127 (2025) 202662

Contents lists available at ScienceDirect

Research in Autism

journal homepage: www.elsevier.com/locate/rasd

Bridging the gap: Exploring the potential of virtual reality for supporting autistic individuals in interview and recruitment processes through a realist review

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ARTICLE INFO

Keywords:
Realist review
Autism
Employment
Virtual reality
Inclusivity

ABSTRACT

The aim of this realist review was to systematically analyse the peer-reviewed academic literature, reports and blogs to determine: (1) the mechanisms and contexts by which recruitment and early employment experiences lead to poor outcomes for autistic adults, and (2) how a Virtual Reality (VR) intervention might lead to positive outcomes within the recruitment and early employment experiences for autistic adults. Throughout, we worked with a PPIE group of autistic people who were fully involved in the realist synthesis process. We identified challenges across the employment journey including limited vocational guidance and employment readiness support, exclusionary job descriptions, and traditional interviews that disproportionately favour neurotypical social behaviours. These issues were further compounded by disclosure anxiety and lack of workplace adjustments. We also identified factors relevant to the development of VR scenarios: (1) the provision of tailored clear job information (2) structured interview preparation experience tailored to the role, and (3) materials to foster supportive workplace practices. Findings highlighted that holistic VR scenarios for employers and employees should include material to promote self-advocacy, build social skills, and address sensory challenges. VR scenarios would likely help autistic people practise and improve their ability to undertake job interviews and work-related tasks while promoting understanding and empathy amongst neurotypical work colleagues. Using the findings of this realist review, we considered the implications for the co-creation of a VR package that can prepare autistic individuals for

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https://doi.org/10.1016/j.reia.2025.202662
Received 10 February 2025; Received in revised form 4 June 2025; Accepted 8 July 2025
Available online 17 July 2025

employment, help educate employers and foster a more inclusive and supportive workplace environment.

1. Introduction

Autism, a neurodevelopmental condition affecting social interaction and communication, poses significant challenges to individuals navigating the employment landscape (Cowen, 2011). In the UK, 1 million autistic individuals without intellectual disabilities have social care costs reaching £ 3.1 million (Department of Work and Pensions, 2024). There is an urgency of addressing that; "autistic people face the largest pay gap of all disability groups, receiving a third less than non-disabled groups on average" (Department of Work and Pensions, 2024). In the UK, only 24 % of autistic individuals are employed, far below Sweden's 60 % (Office for National Statistics, 2020; Black et al., 2020). This perpetuates economic burdens and exacerbates mental health conditions such as anxiety and depression (Hedley et al., 2016).

Others have attempted to develop and test interventions to address the multifaceted challenges faced by autistic individuals in securing and maintaining employment. Systematic reviews highlighted the potential of interventions, including Virtual Reality (VR) job interview training, to improve autistic employment outcomes (Fong et al., 2021; Ogawa et al., 2023; Walsh et al., 2018). However, prior VR interventions often lacked the immersive experience afforded by wearable headsets (Smith et al., 2014).

In response to bridging the autistic employment gap, we aim to develop a VR package tailored to the needs of autistic individuals, facilitating job acquisition and retention. Central to this is a realist review, which goes beyond mere effectiveness assessment to elucidate the mechanisms by which interventions operate in specific contexts (Saul et al., 2013). Findings address key questions pertaining to the recruitment and employment experiences of autistic individuals (Saul et al., 2013). By analysing literature, reports, and insights from young autistic people and autistic members of our project's Public and Patient Involvement (PPI) group, we uncover underlying factors contributing to favourable or unfavourable outcomes in recruitment and early employment (Saul et al., 2013). Moreover, we investigate how tailored VR interventions enhance recruitment and early employment of autistic individuals (Saul et al.,

