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Ready for Release: Exploring Offenders' Acceptance of Virtual Reality for Reintegration Training

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ABSTRACT

Virtual Reality is increasingly recognized as a promising tool for rehabilitation and training; however, its acceptance and perceived suitability within correctional contexts remain under-explored. This study reports on a ten-week immersive VR reintegration training programme delivered in twenty sessions across nine prisons in four European countries. An extended Technology Acceptance Model was used, incorporating Immersion, Enjoyment, VR Sickness, and Computer Anxiety alongside Perceived Usefulness, Ease of Use, Attitudes, and Behavioral Intention. Mixed-methods data collected from prerelease incarcerated individuals indicate high levels of acceptance, with participants describing the VR experience as enjoyable, immersive, and relevant, while reporting relatively low anxiety and discomfort. Qualitative findings further suggest that realistic interpersonal communication scenarios were perceived as valuable and engaging by both incarcerated individuals and facilitators. The study provides evidence of the feasibility and acceptability of embedding VR-supported training in correctional systems and offers an empirically tested model for examining acceptance of immersive rehabilitation-related interventions in prison settings.

KEYWORDS

Virtual reality; technology acceptance; Immersion; offenders reintegration; HCI

1. Introduction

The successful reintegration of offenders into society depends on their ability to acquire practical communication, decision-making, and social skills during incarceration. Traditional rehabilitation workshops however often struggle to offer engaging and realistic learning environments, especially in constrained and resource-limited prison settings. Virtual Reality (VR) through its capacity to virtually simulate complex social situations and enable experiential learning, has emerged as a promising medium to enhance rehabilitation efforts. However, despite growing interest in VR for therapeutic and training purposes in corrections, little is known about how incarcerated individuals actually experience and accept VR-based interventions, particularly when deployed over sustained periods inside prison facilities. Most existing studies rely on short-term pilots or conceptual arguments, offering limited insight into long-term usage and behavioral intentions in real correctional contexts.

In this paper, we present a mixed-methods study conducted across nine prisons in four European countries. The main research question guiding this study is: "*to what extent do immersion, perceived enjoyment, computer anxiety and VR sickness influence offenders' acceptance and intended adoption of immersive VR for reintegration training within correctional settings?*". To ascertain this, we deployed a ten-week VR-based interpersonal communication skills programme designed for prerelease incarcerated individuals delivered over twenty sessions, and evaluated participants' acceptance and perceived experience of VR-supported training in correctional settings through an extended TAM framework. Building

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on the Technology Acceptance Model (TAM), we incorporated the key user experience factors of Immersion, VR Sickness, and Computer Anxiety as additional constructs critical to understanding the user acceptance and their overall experience with the use of VR for their reintegration training. The key contributions of this research are:

- A mixed-methods study examining the acceptability and perceived user experience of a ten-week VR-based interpersonal communication curriculum delivered in nine prison facilities across four European countries, using data from 69 prerelease incarcerated individuals and 12 trained facilitators.
- An empirical assessment of an extended Technology Acceptance Model (TAM) that integrates Immersion, Perceived Enjoyment, VR Sickness, and Computer Anxiety to explore VR acceptance in correctional training settings.
- Quantitative results showing strong associations among key acceptance-related constructs, particularly the roles of immersion, enjoyment, anxiety, and VR sickness in shaping technology perceptions and behavioral intention to use.
- Qualitative findings from incarcerated individuals and facilitators highlighting perceived benefits, implementation challenges, and practical considerations for immersive training in prison settings.
- Practice-oriented recommendations for the design and deployment of immersive VR interventions in prisons, with attention to onboarding, session logistics, content relevance, and technical constraints.

2. Background and context

Work reintegration has been considered a key goal after release from prison as it has been associated with improved resistance and wellbeing outcomes (Link et al., 2019; Nally et al., 2014; Tripodi et al., 2024). Unemployment has been described as one of the main criminogenic risk factors to be addressed whilst preparing for community reentry (Andrews & Bonta, 2014). It has also been connected to the reduction of other recidivism risk factors such as lack of stable housing, illegal activities and substance use, among others (Christy et al., 2011; Doyle et al., 2024). However, returning to work has proven particularly challenging for reintegrating individuals given the many practical and personal barriers encountered in this process (Ramakers et al., 2015). As a consequence, post-prison employment is low, ranging from 28% to 48% in the first four years post-release (Christy et al., 2011; Seim & Harding, 2020). To complicate the matter, individuals need not only to seek but also to secure and maintain employment (Christy et al., 2011). In this vein, studies indicate that interpersonal communication skills related to self-presentation as well as skills related to job maintenance (such as responding, conflict resolution, making requests) may need to be further developed to support community returners (Halushka, 2016; Jolley, 2018). Moreover, given the stigma experienced by reintegrating individuals, this group may need to utilize more advanced communication tactics in their job seeking journey and afterwards (Cherney & Fitzgerald, 2016; Goodman, 2020; Sinko et al., 2020). Recently released individuals seeking employment need to carefully plan a communication tactic for job interviews to create captivating self-presentation whilst choosing whether to disclose, conceal, or conditionally disclose their forensic history (Ricciardelli & Mooney, 2018). Additionally, upon entering employment, they may have to be open to receiving instructions and feedback as they are relearning skills as well as managing suspicion or trust issues from the work environment (Gurusami, 2017). Finally, they will need to find skillful ways of communicating work-related needs so that they overcome adversities and create long-term work experiences (Bumiller, 2015).

Prison and community-based work reintegration programs have long recognized the need for an emphasis on work preparedness and communication skills, albeit with variable emphasis on the different dimensions of worksite communication (Baybutt et al., 2019; Cook et al., 2015). A common approach in a work preparedness program for soon-to-be-released individuals would be to teach interview skills and other soft skills such as conflict resolution and assertiveness (Baldry et al., 2018; Ellison et al., 2017). However typically programs will not explore one's motivation for participating in prison education (and hence their willingness to use the skills taught), and rarely would they explicitly address the dilemma of how much to disclose about one's forensic history in a job interview (Ricciardelli & Mooney, 2018). The lack of attention to these two areas suggests that individuals may have opportunities to practice effective communication skills but may fail to connect their newly acquired skills to personal motivations and clear

decisions regarding disclosure (Cherney & Fitzgerald, 2016). Importantly, change in behavior involves more than the acquisition of new knowledge, but most importantly hands-on practice and the activation of intrinsic motivation to guide the persistence and emotional tolerance needed for long-term behavior change (Gardner & Rebar, 2019).

An approach which places substantial emphasis on activating intrinsic motivation to support behavior change is Acceptance and Commitment Therapy (ACT) (Hayes et al., 2011), a treatment model and an intervention technology which has been applied in short and preventative training programs in forensic settings (González-Menéndez et al., 2014; Valizadeh et al., 2020) and the community (Christodoulou et al., 2021, 2024). The model emphasizes the development of six psychological processes that together increase an individual's psychological flexibility (Hayes, 2004) and which can be summarized into three overarching principles: open (i.e., being allowing of one's internal experience), aware (i.e., being in tune with the affordances of the present moment), and engaged (living life in accordance with deeply held values). In this model, the third principle of being engaged focuses on activating valued living (Wilson et al., 2010); that is, an ability to define and commit to certain life-directing values which are personally meaningful and intrinsically motivating and from which goals and daily actions can derive (LeJeune & Luoma, 2019). Connecting daily actions and choices with personally chosen and intrinsically motivating values has been found to result in improved wellbeing, consistent movement toward goals and long-term behavior change (Finkelstein-Fox et al., 2020; Smout et al., 2014). Moreover, recognizing intrinsic motivational factors can allow an individual to revise their goals and priorities and align them with more prosocial orientations, given that antisocial behavior is often the result of more impulsive and less reflective cognitive processes (Brennan & Baskin-Sommers, 2019).

In summary, connecting a communication skills training to values-based motivation can boost prosocial value orientations and increase internal motivation toward utilizing the skills in the workplace, and additionally, providing the necessary reflective space to make a values-based decision on how much of their past forensic history they prefer to disclose.

2.1. VR In training and rehabilitation

VR has emerged as a versatile technology for use as an adjunct tool in the delivery of training programs focusing on increasing communication and behavioral skills for various populations, capable of providing a safe and immersive virtual space for practice and exploration (Geraets et al., 2021; Rodríguez-Rivas et al., 2022). VR has helped to produce positive outcomes in training programs on interview-based communication skills for vulnerable populations that struggle with accessing employment, such as individuals on the autistic spectrum (e.g., Ward & Esposito, 2019); individuals diagnosed with schizophrenia (e.g., Smith et al., 2015), psychiatric disabilities (e.g., Smith et al., 2014) among others. Under a similar premise, VR has also been recently introduced as a useful technology to support prison-based training programs, as it can create a valuable link across prison to stressful real-life situations that can be encountered post-release (Teng & Gordon, 2021). VR based programs have focused on skills-based practice via technology. For example, on providing virtual tours of halfway houses to reduce anxiety around post-release living spaces (e.g., Lewis, 2018), practising routine tasks prerelease (e.g., putting laundry, using self-checkout counters; (Rohringer, 2018)) and practising post-release job interview skills (Smith et al., 2023), evidencing increases in users skills and interview-related motivation.

