers address issues pertaining to Well-Being. Within this category, there was no predominant theme appearing here. The papers were distinct enough that they were not grouped and there was in fact a category for each theme that was found within the category. In terms of differences between the Global North and South, the South had 3 separate papers that were addressing Well-being as a primary issues worth address, whereas the

North had 2 papers addressing this.

### **5.3 RQ3: What are the different methods researchers have used to tackle the issue of Civic Participation for creating an inclusive digital society?**

Our results found that 50% of all papers addressed issues pertaining to Civic Participation. Within this category, there was a clear focus on education being a priority with over 50% of papers within this category addressing this issue. When splitting this category into papers from the Global North and the Global South, we found that both the North and South put a focus on addressing accessibility to education. For the South, this accounted for 66% of papers, suggesting a clear focus on improving education. For the North, this accounted for 43%.

### **5.4 The intersectionality between Precarity, Well-Being, and Civic Participation**

In this section, we will discuss the intersectionality of the topics that we have tried to separate into discreet, mutually exclusive topics which no overlap. The reality in some ways is that they are often interlinked. A good example of this is the paper by Foko et al [14] which looked to improve the access to the internet for those who were living in the rural parts of South Africa, which we identified as being a problem which was motivated by solving an issue pertaining to the area of precarity. What they found as a result of their intervention was that people who interacted with their ICT deployables were beginning to engage more with the digital society by getting access to educational content with reading or educational games as the children would often do. As for the adults, they found that they were using the ICT tools to print CVs to help in finding employment and more. In the attempt to solve an issue of precarity, it affected the amount in which they engaged with society. Additionally, they noted that over a longer period people would often find themselves happier and connecting more and in some ways, developing a social network in a physical sense (i.e., engaging with their local community) and also digitally (connecting and talking to distant family members using the internet).

Another example of this intersectionality appearing occurs in the paper by Hayashi et al [16] where they explore the experiences that who are deaf, blind, low vision or low literacy have when it comes to using self-service kiosks. Their primary objective is to improve the experience of these demographics when it comes to having to use these automated systems that are become more prevalent in society. In terms of the content analysis approach, this was their primary motivation which meant that this paper fits in the category of Civic Participation. For their intervention approach they had participants split into groups with at least one person with a disability (e.g. blind) with an able-bodied person and they had to create a presentation of their experiences and suggestions

they would make to improve the current systems for kiosks in this participatory workshop. What they had found as a result of this process, the people with their disabilities were able to feel seen as a person and their experiences, which would aptly fit when discussing their mental well-being.

## 5.5 Limitations

It's worth mentioning that as a result of employing the PRISMA strategy, there was a significant number of papers that did not fit within the scope. In particular, there were numerous papers that were exploring these issues from a theoretical framework perspective. Since this was the case, there were not many papers overall that were included within the review. Thus, one limitation of this review is that what we have found is not conclusive. A more exhaustive version of this review would be required to draw more explicit conclusions. This conclusions based on these results more suggest potential trends that may persist within the research.

## 6 Conclusion

To conclude, this report has presented a literature review to gain insight into the current trends in research towards creating a more inclusive digital society through the lens of Precarity, Well-Being and Civic Participation. In additional these factors were explored and categorised into interventions that occurred in the Global North and the Global South. To do this, we employed a PRISMA strategy to answer the following research questions which were:

- **RQ1:** What are the different methods researchers have used to tackle the issue of Precarity for creating an inclusive digital society?
- **RQ2:** What are the different methods researchers have used to tackle the issue of Well-being for creating an inclusive digital society?
- **RQ3:** What are the different methods researchers have used to tackle the issue of Civic Participation for creating an inclusive digital society?
- **RQ4:** Are there any differences in the methods used between the Global North and the Global South in tackling these issues?

From this process we found that of all the categories, both the Global South and Global North are particularly interested in getting all groups of people involved as active members of society; namely they place a large importance on civic participation and in particular there is a focus on improving access to education with the intention of getting them to integrate with the current digital society. Furthermore, interventions largely use mobile devices such as smart phones or computers to reach all groups of people. Speaking of demographics, there was a significant interest in people who had disabilities. The final

observation was that despite the clear motivation for a single aspect (e.g. Precarity, Well-Being or Civic Engagement), it often ended up being intersectional in its effect. Papers tackling one problem would often improve another as we discussed above in the Discussions section.

