INFORMATICS JOURNALS

RESEARCH ARTICLE

©2026 The Academy of Environmental Biology, India

Journal of Ecophysiology and Occupational Health, Vol 26(4), *DOI: 10.18311/jeoh/2026/30033, 295-302, December 2026*

ISSN (Print) : 0972-4397
ISSN (Online) : 0974-0805

Awareness, Clinical Use and Technology Acceptance of Virtual Reality among Physiotherapists: A Cross-Sectional Survey Based on the Technology Acceptance Model

S. Kanchan[1*], Sheetal K. Rao[2] and Mayuri Shukla[3]

[1]Department of Cardio-Pulmonary, College of Physiotherapy, School of Health Sciences, Dayananda Sagar University, Bengaluru South District, Bengaluru - 562112, Karnataka, India; kanchan05shah@gmail.com

[2]College of Physiotherapy, School of Health Sciences, Dayananda Sagar University, Bengaluru South District, Bengaluru - 562112, Karnataka, India

[3]Nitte Institute of Physiotherapy, Nitte (Deemed to be University), Mangaluru - 575018, Karnataka, India

Abstract

Background: Virtual Reality (VR) is increasingly used as an adjunct in physiotherapy, but little is known about how physiotherapists use it and how useful and easy to use they perceive it to be. **Aim:** To describe awareness and clinical use of VR among physiotherapists and to assess their Perceived Usefulness (PU) and Perceived Ease of Use (PEU) of VR using the Technology Acceptance Model (TAM). **Methods:** In this cross-sectional survey, 96 physiotherapists (mean age 29.98±4.26 years; experience 5.53±3.82 years) from clinics, hospitals and rehabilitation centres in Bengaluru, India, were recruited by convenience sampling between February 2026 and July 2026. A TAM-based questionnaire recorded awareness and use of VR and six PU and six PEU items, each answered as slightly, quite or extremely (scored 1–3; subscale range 6–18). Spearman correlation, Mann–Whitney U and Kruskal–Wallis tests were used, with Holm correction for multiple testing. **Results:** All participants were aware of VR and 68 (70.8%) used it clinically, most often for stroke (35.3% of users), anterior cruciate ligament (17.6%) and cerebral palsy (17.6%) rehabilitation. For every item, 69–81% of respondents rated VR as quite or extremely useful or easy to use; median PU and PEU scores were both 12 (IQR 9.75–14 and 9–14). PU and PEU were not correlated ($\rho = 0.07$, $p=0.522$). PU was lower among hospital-based physiotherapists than among those in clinics (median 9 vs 12; $H=11.77$, $p = 0.003$; Holm-adjusted $p = 0.025$), whereas PEU was similar across settings. VR users tended to rate PU higher than non-users ($p = 0.062$), and PU and PEU did not differ significantly by qualification or gender. **Conclusion:** Physiotherapists in this sample were universally aware of VR, most used it clinically, and most rated it as useful and easy to use. Perceived usefulness was rated independently of perceived ease of use, and practice setting was its clearest correlate, pointing to hospital settings as a priority for implementation support. Larger, multi-centre studies using the full seven-point TAM scale and measuring training and access to equipment are recommended.

Major Findings: All 96 physiotherapists knew of VR and 70.8% used it, mostly for stroke, ACL and cerebral palsy. For every item, most respondents (69–81%) rated VR as quite or extremely useful and easy to use. Perceived usefulness was lowest in hospital settings.

Keywords: Perceived Ease of Use, Perceived Usefulness, Physiotherapy, Rehabilitation, Technology Acceptance Model, Virtual Reality

Abbreviations: VR – Virtual Reality; PU – Perceived Usefulness; PEU – Perceived Ease of Use; TAM – Technology Acceptance Model; ACL – Anterior Cruciate Ligament; BPT – Bachelor of Physiotherapy; MPT – Master of Physiotherapy; SD – Standard Deviation; IQR – Interquartile Range; CI – Confidence Interval; STROBE – Strengthening the Reporting of Observational Studies in Epidemiology.

Article Received on: 10.09.2026 Revised on: 23.10.2026 Accepted on: 26.10.2026

**Author for correspondence*

1. Introduction

Virtual Reality (VR) refers to computer-generated, interactive environments delivered either through immersive head-mounted displays or through non-immersive screen- and console-based systems. In rehabilitation, VR is used to provide repetitive, task-specific practice with real-time feedback on performance[1]. The evidence is strongest in stroke: a Cochrane review found that VR added to usual care improved upper-limb function, whereas VR used in place of the same dose of conventional therapy produced similar upper-limb outcomes, with a small benefit for activities of daily living[1]. A multicentre trial likewise found non-immersive VR gaming to be no more effective than simple recreational activities for upper-limb recovery after stroke[2]. VR has also been evaluated in gait rehabilitation[3], in home-based telerehabilitation for postural instability in Parkinson's disease, where VR exergaming was a feasible alternative to in-clinic balance training[4], and in chronic low back and neck pain[5], and its feasibility, usability and acceptability have been examined in patient groups[6,7]. Taken together, these studies position VR as a potential adjunct to, rather than a replacement for, conventional physiotherapy.