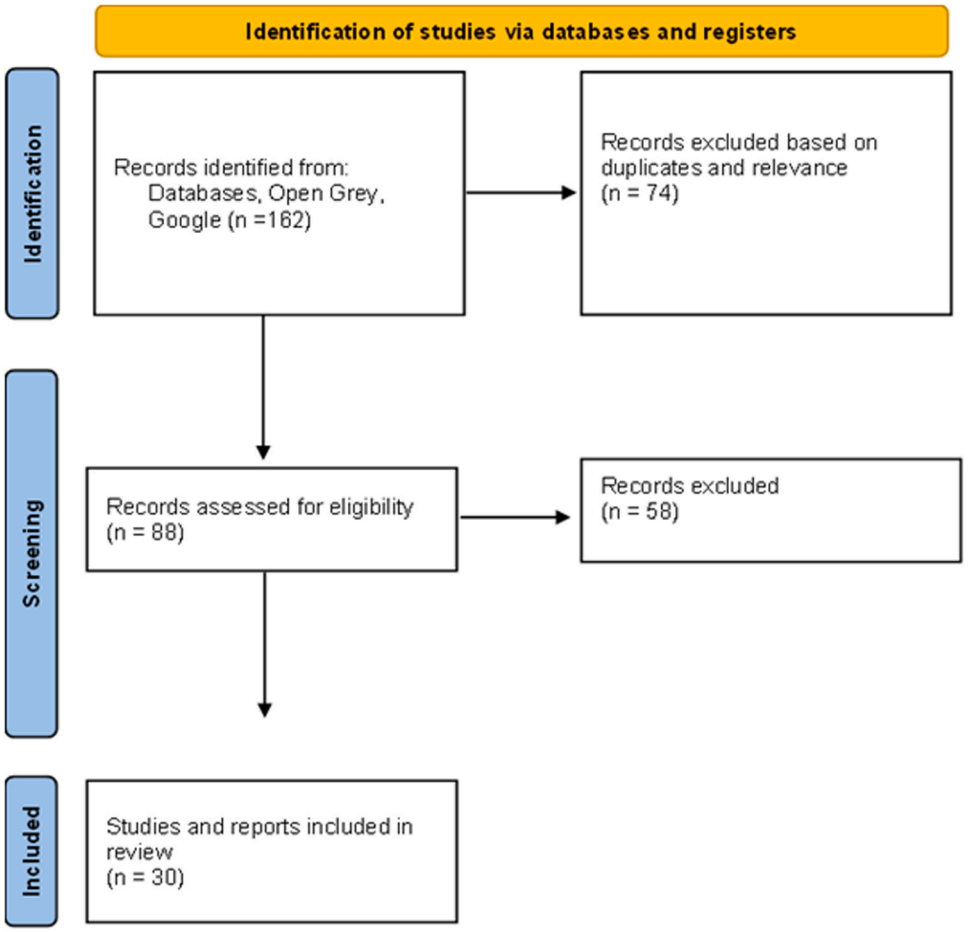

Fig. 1. Search flow diagram.

2013), aligning with national priorities of the NHS Long-Term-Plan and the national Autism Strategy 2021–2026, which seek to improve employment prospects and quality-of-life for autistic individuals. This realist review aimed to answer two questions; firstly, how do recruitment and early employment experiences lead to poor outcomes for autistic adults; by what mechanisms, and in what contexts? Secondly, how might a VR intervention lead to positive outcomes of recruitment and early employment experiences for autistic adults?

2. Methodology

2.1. Realist approach

A Rapid-Realist-Review offers a framework for synthesising evidence efficiently, within constrained timeframes, to uncover explanations for how various models of service delivery or complex interventions yield desired outcomes (Saul et al., 2013). It addresses "questions about how, why, for whom, in what contexts and to what extent health systems, programmes and/or policies function [and are] based on the premise that for any observed outcome, there are one or more causal processes (called "mechanisms") that only become active in certain contexts: Context (C) + Mechanism (M) = Outcome (O)" (Wong, G. 2018). The CMO configurations can be found in Appendix A.

By integrating evidence from diverse sources such as published academic literature, grey literature, and stakeholder perspectives including those of autistic individuals and individuals in personal or professional relationships with them, the review aims to elucidate the nuanced interplay between contextual factors, underlying mechanisms, and outcomes of early employment experiences.

2.2. Search and synthesis methods

The search terms (Autism OR neurodivergent) AND (workplace OR job OR employment OR interview OR virtual reality) AND (outcome OR barrier OR problem OR opportunity OR experience) were entered into the following databases: AMED, CENTRAL, CINAHL, PsycINFO, PubMed, Social Care Online, Open Grey and Google. Fig. 1 summarises the process and results. Studies were deemed eligible if they included content that were relevant to the two research questions and were published after 2017. This was to ensure contemporary findings. The selected 30 were subjected to 'journaling' by the review team, which involved scrutinising the article or blog to learn about the employment contexts and mechanisms that lead to certain outcomes, and to identify key themes.

2.3. PPI involvement

We received feedback from 32 young autistic people recruited through a charity that helps autistic young people into employment. Young people were a mix of males and females, 18–25 years old, from various socioeconomic backgrounds. Most were employed part time, in their first employment and most had only been in post less than 6 months. Young people were asked to provide feedback and information about their experiences when applying for jobs, going to job interviews and their early experiences within the workplace. Feedback was conducted via an online Teams call and was facilitated by a researcher (JP). Responses were recorded and transcribed.

Table 1
The 'context' 'mechanism' and 'outcomes' involved in autistic individual's experiences across the employment journey.

Stage	Context	Mechanism	Outcome
Pre-employment factors			
Employment readiness	Poor access to guidance, vocational support	Low confidence, social anxiety, uncertainty	Reduced job-seeking behaviour
Information about the job	Vague/ambiguous/ unclear job advertisements	Difficulty interpreting eligibility and fit	Fewer job application
Application process			
Disclosure and discrimination	Needs for adjustments	Stigma and discrimination	Anxiety around disclosing autism diagnosis
Preparation for the job interview	Getting to the interview and meeting interviewers	Social anxiety, uncertainty	Reduced attendance at job interviews
Job Interviews			
Conduct of job interviews	Emphasis on social performance, distraction and sensory challenges	Fear of judgement/discrimination, interpreting nuance	Difficulty understanding questions, masking, discomfort
Onboarding	Unclear expectations	Social anxiety, misreading norms	Stress, early dropout
Workplace Factors			
Employee awareness of autism and adjustments	Unawareness of needs	Burden of self-advocacy, lack of adjustments,	Disadvantages, lower retention
Supportive work environments	Fitting in in a new environment, judgment of performance	Stress, anxiety around work performance and meeting new people	Discontentment, lower retention

Data were analysed using content analysis (Erlingsson & Brysiewicz, 2017). Feedback was also sought from the BRIDGING Project (NIHR: 2751289) steering group PPI members, five autistic individuals (3 female, 2 male), aged 20 – 40 who were recruited by the National Autistic Society to provide expert input throughout the lifespan of the project. Relevant verbatim comments made by our autistic collaborators are presented in *italics* within quotation marks.