In line with previous studies in prisons and within the theoretical framework of ACT (Powers et al., 2009), VR has been mainly used in studies focusing on enhancing communication skills. For example, VR has been included in short training programs to support the management of social (Gorinelli et al., 2023; Yuen et al., 2019) and public speaking anxiety (Montesinos et al., 2025) with encouraging outcomes in terms of decreases in anxiety types and increases in self-efficacy. The strength of introducing VR into short interventions designed to enhance communication and self-presentation skills lies in the technology's ability to immerse an individual into life-like interpersonal situations in which they can observe or practice the implementation of taught skills in a safe and non-judgmental environment. More specifically, during incarceration, opportunities for practice in life-like contexts are limited to none, and thus VR can provide a valuable training tool. VR has been long used for crime prevention and for offenders training and rehabilitation (Ticknor & Tillinghast, 2011). Recent work indicates that VR can be an effective medium for prison education, providing immersive experiences that encourage self-reflection and behavioral change

(Moccia & Sabatano, 2024). Despite differences across prison educational systems, prison educators and incarcerated individuals identify common challenges that go beyond institutional barriers and reflect issues like sufficient motivation to learn, inclusive educational methods, sufficient orientation to the learning material, future-focused learning and civic engagement through learning (e.g., Thomas & Glazzard, 2025). These challenges highlight the role of using technology to create innovative and inclusive educational and training interventions within correctional institutions.

Several studies implemented VR for corrections. For example, VR has been introduced in prison settings for therapy (Teng & Gordon, 2021), as part of VR training to reduce aggressive behavior (Barnes et al., 2022), and in re-entry programmes that expose inmates to safe, controlled versions of real-world situations (Dolven & Fidel, 2017; Teng et al., 2019). Other work shows VR can teach basic literacy and numeracy skills (McLauchlan & Farley, 2019) and improve interview performance through realistic practice sessions (Smith et al., 2023). A further study found that VR-based mechanical training gained higher user acceptance than conventional real-life training methods (Alshaer, 2023). These findings suggest that VR may be a useful technology to be introduced into correctional settings providing capacities for increasing engagement, motivation, and enhancing educational inclusiveness through its delivery format. Integrating VR immersive tools with existing digital systems would allow researchers and practitioners to design new, technology-enhanced models of prison rehabilitation (Zivanai & Mahlangu, 2022). However, even though there are a lot of positive outcomes and promising results reported for the use of VR in correctional settings, little is known about how prisoners perceive and accept this technology or exploring the factors that shape their experience. This gap is particularly evident in the lack of long-term VR programmes delivered inside prison settings, due to the significant barriers of security, hardware availability, lack of network connections, and the logistics of participatory VR research, where supervising multiple users, scheduling sessions around facility routines, and providing ongoing technical support make sustained and long-term deployment difficult.

While technology in general can provide opportunities to improve inmate rehabilitation, there are several challenges that hinder practical implementation. Several key obstacles such as inadequate IT infrastructure, limited staff skills, high costs (i.e., hardware procurement and costs of operation and training), privacy and data security concerns, general security and misuse concerns, as well as resistance within the organizational culture are some of the barriers to implementation and adoption of technology within correctional settings (Imandeka et al., 2024; Silalahi & Kasih, 2024). Furthermore, there is a lack of clear regulations and legal frameworks that would support the use of new technologies in correctional facilities (Silalahi & Kasih, 2024). Imprisoned people are experiencing a digital divide as they cannot use the same technology (devices, apps, or communication channels) available outside prison, leading to digital disadvantage that fosters digital illiteracy for this group (Castells, 2011; Jewkes & Reisdorf, 2016; Mufarreh et al., 2022). Furthermore, within prisons, technology is often seen as a privilege and officials may restrict its use, so inmates view digital tools less as a rehabilitation support tool but more as instruments of reward (Jewkes & Johnston, 2009). Despite these constraints, studies show that when inmates can use computers (e.g., for education or legal work), the tools advance rehabilitation goals and can lower recidivism rates (Kerr & Willis, 2018; Mufarreh et al., 2022). However, even though there is evidence of positive impact for the use of technology by incarcerated individuals (Mufarreh et al., 2022), little is known regarding the impact of technology within correctional settings (Mufarreh et al., 2022; Ross, 2018). To contribute toward this gap, it is important to investigate which factors influence staff and inmates technology acceptance, to develop a clearer understanding to guide the design of technologies that are practical to deploy and effective in supporting rehabilitation.

2.2. Technology acceptance

The most commonly used method for evaluating user acceptance of various information technologies is through the Technology Acceptance Model (TAM, Figure 1). TAM was originally introduced by Davis (1989) to help understand and predict the users' subjective perceptions toward technology acceptance. TAM builds on the Theory of Reasoned Action (Fishbein & Ajzen, 1977), suggesting that an individual's behavior is driven by the intention to perform the particular behavior, shaped by personal beliefs regarding potential outcomes of their behavior, and their evaluation of the outcome of the values of each behavior. TAM is based on the constructs of Perceived Ease of Use (PEOU), Perceived Usefulness (PU), Intent to Use

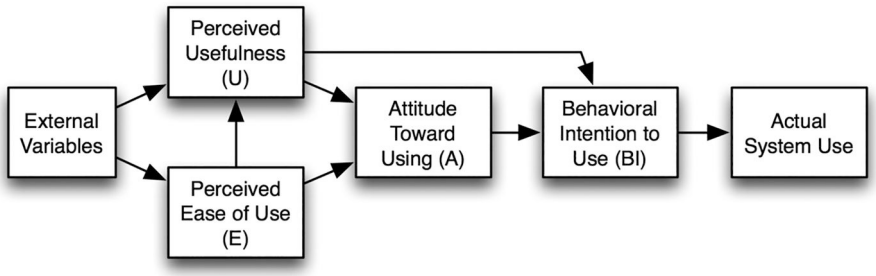

Figure 1. The technology acceptance model (Davis, 1989).

(Behavioral ITU - BITU), and actual use, and specifically examines the connections between PU and PEOU of a technology to determine attitudes toward its usage (Davis, 1989). PEOU refers to the degree to which a user believes that using a particular system would be free from effort; PU concerns the extent to which a user believes the technology will increase or enhance their overall performance; BITU refers to the behavioral motivation that drives users to adopt a particular technology. In TAM, PU shows a relationship with self-reported current usage and self-predicted future use, while PEOU similarly correlates with present and anticipated future usage (Davis, 1989).

Over the years, TAM has been extensively applied to a wide range of technologies and application domains, and is recognized for being a valid, and highly predictive and robust model (Marangunić & Granić, 2015). The TAM was further enhanced and evolved over the years, for example into TAM2 (Venkatesh & Davis, 2000), and to the Unified Theory of Acceptance and Use of Technology (UTAUT, Venkatesh et al. (2003)), undergoing multiple adaptations for applicability in diverse contexts. Adapted versions focus on external variables describing influences outside the users' preferences or perceptions that impact their attitude toward a technology. Examples such as social influence, performance expectancy, resources, voluntariness, and demographics (Venkatesh et al., 2003) among others are commonly used, shaping users' attitudes and intentions on the adoption of a particular technology and their willingness and intentions to use it. For the educational sector for example, TAM's usefulness in explaining the key factors influencing technology adoption is well established (Salloum et al., 2019).

However, TAM has been criticized for its simplicity (Shachak et al., 2019), focusing on users' willingness to adopt a technology without further exploring the complexities of specific environments (Zhang et al., 2022). It is also criticized because of its main emphasis on technical and psychological dimensions, and less on the individual users' characteristics (Al-Adwan et al., 2023), favoring positive perceptions over negative attitudes (Dou et al., 2017). It was further noted that the extensive use of TAM may have led to a point of saturation, making it less likely to generate new insights (Shachak et al., 2019). Despite the criticism however, TAM and its extended versions are the most commonly used approaches to explore user technology acceptance. Especially within the context of correctional facilities, there is a very limited body of knowledge available, and this highlights the need for further investigation to understand and address the value of technology for education and training purposes.

TAM has been used for offender rehabilitation to enable the understanding of how offenders perceive and engage with technology (Mahlangu & Zivanai, 2023; Stamatiou et al., 2022) and to evaluate acceptance between VR and real training scenarios, with positive results (Alshaer, 2023). TAM was also used with correctional staff, for example, in using a mobile collaborative platform for sentence calculation (Nwokoye et al., 2024), electronic monitoring system (Nikani, 2018), and to improve service delivery (Gumisiro et al., 2018). Previous research on education and training of offenders reviewed high levels of perceived usefulness, ease of use, and enjoyment among offenders, for example, in the acceptance of E-Learning technology (Mahlangu & Zivanai, 2023). In particular, when VR-based training was compared to traditional methods, it demonstrated greater user acceptance, suggesting that VR represents a promising alternative for integration into training and rehabilitation services (Alshaer, 2023). It has been proposed that the use of TAM can help to address the gap between policy and practice in offender rehabilitation, helping to devise clear frameworks for designing and assessing evidence-based interventions that can positively influence the offenders training and lives in general (Mahlangu & Zivanai, 2023). Although early studies indicate that incarcerated individuals generally respond well to

digital tools, current knowledge of technology acceptance in correctional settings remains limited. Prisons present distinct constraints: restricted physical spaces, strict security protocols, and populations that often have lower digital literacy or heightened anxiety around unfamiliar technology. These conditions can alter how key TAM factors operate and can introduce additional variables that directly shape the user experience. Additional variables such as the quality of immersion, the onset of VR sickness, and levels of computer anxiety, may impact participants' responses to immersive experiences. For instance, poor immersion or discomfort from VR sickness could reduce engagement, while computer anxiety may limit willingness to participate. Understanding how these variables interact with traditional constructs is essential for building effective interventions, and detailed evidence base will allow practitioners to tailor VR to the realities of correctional environments, ensuring that programs not only meet institutional goals and support meaningful rehabilitation outcomes for participants.