Finally, for future research, we recommend that (1) future research explores digital inclusivity outside of the people who have disabilities, (2) To research in more detail the relationships that Civic Participation, Well-Being and Precarity have in the context of inclusive digital societies and (3) that future researchers and developers think about how to tackle these 3 issues in cohesion when creating and developing new interventions.

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# Appendices

Here in the Appendix, we will provide all the papers that were used in the review. It shall be presented in the following format: Title of the Paper, Citation Link and then their abstract.

## Survey Papers

### **Information and communication technology platforms deployment: Technology access reaches South African rural areas**

**Abstract:** The purpose of this paper is to ascertain how robust ICT Platforms can provide rural communities with access and use of ICTs. The Platform contributes to the creating of an inclusive information society and a thriving knowledge economy in South Africa. One government (Department) utilised ICT Platforms as instruments for achieving their mandate of providing quality ICT infrastructure and to facilitate establishment of rural enterprise and industries. From 2014-2016 the Department partnered with CSIR, as their implementation partner, to roll out the solar-powered ICT Platform to 14 sites in seven South African provinces where rich data was gathered. This research is underpinned by the notion of ICT for development. Qualitative approaches for data collection which included face-to-face interviews, observations, telephonic and questionnaires were used. The results show that successful deployment of ICT Platforms need involvement of all stakeholders including community leaders, trained champions and users of technology. [14]

**Citation:** <https://ieeexplore.ieee.org/document/8102300>

### **Bridging Digital Divides through Digital Media Buses: An Action Research Study on Digital Inclusion in Sweden**

**Abstract:** The purpose of this paper is to ascertain how robust ICT Platforms can provide rural communities with access and use of ICTs. The Platform contributes to the creating of an inclusive information society and a thriving knowledge economy in South Africa. One government (Department) utilised ICT Platforms as instruments for achieving their mandate of providing quality ICT infrastructure and to facilitate establishment of rural enterprise and industries. From 2014-2016 the Department partnered with CSIR, as their implementation partner, to roll out the solar-powered ICT Platform to 14 sites in seven South African provinces where rich data was gathered. This research is underpinned by the notion of ICT for development. Qualitative approaches for data collection which included face-to-face interviews, observations, telephonic

and questionnaires were used. The results show that successful deployment of ICT Platforms need involvement of all stakeholders including community leaders, trained champions and users of technology.[37]

**Citation:** <https://ieeexplore.ieee.org/document/8046291>

## Digital Literacy Program: Reducing the Digital Gap of the Elderly: Experiences and Lessons Learned

**Abstract:** Digital Literacy is a program aimed at the elderly that allows reducing the digital gap by providing new opportunities for coexistence and interaction in today's world. During 2017 and 2018, 1200 participants have received significant achievements. We believe that the main contribution of this work is to show the structure of our program which can be replicated in various universities that want to give a contribution to their society oriented to the older adults.[36]

**Citation:** <https://ieeexplore.ieee.org/document/8971415>

## Inclusive storytelling workshop Universal usability for technology in self-service kiosks

**Abstract:** As stated by the Brazilian Computer Society, the 'participative and universal access to knowledge' is one of the grand challenges in computer science research. In this work we describe our attempt to address this challenge of designing automated digital solutions in the environment of a public agency of an electric energy utility company. The potential users include the blind, deaf, low vision, low literate, elderly, young, and digital experts or not. The main contribution of this paper is the proposal of a participatory practice that anticipates the communication problems that might occur when this diversity of users are gathered to interact collaboratively in a same activity. We point out the lessons learned from this experience, which might guide other practitioners and designers.[16]

**Citation:** <https://ieeexplore.ieee.org/document/7180494>

## ICTs for Education: An Inclusive Approach to Addressing Challenges Faced by Roma Communities in Europe

**Abstract:** Despite the fact that education is a basic human right, children and youth from marginalized communities often, lack access to quality education programs. Applying ICTs as a tool to education, rather than the solution, has

great potential to narrow existing education gaps, while conveying skills and competences necessary for economic and social survival in today's connected and digitalized societies. Roma are Europe's largest ethnic minority group, and despite multiple efforts to improve the living conditions of Roma people, the majority of Roma households continues to live in deep poverty, is subject to social exclusion and discrimination. Moreover, four out of five students from Roma communities, lack basic cognitive skills and competences. This paper introduces the Head in the Clouds Project (HIC), an innovative learning program based on self-organized learning environments, the use of state of the art IT devices and the innovative learning approach MINIMAX while shedding light on the use of ICTs in marginalized communities. Particularly it discusses potential long-term impacts of ICT enabled self-organized learning environments on creating more inclusive educational programs and societies, and the potential contribution of inclusive and IT supported learning environments towards the achievement of the United Nations Sustainable Development Goals (SDGs).[29]