3. Results

3.1. Review Question 1

How do recruitment and early employment experiences lead to poor outcomes for autistic adults? By what mechanisms, and in what contexts? Across the literature and lived experience data, poor outcomes for autistic adults in employment were found to result from a range of contextual and systemic barriers that are present at multiple stages of the employment journey. An overview of the stage, context, mechanism and outcomes related to these barriers is provided in Table 1. These begin prior to job seeking and continue throughout recruitment and into early workplace experiences. The evidence consistently highlighted how specific features of systems, processes, and attitudes particularly in contexts lacking autism awareness and inclusive practices create environments where autistic individuals face an elevated risk of exclusion, underemployment, and early exit from work.

3.1.1. Pre-employment factors

Employment readiness.

Autistic adults often lack guidance on employment and seldom take part in good quality vocational training and work experience opportunities. Thus, they may become used to living on state benefits, harbour uncertainty about financial advantages of employment, and not believe that employment is achievable (Snell-Rood et al., 2020; Martin et al., 2019; Baric et al., 2017; Townsley et al., 2014). Additionally, "*social anxiety*" and unease about meeting new people, as well as worrying of "*not having good communication skills*" can affect motivation in gaining work (Walsh et al., 2018).

Grant and Kara (2021) consider the "autistic advantage" a strengths-based model emphasising that autistic people are assets to the community. They have cognitive strengths that help them outperform neurotypical peers: attention to detail; logical analysis, sustained concentration, retention of information, creative problem solving (Autistica, 2024). They also demonstrate systematic thinking, accuracy, technical ability (Blankenship, 2023; Brown, 2022). Thus, it is "*essential to build self-esteem and confidence*", "*find the intrinsic motivation*", "*be more relaxed, knowing everything is going to be ok*".

Information about the job.

Where autistic individuals do seek work, the recruitment process itself often acts as a barrier, privileging neurotypical modes of communication and implicitly expecting candidates to conform to unwritten norms. Job specifications provided by employers that appear vague/ambiguous may cause autistic applicants to be unsure about what to expect or doubt their suitability, and proceed no further (NAS, 2024b; Martin et al., 2019). When advertised job specifications are vague/unclear (Context), autistic adults have difficulty 'reading between the lines', decoding what is asked, and gauging their own suitability (Mechanism), leading to being unsure on whether to apply (Outcome). Additionally, when job descriptions include wording such as good 'communicator', 'team player' etc, that are not essential (Context), then autistic applicants will assume they are not eligible (Mechanism), and many will not apply for the job (Outcome). Another obstacle for autistic applicants can be judging how much to write on job application forms and how to structure content concisely (NAS, 2024a; Brown, 2022).

Recruitment can be made more inclusive through employers considering advert wording, by "making it easier to understand what the job is", and by listing adjustments that could be requested during recruitment or allowing applicants to highlight such needs (NAS, 2024a). This can reassure and raise the confidence of autistic applicants and encourage more to apply (Davies et al., 2023). Employers could also offer autistic applicants the option of completing a direct/structured application where, for example, information can be imparted by ticking boxes rather than writing a full account (NAS, 2024b).

3.1.2. Application processes

Disclosure and discrimination.

Some of the anxiety surrounding job applications can come from deciding whether to disclose being autistic. In a recent survey by the NAS's Autism Insight Panel, 68 % of respondents said they did not disclose their diagnosis. This masking may continue at the workplace, particularly if autistic employees struggle with communication norms and social interaction expectations (Davies et al., 2022; Newlands, 2023). Therefore, when the workplace is perceived by autistic employees to be an inequitable environment (Context), worries about the possibility of stigma and discrimination (Mechanism), lead to anxiety about disclosing their autism (Outcome).

Sometimes, autistic employees experience discrimination with "*employers disregarding neurodiverse people*" (Djela, 2021; Raymaker et al., 2023; Adiani et al., 2024). Thus, autistic employees who communicate their need for adjustments at application stages (Context) can face discriminatory or insensitive reactions from employers (Mechanism), with the consequence that some autistic employees may face stigma (Outcome).

Preparation for the job interview.

For those who progress to interview, the process itself is frequently misaligned with the abilities and communication preferences of autistic people. Most people can experience some trepidation before a job interview but autistic adults, who may have little experience of formal social engagement, unease/anxiety can be profound (Nagib & Wilton, 2020; Finn et al., 2023): "*[my] anxiety was very high, as I didn't know what to expect from the interview*", "*[autistic candidates] can find the interview process difficult because of questions that they*

might not be prepared for".

Difficulties when preparing for an interview centre on two main concerns: anxiety about practicalities, such as getting to the interview venue and meeting interviewers, and pressure of processing and answering interview questions spontaneously (Brown, 2022; Davies et al., 2023). Thus, unease about getting to job interviews and answering questions (context)can lead to increased trepidation and anxiety (mechanism) potentially leading to decreased interview attendance and disadvantaged performance.

Advance and clear information about the interview process, location etc., can make them feel better prepared, knowing they are less likely to be faced with "*unknown aspects*" and destabilising surprises (Martin et al., 2019; Brown, 2022; Blankenship, 2023). This information could be provided in writing but also in video formats, to increase accessibility and usefulness (NAS, 2024b). Further, employers could provide interview questions in advance, and allow autistic candidates to bring notes to the interview, thereby enabling them to take a considered approach to their answers (Adiani et al., 2024; NAS, 2024a).

3.1.3. Job interviews

Conduct of job interview.