3. Conceptual model and research hypotheses

To understand how offenders perceive the use of VR in their reintegration training, this study utilizes and extends the TAM to include the factors of Immersion, VR Sickness, and Computer Anxiety, proposing that these constructs may influence user technology acceptance perceptions in a correctional setting. Building on established theoretical frameworks and previous research, a series of hypotheses has been formulated. The basic constructs of TAM are Perceived Usefulness (PU), Perceived Ease of Use (PEOU), Attitudes Toward Using (ATU) and Behavioral Intentions to Use (BITU). The importance of usefulness and ease of use in explaining user attitudes and intentions to use a technology are widely accepted and validated in the literature (Abdullah & Ward, 2016; Lee et al., 2019; Wallace & Sheetz, 2014). Therefore, we begin the formulation of hypotheses with the following:

H1: *PEOU positively influences Perceived Usefulness (PU).*

H2: *PEOU positively influences Attitudes Toward Using (ATU).*

H3: *PU positively influences Attitudes Toward Using (ATU).*

H4: *PU positively influences Behavioral Intentions to Use (BITU).*

H5: *ATU positively influences Behavioral Intentions to Use (BITU).*

3.1. Enjoyment

Perceived enjoyment (Davis et al., 1992) relates to the fun or pleasure derived from using a technology (Venkatesh et al., 2003), and refers to the degree to which using a system is considered enjoyable, independently of any performance outcomes as a result of its usage (Davis et al., 1992; Venkatesh, 2000). Research suggests that technology usage is influenced by extrinsic (Perceived Usefulness—PU) and intrinsic (Perceived Enjoyment—PE) motivations (Zhou & Feng, 2017). Enjoyment is a system-specific conceptualization of intrinsic motivation, meaning that individuals engage with the technology for the inherent pleasure or satisfaction it provides, rather than external rewards or improved performance. It is an important determinant of Perceived Ease of Use (Venkatesh, 2000) and also has significant influence on the users' behavioral intention to use a particular technology (Zhou & Feng, 2017). Due to its recognized significance and impact on users' intentions to use technology, Perceived Enjoyment has been frequently included as a key variable in various extensions of the original TAM (Hsiao & Yang, 2011). Various studies exploring the use of VR highlight enjoyment as an important factor influencing the users' behavioral intentions to use the system (Lee et al., 2019; El Shamy & Hassanein, 2017). Drawing on existing research, and considering the importance of Perceived Enjoyment in TAM, we propose the following hypotheses:

H6: *PE positively influences Perceived Ease of Use (PEOU).*

H7: *PE positively influences Perceived Usefulness (PU).*

H8: *PE positively influences Attitudes Toward Using (ATU).*

3.2. Immersion

One of the key affordances of VR is the sense of immersion and presence the user develops while experiencing the technology. Immersion refers to *"the degree which the range of sensory channel is engaged by the virtual simulation"* (Kim & Biocca, 2018), indicating how deeply a user is involved in a virtual experience through sensory input. Presence is a 'perceptual illusion' (Slater, 2018) defined as *"the subjective experience of being in an environment when physically situated in another"* (Witmer & Singer, 1998), reflecting the psychological perception of 'being in' the virtual space rather than the physical one (Sheridan, 1992; Steuer, 1995). Although presence and immersion are often used interchangeably, they are different (Slater, 2003, 1999). Presence depends on the user's subjective perception where immersion is determined by the technological capabilities that replace real sensory stimuli with artificial, leading to presence (Slater, 2018; Slater & Wilbur, 1997). Immersion is a multi-dimensional construct that can be found in technology, physical sensation, and psychological responses, ranging from the feeling of being physically immersed in a computer generated experience, to being immersed in real life (for example immersed underwater), and to being captivated by a book's story (Sherman & Craig, 2018). Immersion develops through three key stages: (1) the *Engagement* stage where the user is initially involved with the virtual environment; (2) the stage of *Engrossment* where the user develops emotional connection and masters the system controls; and (3) to finally *Total Immersion,* characterized by a strong sense of presence, where the higher levels of immersion lead to a stronger sense of presence (Jennett et al., 2008)

Previous studies focused on the impact of immersion on acceptance, revealing that it significantly affects users' behavioral intentions to use VR (Disztinger et al., 2017), it has strong positive links with perceived usefulness (Hsiu-Mei Huang & Lai, 2016), and direct influence on perceived ease of use (Barrett et al., 2021). Considering the existing literature and previous theoretical frameworks, in this study we consider Immersion (IMRSN) as the feeling of being included in a virtual experience driven by the degree to which the range of sensory channels are engaged by the virtual simulation as defined by Kim and Biocca (2018), developing a sense of engagement and the feeling of being present in the virtual setting. Based on this, the following hypotheses have been formulated:

H9: *IMRSN positively influences Perceived Enjoyment (PE).*

H10: *IMRSN positively influences Behavioral Intentions to Use (BITU).*

3.3. VR sickness

One of the key challenges that affect user comfort and hinder the wider practical adoption of VR technology is VR Sickness (VRS). VRS is a type of Motion Sickness (MS) users experience during or after the use of a VR system, developing symptoms such as headaches, vertigo, disorientation, nausea, eye strain, and fatigue (Davis et al., 2014; Keshavarz et al., 2015; LaValle, 2023). VRS arises from sensory conflicts induced by virtual stimuli, and is often referred to as Visually Induced Motion Sickness (VIMS) (Keshavarz et al., 2015). The term "Cyber Sickness" was initially used to describe this form of discomfort in virtual environments, however the term has expanded over the years to include a variety of issues related to digital technology (LaValle, 2023), making the term VR Sickness a more specific descriptor for the symptoms linked to VR experiences.

Ongoing research investigates the causes of VRS and reliable measurement tools and strategies of mitigation (Sepich et al., 2022). Over the years, several factors have been identified as potential contributors (Ibánez et al., 2016; Monteiro et al., 2020; Serge & Moss, 2015), and are mostly categorized into three domains: hardware and its configuration, VR software and its content, and the individual user susceptibility to VRS (Davis et al., 2014; Rebenitsch, 2015). Efforts to reduce symptoms frequently involve best practices such as adjusting the field of view, using rest frames or dynamic depth of field, time dilation techniques within the virtual environment among others (Nisiotis et al., 2024; Wang et al., 2023). However, some of the mitigation techniques used (for example blurring or restricting the user's field of view) can reduce the overall fidelity and quality of the experience.

Prior studies have shown that users' intention to use VR is positively influenced by Perceived Usefulness (PU) and negatively affected by VRS (Sagnier et al., 2020). Furthermore, VRS has been identified as a significant barrier to continued use of immersive technologies, as it can disrupt the user experience and lead to avoidance of VR altogether (Al Khalifah et al., 2025; Diels & Howarth, 2013; Lin & Parker, 2007). In addition, recent work suggests that VRS negatively impacts Perceived Ease of Use (PEOU) and Perceived Usefulness (PU) (Alnagrat et al., 2023), further impacting technology acceptance. A negative correlation between VRS and anxiety is also identified, implying that more anxious users may approach VR more cautiously, potentially affecting their engagement (Al Khalifah et al., 2025). Building on the existing body of literature and our conceptual model, the following hypotheses were formulated:

H11: *VRS negatively influences Immersion (IMRSN).*

H12: *VRS positively influences Computer Anxiety (CANX).*

H13: *VRS negatively influences Behavioral Intentions to Use (BITU).*

H14: *VRS negatively influences Attitudes Toward Using (ATU).*

H15: *VRS negatively influences Perceived Enjoyment (PE).*

3.4. Computer anxiety

Anxiety is a negative emotion linked to feelings of worry, concern, and nervousness. It is often associated with low self-esteem, risk aversion, and inhibition, and can manifest at varying levels of intensity (Brown, 2007). Technology anxiety has been characterized as "*an individual's apprehension, or even fear, when faced with the possibility of using computers*" (Venkatesh, 2000). It is defined as the fear of using computers (or technology) and/or the possibility of doing so (Chua et al., 1999), and is in general a negative response toward the use of technology (Rajak & Shaw, 2021). Such type of anxiety (Computer Anxiety—CANX) has been attributed to concerns regarding negative outcomes linked to emotional reactions, potentially leading to computer damage or unreasonable behavior (Rahman et al., 2019). Several studies have been examining the effects of CANX on perceived usefulness (PU), where some reported that CANX significantly impacted PU, while other studies did not (Abdullah & Ward, 2016). Similarly, Saadé and Kira (2009) identified a direct influence of CANX on perceived ease of use (PEOU), but computer self-efficacy can mitigate these effects. Consequently, CANX reflects a negative response to using new technologies (Rajak & Shaw, 2021), and earlier work by Venkatesh and Bala (2008) suggests that such anxiety negatively affects PEOU. Studies also indicate that CANX generally lowers PEOU without significantly impacting PU (Ibili et al., 2019; Venkatesh, 2000), but other research (Rajak & Shaw, 2021; Zheng & Li, 2020) shows that CANX can negatively influence both PEOU and PU. These mixed findings highlight that the role of computer anxiety in shaping user perceptions of technology may vary depending on context and population. Based on these insights, we hypothesize the following:

H16: *CANX negatively influences Perceived Enjoyment (PE).*

H17: *CANX negatively influences Behavioral Intentions to Use (BITU).*

H18: *CANX negatively influences Immersion (IMRSN).*

4. Research methodology

Considering the abovementioned hypotheses, a modified TAM was developed to evaluate acceptance of VR as a tool to support offenders in their reintegration training, examining key factors influencing the adoption and effective use of VR technology. In addition to the standard factors of Ease of Use, Perceived Usefulness, Enjoyment, Attitudes Toward Using and Behavioral Intentions to Use VR, the factors of Immersiveness, Computer Anxiety, and VR Sickness are incorporated. The aim is to develop

a comprehensive understanding of how comfortable, effective and meaningful VR is for participants, its suitability, and impact in supporting offender rehabilitation training. To examine the extent to which immersion, perceived enjoyment, computer anxiety, and VR sickness are associated with offenders' acceptance and intended use of immersive VR for reintegration-oriented training, we studied participants' experiences of the *RECOMMIT VR* environment within a mixed-methods research design.

4.1. Research design

To explore the research question and test the proposed hypotheses, the *RECOMMIT VR* experience was developed by the University of Central Lancashire, Cyprus, as part of the RECOMMIT project. RECOMMIT (woRksitE COMMunIcaTion https://recommit-project.eu/) was a 2 year project funded by the European Commission through Erasmus+ programme aiming to support incarcerated individuals' reintegration through structured Interpersonal-Communication-Skills (ICS) training, delivered with the support of immersive VR scenarios and complemented by targeted prison-staff workshops. Partner organizations in Greece [1], Cyprus [2], Romania [3], and Spain [4] worked with local prisons through three coordinated phases: (1) *Needs analysis*: interviews, focus groups, and document reviews identified common work-related communication challenges and the key interpersonal skills (ICS) prerelease inmates require; (2) *Curriculum and VR design*: those findings informed a flexible syllabus and an immersive VR platform featuring realistic workplace and civic scenarios; and (3) *Staff capacity building*, where correctional educators and officers completed a train-the-trainer programme to improve their own ICS, share common civic values, learn how to use the VR experience and ensure consistent VR-curriculum delivery across nine institutions (one in Cyprus, Greece, and Romania, and six in Spain). The training sessions included prerelease inmates who enrolled in scheduled reintegration courses and completed a sequence of VR sessions embedded within a 10-week training programme (sessions frequency and duration detailed in Section 4.6).

4.2. Curriculum development

RECOMMIT is a reintegration programme for incarcerated individuals approaching release. The curriculum is designed to teach interpersonal skills that will serve them in workplace reintegration, targeting topics like personal values, active listening skills, conflict and emotion management, prosocial responses and behaviors, interpersonal boundaries and request making, social problem-solving and decision-making, etc. This training programme combined experiential activities and the use of VR for practising skills.

4.2.1. RECOMMIT VR *experience*

RECOMMIT VR is an immersive VR experience developed by University of Central Lancashire, Cyprus (UCLan Cyprus), to support the delivery of the project workshops. The immersive experience was designed to provide to incarcerated individuals with structured exposure to workplace and social communication scenarios relevant to reintegration training. The experience combined scenario-based and gamified learning activities intended to support engagement with the training content. It was developed iteratively with feedback and contributions from expert trainers and psychologists from the participating countries to develop VR scenarios relevant and effective for rehabilitation purposes. The content was created in English and translated into Greek, Romanian and Spanish. The VR experience was developed to complement the rehabilitation training program and featured a series of structured levels. An *Orientation Level* introduced users to the VR system and its controls, incorporating simple activities based on Acceptance and Commitment Therapy (ACT) principles. At first, users experienced the *"Introductions to Value Systems"* level, helping them to explore various values interactively and create a "valued self" through puzzle activities. The next level focused on "*Listening Skills,"* and in particular on active and empathic listening using work-related videos, Q & A tasks, and dialogue-based activities with virtual agents. A *"Disclosure"* level was designed to engage participants in a simulated interview setting with virtual characters to practice disclosure strategies. Participants also experienced the *"Conflict Management"* level, delivering key concepts through videos, puzzles, and a mini-game matching facial expressions to emotions. Finally, an *"Interpersonal Boundaries"* level was designed to address

workplace interactions through dialogue scenarios, tackling challenges like requesting leave or managing lateness. Each level was implemented across 2–3 sessions according to the topic, complementing an overall rehabilitation training program of 10 modules delivered across 20 sessions. To ensure accessibility to participants who could not or refused to use VR during the training, and enable them to participate and still benefit from the program, a PC version of the VR experience was also created.

The *RECOMMIT VR* experience was developed using Unity 3D, specifically targeting the Meta Quest 2 platform. Users were able to navigate and interact with the environment, digital objects and virtual humans, watch videos, listen to music, and engage with several interactive objects through the VR controllers (Figures 2 and 3). To enhance the realism of virtual characters, NVIDIA's Audio2Face tool was employed for generating high-fidelity lip synchronization, ensuring accurate character animations during dialogues. Furthermore, the *"Disclosure Level"* was uniquely developed in Unreal Engine, utilizing Metahuman characters and the Metahumans SDK for high-fidelity lip synchronization and voice generation across all supported languages (English, Greek, Romanian, Spanish).

Before executing the training sessions in the respective correctional settings, a pilot study was carried out during a project transnational meeting with 25 academics, trainers and psychologists. Participants completed a full VR session using a think-aloud protocol and provided written play-testing feedback, identifying some usability and content issues. A second pilot took place at a dedicated "train-the-trainer" workshop, where prison trainers tested the updated version of the VR experience, validating its usability and content as ready for deployment.

4.3. Data collection instruments

A mixed research methods approach has been employed in this study. For the quantitative data phase, the data collection instruments used were established measures adapted from prior research. Perceived Enjoyment (PE) was measured using items from Venkatesh and Davis (2000). Perceived Usefulness (PU), Perceived Ease of Use (PEOU), and Behavioral Intention to Use (BITU) were based on the Technology Acceptance Model (TAM) by Davis (1989). Attitude Toward Use (ATU) was measured using items adapted from Fussell and Truong (2022). Immersion (IMRSN) was assessed using items 22

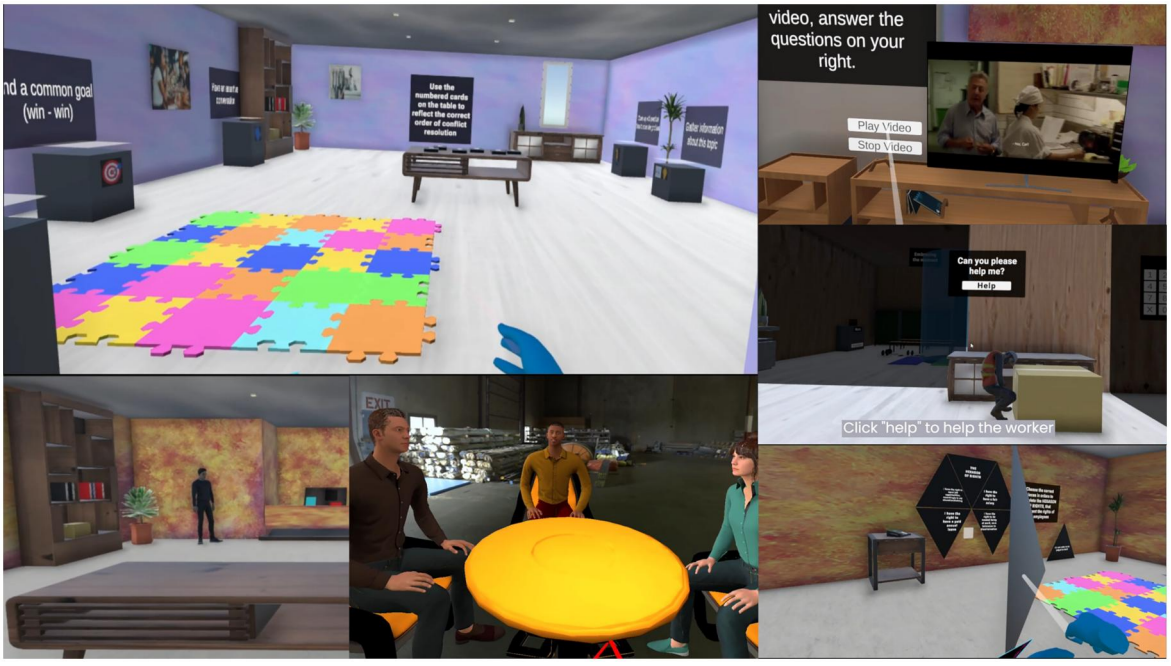

Figure 2. Screenshots from the *RECOMMIT VR* interpersonal communication training VR tool used in correctional settings in this study. The experience includes interactive environments, video-based scenarios, group dialogue simulations, and gamified progression tasks in VR designed to support engagement, civic reflection, and workplace communication skills among incarcerated individuals.