**Citation:** <https://ieeexplore.ieee.org/document/8757108>

## Inclusive Design of Digital Banking with Voice User Interface: A Study Based on Indonesia's Population

**Abstract:** The financial industry has been disrupted by digital transformation. Nowadays, most banks have provided digital banking services to their customers. However, the current issue shows that not all groups of the society in Indonesia can easily access banking services, such as people with disabilities, especially visually impaired people as the largest percentage of people with disabilities in Indonesia. They often face difficulties and discrimination when registering bank accounts. Moreover, existing digital banking has low accessibility for visually impaired people. This study aimed to improve the interaction design of digital banking with inclusive design so it could be used as inclusive as possible. User research was conducted to understand users' needs and problems through questionnaires and interviews. Then, a prototype that is equipped with a voice user interface (VUI) was developed and evaluated with three visually impaired and two sighted people. The evaluation was measured through the System Usability Scale (SUS), Single Ease Question (SEQ), and an additional five-point scale questionnaire. The empirical result showed that the prototype has achieved usability and user experience goals: effective to use with 100% completion rate, easy to learn with 96.3% score, helpful with 96% score, and satisfying with 88% SUS score, both for visually impaired and sighted users. [28] **Citation:** <https://ieeexplore.ieee.org/document/9970807>

## Scratch4All Project - Educate for an All-inclusive Digital Society

**Abstract:** Computational thinking is a fundamental competence for the 21st century. It refers to a set of capacities and skills that can be stimulated to facilitate the teaching-learning process in a wide range of fields, including Science, Technology, Engineering and Mathematics (STEM). Experts in information technology argue that the earlier children are exposed to programming through digital platforms appropriate for their age, the easier it will be for them to assimilate their concepts in the future. This effort should be continued throughout the educational stages of children and youth to increase students' interest in pursuing STEM studies and careers. This paper describes the Scratch4All project promoted by the consortium CASPAE (a Private Social Solidarity Institution) and Inova-Ria, with technical assistance from professors at the public higher education institution Coimbra Institute of Engineering. Scratch4All Project includes the activities Scratch on Road, Programming and Robotics Lab, and the Scratch4All Digital Platform. According to the impact assessment for the school year 2020-2021, the Scratch4All project promotes school success and true equality in access to new technologies for students in the 1st, 2nd, and 3rd cycles of elementary school, developing essential skills for their academic and professional future such as computational thinking, STEM competencies and social skills. By encouraging young girls to participate in technological projects, this project also aims to combat gender stereotypes. [35]

**Citation:** <https://ieeexplore.ieee.org/document/10182189>

## A technological framework for self-management of a homeless people institution

**Abstract:** In this paper we present a case study of the development of a technological framework to promote and enhance the self-management of a homeless people institution. This work has been developed by students of a bachelor's degree, included in the Inclusive School Project of the High School of Technology and Management of the Viana do Castelo Polytechnic Institute. This paper has two main contributions: the ICT tools adoption to the digital modernization of the society and the role academic community play in social responsibility. We present the solution architecture as well as the final prototype developed. [30]

**Citation:** <https://ieeexplore.ieee.org/document/8399446>

## Digital Divide Strategy Based-on ICT Services Model

**Abstract:** The Knowledge Society influenced by ICT modifies economic, political, cultural and social concepts allowing access to other levels of well-being

and progress. However, the existing differences in terms of access and use of ICTs between different groups in society have generated a problem of digital divide. In order to overcome this problem, models and strategies are required to achieve a greater impact on the population that develops competencies that favor their inclusion in this society. This article proposes a strategy to reduce the digital divide based on a ICT-services model that aims to establish a basis for promoting Aguascalientes towards a knowledge society by bringing society closer to new information technologies and transferring to them in a practical way the knowledge that will enable them to be more competitive in today's world and thus shorten the digital divide. [25]