Traditional job interviews often focus on personality and/or social skills. This may disadvantage autistic candidates, given the difficulty they can experience with social communication and social expectations (Davies et al., 2023; Hayward et al., 2019). Thus, autistic candidates may "mask" their condition to "give the answers your employer wants to hear", a form of 'impression management' that may lead to interview success but be internalised by the autistic candidate as an unfair and underhand strategy (Genova et al., 2021; Newlands, 2023; Adiani et al., 2024; Hayward et al., 2019). Thus, when the recruitment process or workplace environment emphasises social skills (Context), autistic applicants fear discrimination if their social communication difficulties are too exposed (Mechanism), leading to autistic applicants/employees feeling they have to mask their authentic self (Outcome).

The conversational nature of an interview can also negatively impact autistic candidates' confidence, given possible communication difficulties and anxiety when meeting "strangers" (Brown, 2022; Megrew, 2020). They may have problems knowing how to start/maintain/end conversations, taking spoken language literally and missing nuances, and judging how much information to give. They can also experience difficulty interpreting body language, coping with eye contact, and varying tone of voice (Yoshikawa et al., 2023; NAS, 2024a). Autistic candidates find, "my mind goes blank when I try to talk about myself". When job interview questions are ambiguous (Context), autistic people may find it problematic interpreting nuances (Mechanism), leading to having difficulty understanding interview questions' meaning (Outcome).

Autistic adults' wellbeing may be negatively impacted by distraction and sensory challenges, such as "*noise sensitivity*" (Martin et al., 2019; Davies et al., 2023). When job interviews take place in settings which are brightly artificially lit, noisy, overly warm or cold (Context), then sensory sensitivity/overload can impact their wellbeing (Mechanism), leading to them being anxious and uncomfortable (Outcome). Interviewers can address this by providing a calm setting, with careful regulation of light, noise, and disruptions (Erasmus+, 2022).

3.1.4. Workplace factors

Employer awareness of autism and adjustments.

Once employment is obtained, workplace interactions are important for success and sustainability as maintaining long-term employment remains a challenge for autistic people. A lack of understanding about autism is a common factor affecting autistic employees' willingness to stay in the job (Davies et al., 2022; Kim et al., 2022). When employers are unaware of autistic employees' support needs (Context), employees find necessary adjustments are not forthcoming (Mechanism), with this being a barrier to successful employment (Outcome). Those who decide to disclose their autism may wait a long time before they find a colleague who they sufficiently trust (Newlands, 2023). Indeed, according to PPI members, the "*unspoken rules and etiquette*" of a new workplace may lead to loss of "*self-respect*".

Many do not receive necessary social support or sensory adjustments to enable them to fulfil their role (Department of Work and Pensions, 2024). Factors that determine how well autistic people do, include disclosure and discrimination, employer awareness of autism and adjustments, and supportive management and guidance (Davies et al., 2022; NAS, 2024a). Employees' rights to reasonable adjustments are enshrined in UK law (Autism Act 2009, Equality Act 2010). Notwithstanding this legislation, autistic employees may have to raise and negotiate the topic themselves, assuming they disclose their condition (Djela, 2021; Davies et al., 2022). This can be onerous, especially for new employees, who may balk at classifying their needs and identifying specific adjustments that would be beneficial, and then formally requesting adjustments (Djela, 2021; Davies et al., 2022). Therefore, when employers lack sufficient knowledge/understanding of autism (Context), autistic employees must advocate for themselves by making a case for adjustments (Mechanism), leading to autistic employees feeling disadvantaged (Outcome).

Awareness training regarding autistic employees' needs can limit discrimination, such as "*biases and ableism*", and increase understanding of common social and sensory challenges that autistic employees face (Kim et al., 2022). Employers and neurotypical staff would benefit from training on autism and potential adjustments (Hayward et al., 2019; Flower et al., 2021; Davies et al., 2022). Adjustments include working hours, low-stimulus workspaces, quiet spaces, noise-cancelling headphones, flexible working hours, modification of job role, access to communication technology (Brown, 2022; NAS, 2024a; Waisman-Nitzan et al., 2021).

Supportive work environments.

Job retention is strongly influenced by whether autistic employees receive ongoing, individualised support and whether workplace culture is inclusive. Autistic individuals can experience social unease when starting a new job (Erasmus+, 2022; Amat et al., 2023). A PPI member stated *"I have social issues meeting new people, so I just hope people can go easy on me and not judge if I'm too quiet"*.

Other PPI members highlighted the difficulty when "*working alongside other people who I didn't know*". In such situations, *"trying to*

connect with [colleagues] was stressful to begin with" and could lead to feeling "*ashamed*" if the autistic employee was unable to judge whether they were doing a good enough job. When asked of useful ways to practise meeting and working with new people, PPI members suggested *"a buddy" system might help", as well as* permitting autistic workers to have familiar sources of reassurance at hand, *"personally, I like having a stress/fidget toy with me that I can use for comfort"*. When asked what employers could or should do, to make settling into a new job less stressful they stated: *"ensure [you're] not getting thrown in at the deep end", "help to get a feel for the place [for example] a trial day or two"*. Employers should also avoid immediately setting "*high standards",* PPI commented *"I personally feel very anxious and worry about making any mistakes and having to feel like I need to be perfect increases my anxiety"*.

Distractions and sensory challenges in the workplace present a significant hurdle for autistic employees. Employers can usefully consider ways to regulate light, noise, and temperature, to create a calm setting (Erasmus+, 2022; Brown, 2022; Waisman-Nitzan et al., 2021). Therefore, when autistic employees work in a safe and predictable setting (Context), then they experience a calm and certain environment, without surprises (Mechanism), and they are more likely to be productive and content in the workplace (Outcome).

3.2. Review question 2: how might a VR intervention lead to positive outcomes of recruitment and early employment experiences for autistic adults?