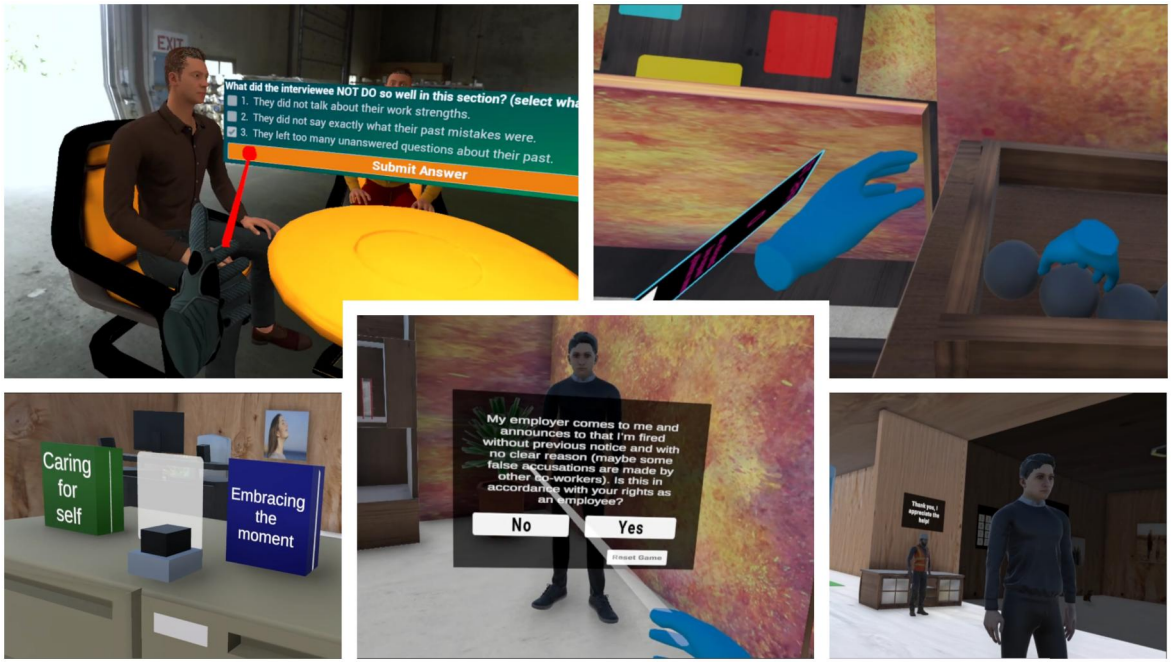

Figure 3. Example screenshots from the *RECOMMIT VR* experience illustrating immersive interactions between users, virtual agents, and the learning environment. Multiple themed rooms are designed to support interpersonal communication and reintegration training, each equipped with scenario-based videos, dialogue activities, and interactive educational materials.

and 23 from the work of Hamari et al (2016) and items 24 to 26 from Barrett et al (2021). Computer Anxiety (CANX) was measured using the instrument developed by Venkatesh and Bala (2008). Finally, VR Sickness (VRS) was evaluated using the Virtual Reality Sickness Questionnaire (VRSQ) by Kim et al. (2018). The original VRSQ is typically administered immediately before and after VR exposure to capture short-term visually induced symptoms. In the present study however, the instrument was implemented for retrospective post-programme use so that participants could report the extent to which the use of VR had occasionally caused specific symptoms across the full set of training sessions. This adaptation was made because the programme was delivered over many sessions across multiple correctional institutions, and repeated symptom measurement before and after each exposure would have introduced substantial logistical burden and disruption to programme delivery. Accordingly, the VRS items in this study were adapted as an overall self-reported scale indicating perceived discomfort across the programme, rather than as equivalent to the standard immediate pre/post administration of the VRSQ.

All data collection instruments utilized a 7-point Likert scale, and the questionnaires were administered to participants only after completion of the full training programme (see Supplemental Appendix A). A post-programme administration strategy was adopted because repeated questionnaire administration within correctional settings would have increased participant burden, interrupted workshop flow, and introduced additional logistical constraints across institutions. As the study aimed primarily to examine participants' acceptance and overall perceptions of VR after sustained exposure, the measures were collected at the end of the programme to capture the experience as a whole. After the quantitative phase, a follow-up qualitative study was conducted to capture participants' subjective learning experiences. Semi-structured interviews were held with prerelease inmates who completed the VR curriculum and with facilitators who delivered the sessions using parallel question sets on learning outcomes, behavioral change, the VR experience, and programme strengths and weaknesses. All conversations were hand-transcribed by a transcription assistant (in accordance with correctional institution rules prohibiting recording devices) and anonymized for thematic analysis. The complete interview and case-study guides are provided in Supplemental Appendix B.

4.4. Qualitative analysis

The qualitative analysis aimed to contextualize the quantitative acceptance findings by exploring how detainees and facilitators perceived the VR-supported training, which aspects they found useful or difficult, and what implementation issues emerged during delivery across sites.

Semi-structured interviews were conducted in the local language at each institution by trained project staff using a common interview guide. Because audio recording devices were not permitted in the correctional settings, each interview was attended by an interviewer who produced a written record of the discussion in real time. The resulting transcripts were anonymized locally before analysis, with names and institution-specific identifying details removed. Two interviewers were involved in the process with one sitting discreetly on the side and producing a transcript of the discussion in real time. Interview materials from the participating countries were translated into English for cross-site analysis. Local research teams reviewed translated extracts to ensure that the meaning of participants' responses had been preserved.

Data were analyzed using thematic analysis, following a reflective multi-stage process. Initial coding was primarily inductive, allowing themes to emerge rather than being imposed directly from the quantitative model, although attention was also paid to topics relevant to technology acceptance, perceived value, barriers, and implementation. Two members of the research team independently reviewed the transcripts to develop an initial coding structure. The researchers then compared codes, discussed differences in interpretation, and agreed a shared coding framework. Coding disagreements were resolved through discussion among the research team until agreement was reached. Related codes were then grouped into higher-level themes, which were reviewed against the dataset and refined iteratively to ensure internal coherence and distinction across themes. The final themes reported in the manuscript focus on participants' perceptions of usefulness, engagement, discomfort, and implementation challenges, as these were most relevant to interpreting the quantitative findings and drawing practice-oriented conclusions.

4.5. Participants

A total of 73 prerelease incarcerated individuals were enrolled in the RECOMMIT training programme across the participating institutions. Of these, 72 provided consent for their data to be used for research purposes, while 1 did not consent. Among those who consented, 70 completed the post-programme questionnaire. One questionnaire was excluded because of incomplete data, resulting in a final quantitative sample of 69 participants included in the statistical analyses comprised of 49 male and 20 female participants. The mean age of male participants was 36.04 years, and the mean age of female participants was 34.45 years. Within the final sample ($N = 69$), 4 participants were from Cyprus, 22 from Greece, 20 from Romania, and 23 from Spain. In terms of recent employment background, 39 participants reported having been in full-time employment in the past year, 8 reported part-time employment, 9 reported no employment for longer than one year, 4 reported remote work, 4 reported being students only and 5 participants did not report employment background. Regarding custodial sentence length, sentence information was available for 66 participants, as three participants did not report this information. Among those who reported sentence length, 5 participants reported 5 to 12 months, 13 reported 13 to 24 months, 10 reported 25 to 36 months, 11 reported 37 to 48 months, 5 reported 49 to 60 months, and 25 reported more than 5 years. 48 participants reported that their current sentence was their first offense, while 21 participants reported having previous sentences.

The programme was delivered locally by trained facilitators involved in prison education and reintegration support across the participating countries. These facilitators included professionals such as trainers, educators, and psychology or rehabilitation related staff working with the partner organizations and correctional institutions. Before implementation, they participated in a train-the-trainer process covering the RECOMMIT curriculum, session delivery procedures, and practical use of the VR equipment. Their role was to guide the sessions, support participants during VR use, and manage the local delivery of the programme within the operational constraints of each institution.

Ethical approval for the study was obtained centrally from the Ethics Committee of the University of Oradea (Romania) and the relevant institutional bioethics committees in each participating country.

Special access to the prisons for trainers and the necessary equipment was secured through collaboration with the prison administration. The selection of incarcerated individuals to participate was completed according to the following criteria: (1) Participants should be incarcerated individuals that have up to 2 years until release; they should be eligible for release and have no disciplinary act outs; (2) should have participated in working activities inside and outside penitentiary; (3) have no medical condition that is incompatible with VR; (4) do not use medication that prevents them from using VR; (5) must give their consent for the participation in the project activities; and (6) have minimal reading and writing skills at least at completed secondary level of education. Prison administration in each respective institution was informed of the program, and incarcerated individuals who met the criteria were accordingly informed and enrolled in the program. For the post training qualitative study, a total of 12 incarcerated individuals (Spain = 2, Romania = 2, Greece = 5, Cyprus = 3) and 12 facilitators (Spain = 4, Romania = 2, Greece = 2, Cyprus = 4).

4.6. Experimental procedures

Trainers/facilitators conducted the study within the prison setting over a period of 10 weeks, delivering a session twice a week, for a total of 20 sessions. Each session concluded with a VR training part, during which participants engaged with the VR system for 20 to 40 minutes. To ensure smooth operation and participant safety, the trainer monitored the VR experience in real time through projecting the VR content onto a screen via a cable connection for immediate observation and intervention if needed. At the end of the full series of sessions, participants were asked to complete a post-experience questionnaire to provide feedback on their perceptions and experiences with the VR training.