**Citation:** <https://ieeexplore.ieee.org/document/8971405>

## **Analysis of technology-mediated pedagogies: Experiences from a BYOD initiative in New Zealand**

**Abstract:** A longitudinal study was conducted in a New Zealand secondary school to investigate the immediate and longer-term challenges and opportunities of a technology-supported learning initiative. A 'bring your own device' (BYOD) initiative called for a stronger connect with digital technology in formal educational settings in 2012. This was indeed much ahead of its time, as now evident from worldwide move towards digital education in the aftermath of the COVID-19 pandemic. In this study, we tracked transformations within learning and teaching for over five years. At the inception of the idea, there was much resistance from parents and other stakeholders; however, the BYOD initiative ultimately showcased a very successful example of technology-supported teaching and learning initiative for other New Zealand schools. Our investigation primarily focused on one of the critical indicators for the success of such an initiative, the digital divide. The digital divide is particularly important because of the level of attention and dialogue this BYOD topic gathered across New Zealand. Initial discourses (over newspapers, radio and television) suggested that this initiative would be damaging in view of existing digital divides across societies and the overall public opinion outweighed the potential positives from such an initiative. As part of our five-year study, we investigated some of the key concerns around the digital divide issue in the context of such a technology-supported learning initiative. One of the key enablers of this study was integration of two frameworks, to enable the cross-examination of relationships between various sources of social cognitive abilities related to an individual's information literacy, motivational and behavioral aspects. That is, how skill development, knowledge acquisition, and changes in personal and behavioral aspects impact self-efficacy levels as a consequence of BYOD strategies. The resulting framework is especially relevant in post-COVID-19 times, since technology-driven remote education delivery formats are now being touted as the new norm. Our framework will therefore provide much value to policy-makers in establishing inclusive educational policies. [2]

**Citation:** <https://ieeexplore.ieee.org/document/9718393>

## On Smart-Care Services: Studies of Visually Impaired Users in Living Contexts

**Abstract:** Smart care technology is any sensor based technology used to aid and support human independent living. Such technologies offer new potential and can give rise to new problems for making the technology accessible to users. In this work we focus on integrated services for people with visual impairment. Web based information services have already been adapted for people with varying degrees of disability. What is needed now is a service oriented architecture that integrates information services with smart care technology such as sensor devices that generate data for input, processing, storage and query. The main new challenge we identified here is that users may be living in a perplexing contexture - a chain of barriers affecting their ability to live independently. Contexts such as mobility dependencies must therefore be recorded and used, indoors and outside. Users should be monitored during their interactions with services, and the meaning of their behaviour inferred in order to refine the services. Moreover, by giving a set of user scenarios, we present a higher level view of users' needs than single service invocation; alternatives and follow-on services might be suggested and previous interactions built upon. Management of the architecture must allow for incorporation of new technology and upgrade of services. Technology for smart care is developing rapidly; its usefulness, and acceptance, requires a dynamic and flexible architecture to support ease of management and use. [24]

**Citation:** <https://ieeexplore.ieee.org/document/4063793>

## Intelligent Learning Systems for Inclusive Education in Ghana: Towards an Effective Engagement with Hard of Hearing Students

**Abstract:** This research attempts to address some challenges faced when facilitating an inclusive classroom experience for Deaf/Hard of Hearing students (D/HH) in Ghanaian schools and universities by proposing an intelligent learning system. Hence, this research contributes an Intelligent and Inclusive Learning System (IILS) with two main components: signWithMe subsystem and audio-visual transcription system (AVTS) subsystem. The signWithMe subsystem presents a Ghanaian sign language learning management system (LMS) that is motivated by the limited sign language literacy in Ghana. This subsystem consists of a sign language dictionary, an E-resource, an E-forum, and an E-payment system. It supports inclusive learning of the Ghanaian sign language for both Deaf and Non-Deaf students to interact with the system. This ensures improved diversity and inclusion in our Ghanaian society. Also, the