The realist review found that VR comprises several intrinsic attributes that appeal to autistic adults. Findings were grouped into two key themes: *practising and improving ability to complete job interviews and work-related tasks;* and *promoting understanding and empathy amongst neurotypical work colleagues.*

3.2.1. VR attributes

Findings about VR attributes indicated the multifaceted benefits of VR interventions for autistic individuals.

Familiarity and accessibility: Some people with visual impairments may be unable to use VR headsets and even though some may experience cybersickness and allied sensorial difficulties, more commonly autistic adults are often familiar and comfortable with using VR (Erasmus+, 2021; Smith et al., 2014). Familiarity may result from various experiences, such as "*using [VR] in school for doing an activity*", "*at an airport terminal [where] you could look and interact with [VR]*", or "*gaming",* which may involve a conversational life-like platform for "*social games with my long-distance friends*". Moreover, the flexible and personal nature of VR can produce environments and social engagement tailored to autistic adults, providing personalised interventions, whatever level of language, cognition, and social skill (Kim et al., 2022). As well as familiarity, VR offers "*more visual learning than being told*", this can facilitate the communication and comprehension of otherwise difficult concepts (Kim et al., 2022). As a result, a PPI member said, "*recordings or videos of processes of what to expect will reduce anxiety*". Therefore, when VR provides gradual exposure to fear-producing stimuli and contexts in a supportive, contained setting (Context), autistic adults can practise building interview and employment skills in a safe environment (Mechanism), leading to the promotion of their coping abilities and reduction of anxiety (Outcome).

Strategic learning: Simulated reality provides an immersive and interactive learning environment that enables autistic people to practice skills multiple times in various scenarios (Smith et al., 2014, 2021; Erasmus+, 2022). It can also benefit autistic employees once in a job, as suggested by one PPI member *"[VR] could be used to simulate situations that might arise after starting the job, to help think about ways to deal with them effectively*".

VR can provide a structured, interesting, and motivational learning environment. Through a focus on relevant stimuli, VR offers repeatable scenarios and interactions that enable consistent practice and immediate real-time feedback (Smith et al., 2021).

Safety and containment: Lack of opportunity to experience potential problems in the workplace may make autistic adults feel inadequately prepared for work. Therefore, it can be beneficial to practise social skills without worrying about the negative consequences of making common mistakes associated with face-to-face interactions (Kim et al., 2022).

Through VR's immersive, multi-sensory, interventions in controlled and structured environments, autistic individuals can experience authentic social situations that replicate real-life but don't impact the real world, thereby reducing social anxiety (Erasmus+, 2021). The following comments illustrate this point: "*it [VR] may alleviate the stress of being in person*"; *"[VR] provides an opportunity to practise or become familiar with a situation in a safe environment*". This experience can in turn lead to an increase in confidence and skills, with positive implications for managing challenging situations in reality (Burke et al., 2018). If we describe the (Context) as a lack of VR opportunities, to experience and rehearse dealing with potential problems in the workplace, may harbour significant fears about social interactions with colleagues (Mechanism), with the consequence that they may feel inadequately prepared for work (Outcome).

Physiological feedback: Sensing technologies that measure behavioural and physiological signals of autistic individuals during VR can be used to identify personal reactions to stimuli, and provide feedback and insights (Kim et al., 2022). Physiological and emotional response data may assist with learning of particular stresses and their impact and provide rich data on verbal and behavioural response patterns. Further analysis can help identify challenging interview questions and ways for employers to adapt interviews, so they are better attuned to assessing the skills of autistic candidates (Adiani et al., 2024). Physiological measures incorporated in the VR technology also offer objective verification of self-reported improvements, for example in respect of a reported increase in confidence and reduced stress during and after a mock job interview (Kumazaki et al., 2019; Strickland et al., 2013). Indeed, VR enables users to see objectively how an individual behaves in certain situations and what lessons can be learned (Kumazaki et al., 2019) "*VR is a good practice technique for helping people like myself to practise communication and [see] what they're doing right and wrong*".

Physiological feedback results in the (Context) being described by sensing technologies which measure the behavioural and physiological signals of autistic individuals during VR interactions which provide the (Mechanism) – as a personalised VR experience with the (Outcome) represented by helpful insight and feedback about relevant behaviours.

3.2.2. VR and employment-related training benefits

Findings on VR and employment-related training benefits outline several key aspects. Firstly, VR facilitates the practice and enhancement of job interview skills and work-related tasks, offering simulated environments for job scenarios and promoting self-confidence in real-world job interviews. Secondly, VR interventions contribute to promoting understanding and empathy among neurotypical colleagues through immersive experiences that simulate the challenges faced by autistic workers, fostering collaborative support systems in the workplace. Thirdly, the implications for scenario development emphasize the importance of designing authentic VR scenarios that accurately reflect the complexities of real-world job interviews and workplace interactions. Lastly, the potential for VR to support multi-user interaction holds promise for fostering positive collaborative teamwork between autistic and neurotypical adults, enhancing engagement in shared social, cognitive, and behavioural processes within virtual environments.

Practising and improving job interviews and work-related tasks: VR has been shown to be an effective medium to use when training autistic adults on social communication skills for job interviews or the workplace (Williams % Smith, 2023). VR can do this through "*mock courses on activities you may be doing in the job*". Indeed, there is evidence that VR training leads to an increase in job interview skills, such as: answering situational and socially oriented questions, making appropriate introductory and closing statements, communicating relevant personal and professional strengths, understanding day-to-day work practicalities, and improving non-verbal communication skills (Burke et al., 2018; Burke et al., 2021; Genova et al., 2021). Furthermore, VR training instils greater self-confidence in attending a real job interview, and improved chances of obtaining a competitive job (Smith et al., 2017; Erasmus+, 2021) "*Putting the person in a job interview test through VR would be a better way of showing them how the job interviews work… and will make job interviews a lot easier as they will be more used to being in that situation"*.