All interviews were conducted after the training sessions, with participants who had provided consent at each correctional institution. A preplanned interview schedule guided the discussions, which covered conceptual, experiential learning and participants' experience with the VR components of the program. Each interview was attended by the interviewer and a transcription assistant, who transcribed the conversation in real time. Interviews lasted between 30 and 45 minutes.

The logistical setup of the VR intervention required close coordination with each correctional institution. Access to the equipment had to be approved locally, and sessions were scheduled around institutional routines, staff availability, and security procedures. Headsets, controllers, and supporting hardware were transported, checked, and prepared in accordance with each prison's local requirements, and storage and access arrangements varied by site depending on available secure space and operational permissions.

5. Results

5.1. Technology acceptance evaluation results

We first assessed the normality of the data using the Shapiro–Wilk test and visual inspection. Results indicated that most factors, with the exception of PEOU and IMRSN, deviated from normality ($p < 0.005$). Accordingly, descriptive statistics are reported using medians (Mdn) and interquartile ranges (IQR), and bivariate relationships were examined using Spearman's rank-order correlations. For model-based hypothesis testing, we used Partial Least Squares Structural Equation Modeling (PLS-SEM), which is appropriate for smaller samples and non-normal data distributions. The reliability of the TAM scales, as well as those used in this modified version, has been previously validated by their original authors. To confirm data reliability, we calculated the Cronbach's alpha coefficient, which demonstrated high internal consistency across the items in each factor scale (see Table 1).

Data analysis began with exploring descriptive statistics. Based on the collected data, participants generally exhibited positive perceptions toward VR acceptance across all measured factors (Table 1). Participants positively rated Perceived Enjoyment (PE: Mdn = 6, IQR = 2), and Perceived Ease of Use (PEOU: Mdn = 5.50, IQR = 3), suggesting that participants enjoyed and generally found the VR system easy to use. Similarly, Perceived Usefulness (PU: Mdn = 5.88, IQR = 2) indicated that participants largely agreed on the practical benefits of VR in their reintegration training, viewing it as a valuable tool for its intended purpose. Participants also showed favorable Attitudes Toward Using (ATU: Mdn

= 6.00, IQR = 2), indicating that they evaluated the use of VR in reintegration training positively. This pattern was complemented by high Behavioral Intentions to Use (BITU: Mdn = 6.00, IQR = 2), suggesting a strong reported willingness to use the technology in the future. In terms of Immersion (IMRSN: Mdn = 5.40, IQR = 2), participants reported high levels of immersion with the VR environment, suggesting that the system successfully captured their attention and created an immersive experience. Additionally, the data for Computer Anxiety (CANX: Mdn = 2.00, IQR = 2.25) suggests low levels of anxiety among participants, indicating confidence and comfort when interacting with the VR technology. VR Sickness (VRS: Mdn = 2.55, IQR = 2.58) revealed relatively low scores indicating that participants experienced minimal symptoms of VR sickness during the sessions in general, implying that the VR system was generally comfortable to use for most participants. Analyzing the frequency distribution of the VRS scores revealed that a significant proportion of participants (21.8%) reported no symptoms of VR sickness, and cumulatively, over half of the participants (approximately 52.7%) had reported VRS scores of 2.00 or lower, demonstrating that the majority experienced little to no discomfort. 27.3% experienced higher levels of discomfort (>4), suggesting that although the VR system was generally well-tolerated, a subset of participants reported symptoms. A small percentage of participants (3.6%) reported an overall significant VRS score of 7, however no participants were reported to drop out due to discomfort. This distribution suggests that while most participants found the VR experience comfortable, a minority experienced notable discomfort, which should be addressed in future system enhancements to improve user comfort and reduce VR sickness symptoms. Overall, the evaluation findings highlight participants' positive perceptions of VR acceptance as a tool to support their reintegration training, with high enjoyment, usability, perceived usefulness, and intentions to use, coupled with low anxiety, low VR Sickness symptoms, and high immersion levels.

The constructs were then investigated for correlations between them (Supplemental Appendix C: Table C1). A Spearman's rank-order correlation analysis was performed revealing significant relationships among all constructs, indicating strong inter-dependencies in participants' perceptions toward evaluating VR acceptance. The results concerning participants BITU of VR for training, demonstrated statistically significant positive associations with all factors. Perceived enjoyment (PE) showed the strongest correlation with BITU ($\rho = 0.760$, $p < 0.001$), together with Perceived Usefulness (PU: $\rho = 0.691$, $p < 0.001$), and Positive Attitudes Toward Using (ATU: $\rho = 0.675$, $p < 0.001$), followed by Perceived Ease of Use (PEOU: $\rho = 0.530$, $p < 0.001$), indicating relation to participants' intentions to adopt the VR system for training purposes. The sense of Immersion (IMRSN) experienced by participants was also positively associated with BITU ($\rho = 0.646$, $p < 0.001$), implying that immersive VR environments can boost willingness to use the technology. Computer Anxiety (CANX) was negatively correlated with BITU ($\rho = -0.489$, $p < 0.001$), suggesting that higher levels of VRS are associated with lower intentions to use the VR system, indicating that participants who experienced more symptoms of VRS were less inclined to adopt the technology. Overall, considering the BITU scores and statistical correlational significances in conjunction with the rest of the acceptance factors, evidence suggests that participants highly accepted VR as a tool to support their reintegration training.

To further investigate our hypotheses, we used Partial Least Squares Structural Equation Modeling (PLS-SEM) approach, due to our small sample size and the non-normal distribution of our data. PLS-SEM is a versatile approach to structural equation modeling that is applicable in a range of situations (Hair et al., 2014) and commonly used in TAM analysis research. It is less restrictive concerning sample size (Haenlein & Kaplan, 2004) and data distribution (Chin, 1998) compared to other modeling methods. We conducted the analysis using SmartPLS 4 software. Consistent with recommended procedures (Hair et al., 2014), we first assessed the internal consistency, convergent validity, and discriminant validity of the measurement model, and upon satisfactory results, we utilized the structural model to test our hypotheses. To assess the quality of the constructs we used Composite Reliability (CR) in addition to the already reported Cronbach's alpha for internal consistency. CR takes into account the outer loadings of each item and should have values above 0.7 (Hair et al., 2011). For convergent validity, we examined factor loadings and the Average Variance Extracted (AVE). Recommended thresholds for factor loadings are to be greater than 0.7, and AVE values above 0.5 (Hair et al., 2014). To assess discriminant validity, we first applied the Fornell-Larcker criterion (Fornell & Larcker, 1981), which compares

Table 1. Combined descriptive and reliability results.

Scale	Median	IQR	Max	Min	Cronbach's α	Items	CR	AVE
Perceived Enjoyment (PE)	6.00	2.00	7	2.00	0.842	6	0.899	0.606
Perceived Ease of Use (PEOU)	5.50	3.00	7	2.00	0.860	4	0.901	0.696
Perceived Usefulness (PU)	5.88	2.00	7	2.00	0.899	4	0.931	0.772
Attitudes Toward Using (ATU)	6.00	2.00	7	2.00	0.828	3	0.891	0.734
Behavioral Intentions to Use (BITU)	6.00	2.00	7	2.00	0.949	4	0.966	0.876
Immersion (IMRSN)	5.40	2.00	7	2.00	0.850	5	0.889	0.616
Computer Anxiety (CANX)	2.00	2.25	6.5	1.00	0.811	4	0.875	0.640
VR Sickness (VRS)	2.55	2.58	7	1.00	0.920	9	0.930	0.599

the square root of the AVE for each construct with its correlations with other constructs. Discriminant validity is confirmed when the square root of the AVE for a construct exceeds its correlations with other constructs (Chin, 1998). We then utilized the Heterotrait-Monotrait Ratio (HTMT) (Henseler et al., 2015), which requires HTMT values to be significantly less than 1. All factor loadings met the preferred >0.7 criterion except for PE4, ATU3, VRS1, and CANX1 (Supplemental Appendix C, Table C2). Rather than removing these items, we decided to retain them to ensure the reliability and content validity of the scales, as these items have been previously validated in other studies, and removing them could compromise the theoretical integrity and comparability of our constructs. However, the relatively low loading of PE4 in particular indicates that this item may have captured a weaker or slightly different aspect of perceived enjoyment in this setting. A formal sensitivity analysis excluding the weakest items was not conducted; therefore, the measurement model should be interpreted with caution, and the robustness of the structural paths should be confirmed in future studies using larger samples and alternative reduced-item specifications. CR and AVE values were above their thresholds (see Table 1) confirming the quality of constructs. For the Fornell-Larcker criterion, the square root of each construct's AVE exceeded its correlations with other constructs. HTMT values were then inspected using conventional interpretive thresholds of 0.85 and .90. Most HTMT values were below 0.85, while PU–ATU (0.889), ATU–BITU (0.840), and PE–ATU (0.821) indicated relatively high conceptual proximity among acceptance-related constructs. The highest value, PU–ATU (0.889), exceeded the stricter 0.85 threshold but remained below the 0.90 threshold, suggesting that discriminant validity was acceptable but should be interpreted cautiously, especially for closely related TAM constructs.