AVTS focuses on improving the teaching and learning experience of Deaf students in Ghanaian schools. The AVTS contributes a novel artificial intelligence approach that uses a counter-checking of Google speech-to-text and lip-reading-to-text transcriptions of the Ghanaian sign language in inclusive university lectures. These two subsystems provide services in line with the mandate of the tenth and fourth Sustainable Development Goal (S.D.G.) of “Reduced Inequality” and “Quality Education” respectively. Finally, the IILS was analysed per the two main components (i.e., signWithMe and AVTS) and are considered to have high level of usability by 20 Deaf and 5 Non-Deaf users. [1]

**Citation:** <https://ieeexplore.ieee.org/document/10079372>

## Good Practices in Usability Testing on People with Disabilities

**Abstract:** It is common that in the development of software the usability tests are not carried out contemplating users with disabilities, even if these products are oriented to this population. The usability evaluates the ease with which a user can interact with an interface, which is why applying usability tests to the tools developed allows us to improve the usability. Includetec is a group that focuses on the development of software-based inclusive technologies. For this reason, usability tests are designed and executed in digital products, establishing specific characteristics and requirements based on the disability conditions of the test subjects and the environment where they are carried out. This article presents the adaptations that were applied to usability tests that are usually used when validating a tool considering people with disabilities as main users. Based on the experiences obtained when applying these tests to people with visual, motor and hearing disabilities, it was possible to document essential elements to be considered based on the disability presented by the user. [12]

**Citation:** <https://ieeexplore.ieee.org/document/8971432>

## ClassRoute: Bridging the Digital Academic-Content Divide

**Abstract:** Information Communication Technology (ICT) has revolutionized almost every sphere of life by enhancing access to information anytime and anywhere. However, there still exists digital inequalities both between and within countries. This digital divide is not merely physical access to ICT but also access and usage of information (such as educational content) generated by ICT, which is often limited due to language and geographic location. This possesses a major obstacle to education of pupils who lack access to quality study materials in their mother tongue language. Addressing this threat, ‘ClassRoute’ - a multi-language educational community learning platform and content generator - is proposed to disseminate quality educational content to the most disadvantaged

pupils in India. The novelty of ClassRoute is its focus on a mother-tongue based community learning where the multilingual content generation is achieved using ML/NLP models for channeling/utilizing existing online translation tools and APIs on freely available as well as new educational videos, and then improving the results for translation quality, grammar, and cultural relevance. ClassRoute aims to ensure inclusive quality education that promotes lifelong learning opportunities for all by mitigating these issues. This paper discusses ClassRoute's architecture and experiments, and its potential to bridge the gap of the digital academic-content divide in the Indian subcontinent, which faces a serious digital divide due to income, gender, race, age, and language. [33]

**Citation:** <https://ieeexplore.ieee.org/document/9638822>

## **Towards the implementation of an internet-based neighbourhood watch scheme-Impacts of inclusive technologies on societies**

**Abstract:** In this paper we discuss the current state of our work regarding the development and planned in-situ testing of a computer-based system to enhance community relations through the Neighbourhood Watch scheme. The system is intended for use in a community to help the residents interact with each other more easily and to encourage the reporting of suspicious behaviour or crime. We discuss some details of the system and how we plan to test it in the field using an iterative process. We also discuss the possible implications of the work for the future. [3]

**Citation:** <https://ieeexplore.ieee.org/document/6085913>

## **The role of the use of digital information in the performance and collaboration of university students in extreme economic situation**

**Abstract:** The purpose of this study was to test the relationship between the use of digital information in the performance and collaboration of university students, in extreme economic situation in Peru in a public university, the study makes an approach to different factors related to information management and its relationship with student satisfaction and loyalty, through the Household Targeting System (SISFOH) of the Ministry of Education (MINEDU), which qualifies university students as poor and / or in extreme poverty, to be benefited by the mobile internet access service program in 3G and 4G. The study comprises two phases, firstly, an exploratory factor analysis using IBM-SPSS, secondly, for confirmatory analysis, The PLS-SEM methodology, Modeling of Structural Equations with Partial Least Squares, was used. The model was validated with a sample of 233 students at a public university. The study would

reveal a causal relationship of the different factors of the structural model, based on the different behaviors of digital information that university students experience in times of quarantine as a preventive measure to avoid contagion by Covid-19. [15]

**Citation:** <https://ieeexplore.ieee.org/document/9707123>

## Promoting Inclusive Work with Digital Assistance Systems: Experiences of Cognitively Disabled Workers with In-Situ Assembly Support