VR also offers scope "*for practice of communication skills and a vision of what the workplace could look like*". Benefits include being able to speak calmly, initiate and sustain conversation, establish rapport with a stranger, recognise emotions, negotiate, and work effectively with co-workers, and manage conflict (Adiani et al., 2024; Williams & Smith, 2023). There is, moreover, a clear link between VR training in work-related skills and improvement in those skills, particularly regarding behavioural change (Smith et al., 2021; Strickland et al., 2013).

Practising and improving job interviews and work-related tasks in VR can be described by: the (Context) - when simulated reality creates an interactive learning environment that enables autistic people to practice skills multiple times in various scenarios, the (Mechanism) – created by the VR as an effective medium of vocational support, through training in social communication skills for job interviews or job tasks which leads to the (Outcome) - autistic employees feeling more confident and reassured in the workplace.

Promoting understanding and empathy amongst neurotypical work colleagues: "Employers and managers often reported poor knowledge of autism and felt under-prepared to identify and implement adjustments for autistic people" (Department of Work and Pensions, 2024). People who underwent a VR experience that simulated difficulties facing a particular group, were likely to adopt a positive attitude towards that group (Kim et al., 2022). Observing how autistic employees behave in various simulated social situations in VR could, therefore, help recruiters, managers and co-workers better understand the challenges autistic workers may face, and so be more thoughtful and empathetic (Amat et al., 2023; Kim et al., 2022). Furthermore, VR could potentially be used by autistic employees and neurotypical colleagues, together, to stimulate regular discussion of workplace challenges and strategies to prepare for or deal with these, and to help build a collaborative workplace support system (Erasmus+, 2021; Erasmus+, 2022; Amat et al., 2023).

VR has the potential to create the (Context) for employers to observe how autistic employees actually behave in various simulated social situations in VR, which provides the (Mechanism) for employers to have greater awareness of autism leading to the (Outcome) of employers having a better understanding of the characteristics of autistic individuals and being more mindful of their interactions with autistic employees.

PPI members strongly agreed with this proposition and emphasised that autistic employees should be integral to co-designing VR training initiatives, as this is "*crucial*", if employers are to really "*take on board*" autistic workers' characteristics, concerns and ideas.

Implications for scenario development: VR scenario design needs to be faithful to the lived experiences of autistic adults. Job interview training could, therefore, usefully include dealing with unpredictability as well as judging what to expect in advance, along with a focus on interpreting questions, and relationship building strategies (Kim et al., 2022; Newbutt et al., 2023; Adiani et al., 2024). As such the design of VR scenarios needs to accurately reflect the unpredictability and complexity of real-world job interviews and workplace interactions.

There should also be consideration of VR scenarios that help autistic adults overcome challenges that may arise in the workplace, such as a colleague's apparent hostility. For example, if a scenario presents positive outcomes when an autistic employee speaks up about unfair treatment or bullying at work, they may feel more confident about raising actual problematic workplace interactions (Kim et al., 2022). Incorporating scenarios that teach autistic adults how to manage and respond to common workplace challenges, such as perceived hostility or miscommunication with colleagues. For example, the positive outcome of a VR scenario of an autistic employee who speaks up about unfair treatment at work can be considered the (Context) and the (Mechanism) takes the form of self-advocacy which has been shown to be effective which in turn leads to autistic employees feeling more confident about raising problematic workplace interactions as the (Outcome).

There is certainly a place for VR scenarios that highlight autistic employee rights, self-awareness, discrimination law, and self-advocacy. In this respect, programme design usefully encourages autistic people to set their own goals and determine which skills will help them achieve their employment goals. (Adiani et al., 2024; Kim et al., 2022).

A co-design strategy may also help prevent the potential for VR programs to reinforce normative behaviour rather than just respect diversity. Instead, scenarios need to respect alternative values and social norms of social communication and diversity (Kim et al., 2022). The co-design strategy may encompass organising workshops that bring together autistic adults, employers, VR developers, and occupational therapists. Establishing iterative cycles where feedback from evaluation phases is used to refine and adapt the VR

scenarios. (Samson, Lameras. et al., 2024; Jones et al., 2024).