To test the hypothesized relationships in our model, we employed a bootstrapping procedure for 69 cases using 5000 bootstrap samples and a two-tailed significance level of 0.05. The results are presented in Supplemental Appendix C - Table C4, while Figure 4 illustrates the relationships, path coefficients, and corresponding p-values within the research model. Figure 4 also illustrates the variance explained (R^2) for each construct in the SEM model, highlighting the model's explanatory power. Behavioral Intention to Use (BITU) shows high explanatory power ($R^2 = 0.682$), indicating that the predictors account for 68.2% of its variance. Similarly, Attitudes Toward Using (ATU) exhibits strong variance explained ($R^2 = 0.724$), while Perceived Usefulness (PU) demonstrates moderate explanatory power ($R^2 = 0.400$). Constructs such as Perceived Ease of Use (PEOU) ($R^2 = 0.215$) and Immersion (IMRSN) ($R^2 = 0.184$) show lower levels of variance explained, suggesting potential for model improvement. Computer Anxiety (CANX) has a very low variance explained ($R^2 = 0.099$), indicating insufficient predictors for this construct. As a general guideline, R^2 values can indicate the level of predictive accuracy in a model, in which values of 0.25 or lower are considered weak, values between 0.25 and 0.75 are regarded as moderate, and values above 0.75 are classified as strong (Hair et al., 2011). Therefore, the results suggest the model is robust for BITU and ATU but may require refinement for constructs with lower explanatory power.

Based on the hypothesized relationships and the results from the PLS-SEM analysis (Supplemental Appendix C, Table C4), PEOU was found to positively influence PU supporting H1, but its influence on ATU (H2) was not significant, suggesting that ease of use primarily affects perceptions of usefulness rather than attitudes directly. Perceived Usefulness (PU) significantly impacts Attitudes to Use (ATU) supporting H3, but its influence on Behavioral Intentions to Use (BITU) (H4) was not significant. Attitudes Toward Using (ATU) showed a positive association with BITU, providing only marginal support for H5 ($p = 0.050$). This relationship is in the expected direction, but given its borderline

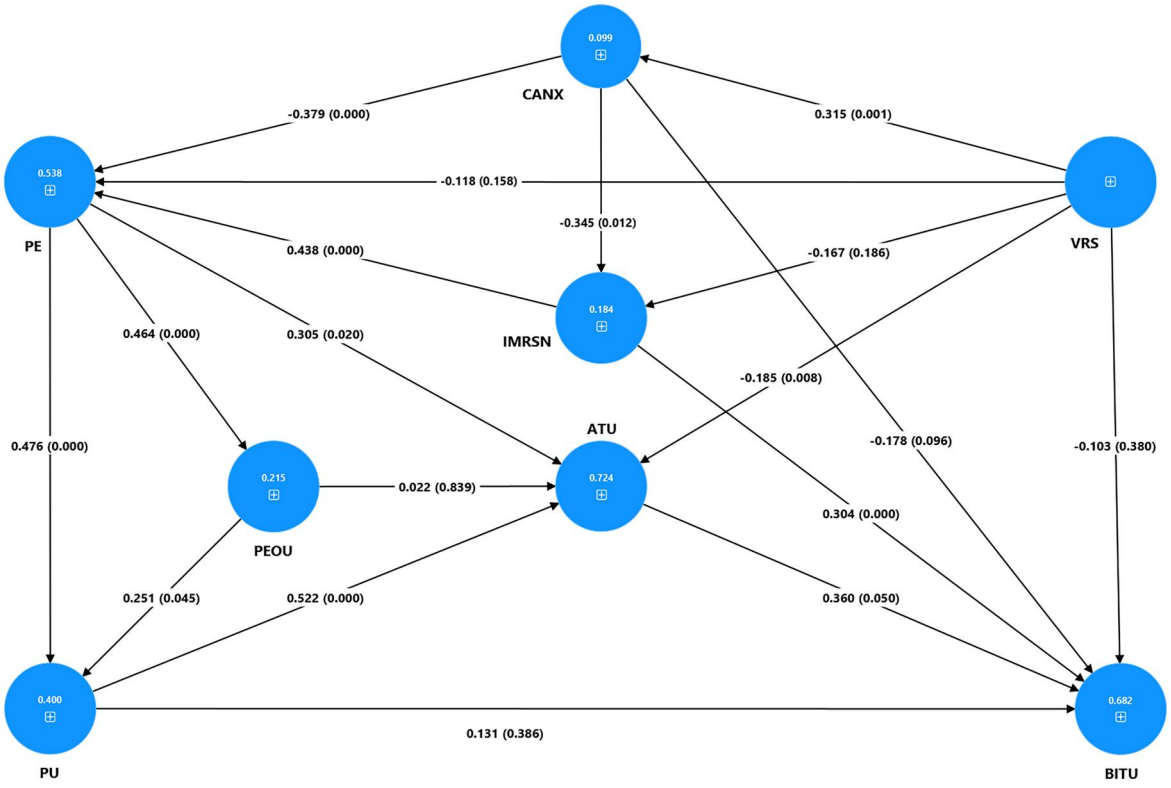

Figure 4. Model estimation results.

significance, it should be interpreted cautiously and confirmed in future studies with larger samples. Perceived Enjoyment (PE) significantly influences Perceived Ease of Use (PEOU), Perceived Usefulness (PU), and Attitudes Toward Using (ATU) VR, supporting H6, H7 and H8, highlighting the importance of enjoyment in shaping ease of use, usefulness, and attitudes. Immersion (IMRSN) was found to positively influence Perceived Enjoyment (PE) and Behavioral Intentions (BITU) supporting H9 and H10, suggesting that immersive experiences enhance enjoyment and drive behavioral intentions. Regarding VR Sickness (VRS), the hypotheses of negative influence on Immersion (IMRSN, H11), Behavioral Intentions to Use (BITU, H13), and Perceived Enjoyment (PE, H15) were not supported, but it significantly increases Computer Anxiety (CANX), supporting H12. It also negatively influences Attitudes to Use (ATU) confirming H14, suggesting that VR sickness is driving attitudes toward the use of VR technology. Finally, Computer Anxiety (CANX) negatively influences Perceived Enjoyment (PE) and Immersion (IMRSN), confirming H16 and H18, highlighting the detrimental effect of anxiety on enjoyment and immersion. However, the hypothesis of negative influence on Behavioral Intentions to Use (BITU, H17) was not significant, indicating that anxiety does not directly affect behavioral intentions to use the VR system.

5.2. Interview results

Thematic analysis identified four recurring themes across detainee and facilitator comments: (1) perceived relevance of VR for real-world preparation, (2) novelty and engagement of immersive delivery, (3) initial discomfort and acclimatization, and (4) implementation and facilitation challenges in prison settings.

5.2.1. Perceived relevance and engagement

The majority of the incarcerated individuals commonly described VR as a novel and engaging way of learning, particularly valuing the simulated interview, workplace behavior, and conflict-resolution scenarios. Many participants viewed these activities as useful for preparing for real-life situations and increasing their confidence: "*The opportunity to use VR during the training was a game-changer for me. It*

allowed us to experience real-life scenarios, such as job interviews and different workplace situations, in a way that went beyond just theory." Facilitators similarly emphasized the practical value of the role-play elements, especially the interview scenarios: *"The job interview in the virtual environment was the most useful for the interns."*

5.2.2. Initial discomfort and acclimatisation

Some incarcerated individuals reported unease when first using the headset, particularly dizziness or unfamiliarity with the equipment: *"I felt dizzy at the beginning of using the headset, as I was not used to it."* However, these comments were often followed by reflections that the experience became easier and more worthwhile after initial exposure: *"This was a completely new way of learning for me, and although it felt strange at first, I began to appreciate the immersive aspect that VR brings to training."* Facilitators also noted that occasional discomfort could interrupt session flow.

5.2.3. Implementation and facilitation challenges

Facilitators highlighted practical barriers related to prison infrastructure, technical setup, and participant support. These included limited IT support, the need to adapt materials for varying literacy levels, and the need for stronger staff preparation for delivering the VR component: *"The lack of IT support made it difficult to install and use the VR equipment properly,"* and *"We had to adapt materials because the ones provided were too complex for some inmates."* Despite these challenges, facilitators perceived participants as becoming more communicative and more future-oriented during programme delivery: *"I noticed that they communicated more between themselves… For sure, their communication skills improved."* They also described perceived increases in confidence and motivation: *"I observed that the participants showed an increase in their motivation and confidence. They started to set employment goals and develop a more proactive attitude towards their future."* However, these comments should be interpreted as facilitator perceptions based on session delivery and interaction with participants, rather than as independently measured behavioral outcomes.

6. Discussion

VR has become an established tool for workplace and skills training, yet its acceptability within correctional settings remains under-explored. The present study contributes to this gap by examining how key user experience factors, namely Immersion, Enjoyment, Computer Anxiety, and VR Sickness, shape technology acceptance among incarcerated individuals participating in a reintegration programme delivered in real correctional settings across nine prisons in four countries. The findings align with prior work suggesting that VR can support immersive learning in correctional contexts (Collins et al., 2020), and extend this literature by showing that incarcerated individuals generally reported high acceptance, enjoyment, and perceived usefulness even under tight security constraints and limited technical support.