**Abstract:** Digital work assistance systems have the potential to promote inclusive work by supporting people with disabilities to carry out manual work processes independently, thereby contributing to a greater degree of personal autonomy. However, the question arises whether people with cognitive disabilities would accept digital assistance systems in the professional environment. In this paper, we present a user study with workers with intellectual and mental disabilities from a sheltered workshop organization to investigate their experiences using projection-based assembly assistance systems. Our results show that people with cognitive disabilities generally have positive experiences using projection-based assistance systems to carry out manual assembly processes. Furthermore, the participants showed a positive emotional connection to the assistance system and reported no to low health symptoms while using the system. [18]

**Citation:** <https://ieeexplore.ieee.org/document/9910994>

## Digital Design Marginalization: New Perspectives on Designing Inclusive Interfaces

**Abstract:** We conceptualize Digital Design Marginalization (DDM) as the process in which a digital interface design excludes certain users and contributes to marginalization in other areas of their lives. Due to non-inclusive designs, many underrepresented users face barriers in accessing essential services that are moving increasingly, sometimes exclusively, online – services such as personal finance, healthcare, social connectivity, and shopping. This can further perpetuate the “digital divide,” a technology-based form of social inequality that has offline consequences. We introduce the term Marginalizing Design to describe designs that contribute to DDM. In this paper, we focus on the impact of Marginalizing Design on older adults through examples from our research and discussions of services that may have marginalizing designs for older adults. Our aim is to provide a conceptual lens for designers, service providers, and policy makers through which they can use to purposely lessen or avoid digitally marginalizing groups of users. [34]

**Citation:** <https://dl.acm.org/doi/10.1145/3411764.3445180>

## Voice Snapping: Inclusive Speech Interaction Techniques for Creative Object Manipulation

**Abstract:** Voice input holds significant potential to support people with physical impairments in producing creative visual design outputs, although it is unclear whether well-established interaction methods used for manipulating graphical assets within mainstream creative applications (typically operated via a mouse, keyboard, or touch input) also present benefits for speech interaction. We present three new voice controlled approaches utilizing interface snapping techniques for manipulating a graphical object's dimensions: NoSnap, UserSnap, and AutoSnap. A user evaluation with people who have physical impairments (N=25) found that each method enabled participants to successfully control a graphical object's size across a series of design tasks, although the automated snapping approach utilized within AutoSnap was found to be more efficient, accurate, and usable. Subjective feedback from participants also highlighted a strong preference for AutoSnap over the other techniques in terms of efficiency and ease of use. [4]

**Citation:** <https://dl.acm.org/doi/10.1145/3532106.3533452>

## An Audit of Inclusive ICTs for Education in Uganda

**Abstract:** But, for a disabled learner, use of ICTs particularly that adapted to their abilities acts as a sort of extension of their physical body part and provides an opportunity to communicate, participate more meaningfully in learning activities and become gainfully employed. For PwDs to use ICTs and ICT enabled services, they need appropriate Assistive Technologies. Therefore, mainstream ICTs and ICT enabled services must be adapted to work with assistive technologies. The adapted ICTs are commonly called inclusive ICTs. In Uganda, the status of provision and support for use of inclusive ICTs in general and in the education of PwDs in particular, is not known. A few studies have reported low level accessibility of ICT and ICT enabled services for PwDs but at a general level. Therefore, more effort is needed not only to report the status but also to address the gaps. Relevant policies such as the 2011 Draft<sup>1</sup> Special Needs and Inclusive Education policy, the Uganda National ICT policy, the Rural Communication Development Fund (RCDF) and the Government of Uganda Website Standards are all silent about making ICTs accessible in general and in the education for PwDs in particular.

This paper reports results of an audit of inclusive ICTs for education of PwDs in Uganda. The study was an implementation of the first phase of the UNESCO policy on inclusive ICTs in education for PwDs in Uganda. The aim of the study was to audit current actions in Uganda on use of inclusive ICTs in education for PwDs and provide recommendations on actions needed to increase use of inclusive ICTs for education of PwDs. Due to time, and resource constraints, and the interest of the sponsor, the scope of disabilities covered in the study was limited to visual and hearing impairments. [5]

**Citation:** <https://dl.acm.org/doi/10.1145/3047273.3047339>