4. Discussion

This realist review explored the mechanisms and contexts that contribute to poor recruitment and early employment outcomes for autistic individuals, as well as the potential of VR to mitigate some of these challenges. Drawing on academic literature, grey sources, and PPIE input, the review provides a framework grounded in real-world contexts, revealing both the barriers autistic individuals face and opportunities for targeted support. The findings highlight how autistic adults are systematically disadvantaged by conventional recruitment processes and early employment practices (Black et al., 2020; Hedley et al., 2016; Davies et al., 2022). This review identifies persistent challenges across the employment journey: limited vocational guidance and employment readiness support (Snell-Rood et al., 2020; Martin et al., 2019), vague or exclusionary job descriptions (NAS, 2024b), and traditional interviews that disproportionately favour neurotypical social behaviours (Hayward et al., 2019; Adiani et al., 2024). These issues are further compounded by disclosure anxiety and lack of workplace adjustments (Newlands, 2023; Davies et al., 2022). However, the review also underscores the potential of VR to address many of these challenges. Existing studies show that VR can support job interview skill development, reduce social anxiety, and promote behavioural change through repetition and immersive feedback (Smith et al., 2014; Burke et al., 2018; Kim et al., 2022). Autistic individuals' affinity for technology-based learning methods (Kim et al., 2022; Erasmus+, 2022) reinforces VR's suitability as a medium for both practising skills and simulating real-world experiences in a safe, controlled environment. The review expands on this by demonstrating that, beyond individual training, VR holds promise in shifting workplace culture. Specifically, its potential to promote empathy and understanding among neurotypical colleagues and managers by immersing them in the lived experiences of autistic individuals could address the persistent gap in autism awareness and inclusive practice within organisations (Department of Work and Pensions, 2024; Amat et al., 2023). Nevertheless, barriers to VR use must be considered including those with visual impairment and cybersickness, although studies have found that few autistic people suffered with cybersickness despite worries around comorbid sensory integrations disorders, making VR use an ethical concern among this population (Glasser et al., 2022). Furthermore, the co-design approach embedded in this review, particularly the contributions of PPIE members, offers a critical insight into how autistic individuals want to be supported. Their emphasis on predictability, structured preparation, and the ability to rehearse challenging scenarios mirrors findings in earlier work (Martin et al., 2019; Brown, 2022). Importantly, the strengths-based framing of autistic traits such as attention to detail, systematic thinking, and problem-solving (Grant & Kara, 2021; Autistica, 2024) provide a foundation for VR interventions that not only address barriers but actively cultivate autistic strengths. Indeed, VR has the potential to be customised to accommodate different needs, preferences and differences, as well as empower individuals to ask for adjustments within the scenarios. Together, these findings suggest that a co-designed VR-based intervention could help rebalance recruitment and early workplace experiences in favour of inclusion, self-confidence, and sustainability. In doing so, it aligns with strategic national goals, including the NHS Long-Term Plan and the Autism Strategy 2021–2026, which call for innovative, person-centred approaches to enhancing autistic adults' access to meaningful employment.

5. Implications for future research and practice

The attributes of VR technology, such as place illusion and plausibility illusion (Slater, 2009), present unique opportunities for addressing the challenges faced by autistic individuals in recruitment and early employment experiences. By leveraging the immersive and interactive nature of VR, we can create tailored interventions that provide realistic simulations of job interviews, workplace scenarios tailored to different job roles and challenges, and social interactions. These simulations offer a safe space for practicing skills, receiving real-time feedback, and building confidence in a controlled environment. Moreover, VR interventions have the potential to foster empathy and understanding among neurotypical recruiters, managers, and colleagues by simulating the challenges faced by autistic individuals. By promoting collaborative support systems in the workplace, VR can contribute to creating a more inclusive and supportive work environment for all employees. Future research involving the use of VR with autistic individuals must also pay heed to several ethical considerations including gaining informed consent, data privacy and protection, as well as making sure VR scenarios, do not promote masking or reinforce normative behaviours.

Moving forward, the implications of our review underscore the importance of co-designing VR scenarios in collaboration with autistic individuals, employers, and stakeholders. By incorporating diverse perspectives and experiences, we can ensure that VR interventions are relevant, accessible, and effective in addressing the specific needs of autistic adults in the context of employment. Key insights from the review, such as the importance of providing clear job information, offering structured interview preparation, and fostering supportive workplace practices, can inform the development of VR scenarios that simulate these scenarios. Additionally, considerations such as promoting self-advocacy, building social skills, and addressing sensory challenges can be integrated into the design process to create holistic and comprehensive interventions.

6. Strengths and weaknesses

A key strength of this review is its foundation in realist methodology, which permitted nuanced exploration of how specific mechanisms interact with context to produce outcomes. The use of Context-Mechanism-Outcome (CMO) configurations enabled us to go beyond surface-level barriers to uncover deeper structural and psychological processes. A further strength of this review is the collaboration with autistic adults who provided unique insights that shaped the findings of this review. By incorporating the voices and perspectives of autistic individuals we were able to synthesise this novel data with existing academic literature. Building upon these

collaborative findings, we aim to further co-create VR scenarios, a process which presents a valuable opportunity to develop tailored interventions that address the unique needs and preferences of autistic individuals.

However, some limitations must be acknowledged. While PPIE involvement enhanced the authenticity of the findings, the feedback was limited to a specific cohort and may not reflect the full diversity of autistic experiences, particularly across cultures or employment sectors. Furthermore, while the promise of VR is compelling, the use of VR raises questions about acceptability, generalisability across different job sectors and cultural contexts. Future interventions will need to be rigorously evaluated in real-world employment settings to establish effectiveness, cost-benefit, and acceptability.

7. Conclusions

In conclusion, the co-creation of VR scenarios offers a promising pathway toward enhancing the recruitment and early employment experiences of autistic adults. By leveraging the insights gained from our review and actively involving the PPI group in the design process, we will continue to develop interventions that empower autistic individuals, educate employers, and foster a more inclusive and supportive workplace environment for all. Future steps include co-creating and testing the initial VR scenario and collecting both qualitative and quantitative feedback using observation, interviews, and data collected through the VR headset and wearable biosensors.

Ethical considerations

The project has received Coventry University Ethical Approval. Date of approval: 27 Sep 2023 Project Reference Number: P163016.

Funding Sources

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This research was funded by the National Institute for Health and Care Research - Research for Social Care [NIHR204260] and the UK Autism Research Charity Autistica.

Glossary

CMO	Context Mechanism Outcome
NAS	National Autistic Society
NDEI	Neurodiverse-Employers-Index
ONS	Office for National Statistics
PPI	Public and Patient Involvement
PPIE	Public and Patient Involvement and Engagement
VR	Virtual Reality

CRediT authorship contribution statement

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Declaration of Competing Interest

None of the authors have any interests to declare.