Qualitative feedback indicated that participants linked the VR sessions with concrete future goals such as job interviews, while facilitators perceived improvements in engagement, communication, and confidence during programme delivery. The usefulness of VR in the provision of practical skills in job interviews was, in fact, also observed in a previous study where incarcerated individuals experienced reductions in their interview-related anxiety and showed greater employment on a 6-month follow-up compared to a control group (Smith et al., 2023). Moreover, our qualitative findings on improved communication skills are consistent with results from other educational programs utilizing VR, which have focused on enhancing interpersonal competencies such as aggression regulation (Ivarsson et al., 2025; Woicik et al., 2023). While the present study did not assess behavioral change, skill transfer, or post-release outcomes directly, the findings provide evidence of perceived relevance, acceptance, and implementation feasibility.

The combination of high immersion, high enjoyment, and relatively low anxiety suggests that well-designed VR experiences may provide a supportive and engaging environment for practising difficult social situations without the immediate pressures of real-world consequences. Participants' positive ratings of immersion, enjoyment, and usefulness indicate that VR was perceived as an acceptable and relevant complement to workshop-based learning. In this sense, gamified and

immersive delivery may help make training feel more approachable for some individuals who have had limited or negative prior experiences with formal education (Alshaer, 2023). While these findings do not focus on rehabilitation outcomes or behavioral change, they suggest that immersive technologies merit further investigation as an acceptable and engaging delivery format within prison education and reintegration programmes. Nonetheless, the findings also highlight the need for basic technical troubleshooting and facilitator preparation, as facilitator comments indicated some level of anxiety and concern in terms of managing the technical complications within the prison setting. Notably, facilitators' challenges were also related to the technical proficiency of the trainers and the technical permissions provided in the correctional institution. For example, only two institutions had technicians on standby to support program application, while in the rest of the cases, trainers (who were not technicians) had to rely on the program's training and manuals to resolve any difficulties. Moreover, internet access was only provided in two institutions, while in the remaining, facilitators had to negotiate a wired connection to institutional PCs. Upon reflection, future studies considering the implementation of VR in this type of setting will need to preplan for ease of technical implementation and accessible technical support (see similar conclusions from Ivarsson et al (2025)), mainly to increase the confidence and reduce the administration anxiety of the professional educators. Taken together, the present study suggests that immersive VR can be feasibly incorporated into structured reintegration training, provided that deployment constraints, onboarding needs, and facilitator support are carefully addressed.

Considering the practical implications of the findings, the results provide a basis for considering VR modules as an acceptable and feasible complement to existing reintegration-oriented training programmes. Continued content refinement, careful management of VR sickness, and stronger facilitator support may improve participants' experience and support sustained engagement. The positive acceptance observed in this setting also suggests that VR may warrant further investigation in related criminal-justice training contexts, including staff development and structured reintegration support. However, future studies are needed to determine whether such interventions lead to measurable learning gains, skill transfer, or longer-term rehabilitation-related outcomes.

7. Conclusions, limitations and future work

This study explored the acceptance of VR technology among offenders in correctional settings, focusing on the key factors of Perceived Enjoyment, Immersion, VR sickness, and Computer Anxiety. By extending the Technology Acceptance Model theoretical framework methodology, the findings contribute to ongoing work focusing on understanding how detainees perceive and engage with immersive technologies during reintegration training.

A limitation of the current model lies in the relatively low explanatory power (ρ^2) observed for some constructs, such as Perceived Ease of Use (PEOU) and Computer Anxiety (CANX), suggesting that important predictors may be missing or are underexplored. Additionally, the model's reliance on specific constructs may not fully capture the complexity of user behavior or external contextual factors. Given the modest sample size, some structural estimates, especially marginal paths, should be interpreted cautiously and validated in future studies using larger samples and alternative model specifications. Future work could address these gaps by exploring potential moderating effects, refining measurement scales and extending the model to improve its predictive accuracy. A further limitation is the modest sample size for structural modeling. Although PLS-SEM was selected because it is appropriate for smaller samples and non-normal data, no formal power analysis was conducted, and the structural estimates should therefore be interpreted cautiously, particularly for borderline effects.

Another limitation concerns the multi-site nature of the study. The intervention was delivered across nine prisons in four countries, but prison site was not modeled as a clustering variable because of the modest and uneven sample across institutions. Site-level differences in infrastructure, staff support, facilitator experience, prison culture, security procedures, and participant selection may therefore have influenced participants' experiences and acceptance ratings. Future studies with larger and more balanced samples should examine site-level and country-level effects more explicitly.

From an implementation view, there were challenges related to participant engagement and curriculum adaptation. Some trainees had difficulty maintaining focus. Facilitators also reported difficulties in adapting the content to accommodate diverse educational levels and prior experiences among participants. To improve inclusivity and learning outcomes, future training programs should consider more adaptive instructional designs and incorporate mechanisms for personalized feedback. Accessibility to VR equipment also posed initial barriers for some incarcerated individuals unfamiliar with the technology. Short introductory sessions and gradual exposure to the equipment helped reduce discomfort, but additional onboarding interventions may further improve engagement and ease the learning curve. A further limitation is that all quantitative measures were collected at the end of the programme using a single self-report questionnaire. This design was selected for practical reasons related to participant burden and institutional constraints, but it limits interpretation due to possibility of common-method variance as all constructs were measured from the same respondents, at the same time, and in the same format, and that the design does not allow to distinguish participants' prior attitudes toward VR and technology from perceptions that were shaped through exposure to the programme itself. As a result, the findings should be interpreted as reflecting post-programme acceptance and perceived experience rather than changes attributable to the intervention over time. An additional limitation concerns the assessment of VR sickness. The original VRSQ was designed for immediate pre/post exposure administration, whereas in this study it was treated as a scale for retrospective reporting across multiple sessions. This approach was selected for pragmatic reasons related to the multi-session design and the operational constraints of the prison context, but it changes the nature of the measurement. The resulting scores should therefore be interpreted as participants' overall perceived discomfort across the programme rather than as a standard VRSQ estimate of acute post-exposure symptoms. This also limits direct comparability with prior studies using the instrument in its original format and may introduce recall bias or attenuation of short-term symptom variation across sessions.

Future research will focus on extending and validating the proposed model across a wider range of correctional settings, institutional structures, and participant profiles to examine its validity and generalizability. This includes testing the model in prisons with different operational constraints, technological infrastructures, and rehabilitation practices, as well as exploring its applicability in related reintegration contexts. Conducting longitudinal studies would also be valuable to assess whether the observed effects are sustained over time and whether engagement with the intervention contributes to longer-term changes in attitudes, confidence, digital readiness, or rehabilitation-related outcomes. In addition, future work will investigate the integration of generative AI and conversational agents into the VR activities to provide more personalized, adaptive, and scalable forms of learning support. This would allow the research team to examine whether AI-enhanced interaction can improve engagement, usability, perceived usefulness, and learning effectiveness compared with more static VR content. Further evaluation will therefore be needed to determine the pedagogical value, acceptability, ethical implications, and practical feasibility of incorporating these intelligent systems into correctional rehabilitation and training programmes.

In conclusion, this study provides insights into how VR can be accepted and practically deployed in correctional settings. Through the identification of key acceptance-related factors, the findings support the potential of VR as an engaging and feasible complement tool for reintegration-oriented training, and also highlighting the practical constraints that shape its implementation in prison environments. Based on the lessons learned and experience developed during this research, it can be suggested that the successful deployment of VR in correctional settings for training requires addressing specific barriers linked to digital literacy, session logistics, and user comfort. Based on our experience, we recommend the following considerations:

- *Simplify onboarding procedures* through structured VR introductory sessions using step-by-step demonstrations and familiarization time to reduce computer anxiety and initial discomfort, especially for users with limited digital experience.
- *Minimize VR sickness risks* through implementing technical optimization practices, consider navigation and interaction design principles, and exposure time. Inclusion of short breaks and static VR scenes for new users particularly during early sessions may be beneficial.

- *Align content with realistic and relatable VR scenarios* to reflect authentic workplace and civic situations relevant to incarcerated individuals' reintegration goals. Role-play and dialogue-driven tasks have shown to support skill transfer.
- *Adapt training materials to varying literacy levels* using simplified language, visual cues, and in-VR guidance to accommodate the wide range of educational backgrounds found in correctional populations.
- *Plan for institutional constraints and session logistics*. It is important to work closely with prison staff to align sessions with facility routines. Ensure equipment is portable, and easy to set up to accommodate for limited technical support and connectivity.
- *Support facilitators with focused VR training* on the technical use of the equipment and on how to guide sessions, address user discomfort, and adapt facilitation to emerging challenges.

The findings of this study contribute to the existing body of knowledge on technology acceptance in specialized training contexts. They can inform practitioners and policymakers on the key aspects to consider when implementing VR technologies in correctional training settings, supporting the efficacy of rehabilitation programs aiming for the successful offender reintegration into society.

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Author contributions

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No potential conflict of interest was reported by the author(s).

Ethical approval

Ethical approval was obtained from the Ethics Committee of the University of Oradea (Approval Code: 989/26.04.2024) and permission was also obtained from each correctional facility in each participating country. Participants were briefed and provided their informed consent in written form to participate in this project prior to interacting with any of the study materials.

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Informed consent

All authors consent for publication of this manuscript.

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