Acknowledgements

We would like to thank Chris Richards and Nic Lander from the Kimel foundation and Dr Ashok Roy from the Coventry and Warwickshire Partnership trust for their involvement in this project.

Appendix A. Context, Mechanisms, Outcome (CMO) configurations as represented in statements arising from BRIDGING study realist review of literature

The following statements were devised in the course of probing relevant literature for content that highlights CMO configurations pertinent to the study's two main questions. Each statement reflects a CMO configuration using three phrases, denoting context, mechanism, and outcome.

1st question:

How do recruitment and early employment experiences lead to poor outcomes for autistic adults? By what mechanisms, and in what contexts?

When employers rely on traditional interviews during recruitment (Context), then autistic applicants may have difficulty managing social expectations, as well as understanding and engaging in verbal and non-verbal communication (Mechanism), leading to them struggling to demonstrate their skills (Outcome).

When employers use open questions to probe personal experience (Context), then autistic applicants often require additional processing time and may not easily recall episodic memories (Mechanism), leading to difficulty and disadvantage if they do not receive this time (Outcome).

When employers rely on assessing personality and social skills during recruitment (Context), then autistic applicants may have difficulty with presentation skills and impression management (Mechanism), leading to autistic applicants being disadvantaged (Outcome).

When the recruitment process or workplace environment emphasises social skills (Context), then autistic applicants fear discrimination if their social communication difficulties are too exposed (Mechanism), leading to autistic applicants/employees feeling they have to mask their authentic self (Outcome).

When advertised job specifications are vague or unclear (Context), then autistic adults have difficulty 'reading between the lines', decoding what is being asked, and therefore gauging their own suitability (Mechanism), leading to potential autistic applicants being unsure whether to apply (Outcome).

When job interview questions are ambiguous (Context), then autistic people may find it problematic 'reading between the lines' and interpreting nuances in communication (Mechanism), leading to autistic applicants having difficulty understanding interview questions' meaning (Outcome).

When job interviews take place in settings which are brightly artificially lit, noisy, overly warm or cold (Context), then sensory sensitivity and overload can significantly impact the wellbeing of autistic candidates (Mechanism), leading to autistic candidates being very anxious and uncomfortable (Outcome).

When the workplace is perceived by autistic employees to be an inequitable environment (Context), then they are worried about the possibility of consequent stigma and discrimination (Mechanism), leading to autistic employees fearing disclosing their autism (Outcome).

When employers lack sufficient knowledge/understanding of autism (Context), then autistic employees have to advocate for themselves by making a case for adjustments and don't feel they have the 'tools' to do this (Mechanism), leading to autistic employees feeling disadvantaged (Outcome).

When autistic employees do not disclose their autism (Context), then they will have to speak up about and negotiate their need for adjustments (Mechanism), leading to their obtaining adjustments very challenging (Outcome).

When employers are unaware of autistic employees' support needs (Context), then employees find necessary adjustments are not forthcoming (Mechanism), with the consequence that this can be a barrier to successful employment (Outcome).

When autistic employees communicate their need for adjustments (Context), then employers can be discriminatory or insensitive (Mechanism), with the consequence that some autistic employees may face stigma (Outcome).

When job descriptions include default, non-essential skills, such as good 'communicator', 'team player' etc, that are not essential (Context), then autistic applicants will assume they are not eligible (Mechanism), with the consequence that many autistic adults will not apply for the job (Outcome).

When during recruitment employers offer work trials rather than traditional interviews (Context), then autistic candidates will perceive recruitment as less socially oriented, less focused on personality, and more practical (Mechanism), leading to candidates being more confident in demonstrating their competence and abilities (Outcome).

When autistic employees work in a safe and predictable setting (Context), then they experience a calm and certain environment, without surprises (Mechanism), with the consequence they are more likely to be productive and content in the workplace (Outcome).

2nd question:

How might the resources provided by the VR intervention lead to positive outcomes of recruitment and early employment experiences for autistic adults?

When simulated reality creates an interactive learning environment that enables autistic people to practice skills multiple times in various scenarios (Context), then VR provides an effective medium of vocational support, through training in social communication skills for job interviews or job tasks (Mechanism), leading to autistic employees feeling more confident and reassured in the workplace (Outcome).

When sensing technologies measure the behavioural and physiological signals of autistic individuals during VR interactions (Context), then such technologies personalize VR experiences (Mechanism), with the result that they can provide helpful insight and feedback about relevant behaviours (Outcome).

When autistic adults lack opportunity through VR to experience and rehearse dealing with potential problems in the workplace

(Context), then they may harbour significant fears about social interactions with colleagues (Mechanism), with the consequence that they may feel inadequately prepared for work (Outcome).

When employers observe how autistic employees actually behave in various simulated social situations in VR (Context), then they have greater awareness of autism (Mechanism), leading to employers better understanding the characteristics of autistic individuals and being more mindful of their interactions with autistic employees (Outcome).

When a VR scenario presents a positive outcome when an autistic employee speaks up about unfair treatment at work (Context), then an example of self-advocacy has been shown to be effective (Mechanism), leading to autistic employees feeling more confident about raising problematic workplace interactions (Outcome).

When VR provides gradual exposure to fear-producing stimuli and contexts in a supportive, contained setting (Context), then autistic adults can practise building interview and employment skills in a safe environment (Mechanism), leading to promotion of their coping abilities and reduction in their level of anxiety (Outcome).

Data availability

Data will be made available on request.

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