Bateni *et al.,* in their narrative review 'Use of Virtual Reality in Physical Therapy as an Intervention and Diagnostic Tool', examined 56 articles to give clinicians an overview of how VR is applied in physical therapy[8]. They reported that VR-based training was associated with improvements in balance and mobility measures, such as the Berg Balance Scale and the Timed Up and Go test, across several patient populations, with better gait speed in some studies of stroke and Parkinson's disease, and with reduced pain in patients with burns and in amputees with phantom limb pain. The review also highlighted the value of VR as an assessment tool for balance and postural control, for example in detecting balance deficits after mild traumatic brain injury, and its role in making exercise more engaging and enabling telerehabilitation. The authors concluded that VR is a promising tool for gait, balance and pain management, but that further research is needed to establish its effectiveness and optimal use in clinical practice.

Whether VR reaches patients depends largely on clinicians. Surveys of physiotherapists in Germany and Palestine[9,10] and qualitative studies of physiotherapists[11] have explored their use and perceptions of VR, and a scoping review has synthesised the barriers, facilitators and interventions that affect VR implementation in rehabilitation[12]. The integration of VR into health care and medical education in low- and middle-income countries has also been reviewed[13].

The Technology Acceptance Model (TAM) proposes that intention to adopt a technology is shaped by two beliefs: Perceived Usefulness (PU), the degree to which a person believes the technology would enhance job performance, and Perceived Ease of Use (PEU), the degree to which a person believes using it would be free of effort. TAM also proposes that PEU increases PU[14,15]. The model has been widely applied to health-care technologies[16], and factors influencing therapists' adoption of VR have been examined specifically[17]. In a TAM-based survey of 102 physiotherapists in Malaysia, respondents rated VR as slightly useful and were largely neutral about its ease of use[18].

Data on how physiotherapists in India use VR, and how useful and easy to use they perceive it to be, are scarce. This study therefore aimed to (i) describe awareness and self-reported clinical use of VR among physiotherapists; (ii) measure their PU and PEU of VR using TAM-based items; (iii) examine the association between PU and PEU; and (iv) compare PU and PEU by VR use, practice setting, qualification and gender. Consistent with TAM, we hypothesised that PEU would be positively associated with PU and that physiotherapists who used VR would report higher PU and PEU than non-users.

2. Materials and Methods

2.1 Study Design and Reporting

A cross-sectional observational questionnaire survey was conducted. It is reported in accordance with the STROBE statement for cross-sectional studies[19].

2.2 Participants and Sampling

Physiotherapists working in hospitals, clinics and rehabilitation centres in Bengaluru, Karnataka, India, were recruited by convenience sampling over a period of six months (February 2026 to July 2026). Eligible participants were physiotherapists, including postgraduate (MPT) students, who were actively involved in clinical or rehabilitation practice and willing to provide informed consent. Physiotherapists not currently engaged in clinical or rehabilitation practice, or unwilling or unable to complete the questionnaire, were excluded.

The protocol specified an age range of 25–45 years; four respondents aged 23–24 years who met all other criteria were also enrolled, and a sensitivity analysis excluding them is reported.

The sample size was calculated with the formula for estimating a single proportion: $n = Z^2_{1-\alpha/2} \times p(1-p) / d^2$, where $Z_{1-\alpha/2} = 1.96$ for a significance level (α) of 5%, p is the anticipated proportion (50%, the value that gives the largest required sample when no prior estimate is available) and d is the absolute precision (10%). This gave $n = (1.96^2 \times 0.50 \times 0.50) / 0.10^2 = 96.04$, and 96 physiotherapists were therefore recruited.

2.3 Questionnaire

Data were collected with a structured questionnaire, administered face-to-face to all participants; no data were collected online. It recorded age, gender, qualification, years of experience, specialisation and practice setting; awareness of VR (yes/no); clinical use of VR, asked as 'Do you use VR for feedback?' (yes/no); and the clinical conditions in which VR had been used (open-ended). VR was explained to participants as visuals displayed with a designated but virtual background, using head-mounted systems or console-based controls.

PU and PEU were each measured with six items adapted from Davis[14] and previously used with physiotherapists[18] (Tables 3 and 4). In the PEU scale, item 4 ('I would find VR clear and understandable') was used in place of Davis's 'flexible to interact with' item. Each item offered three response options — slightly, quite and extremely — which correspond to the positive half of Davis's seven-point likelihood scale; neutral and negative options were not offered. Responses were scored 1 (slightly), 2 (quite) and 3 (extremely), giving subscale scores of 6–18 with a midpoint of 12. The adapted questionnaire was not piloted, and no formal content validation was undertaken; its reliability was assessed through internal consistency (Cronbach's α[20]; see Statistical analysis).

Free-text condition entries were grouped into harmonised categories (Table 2); one respondent listed two conditions. Because all 96 respondents named a condition, including the 28 who reported not using VR, conditions are reported for VR users only.

2.4 Ethical Considerations

Ethical approval was obtained from the Institutional Ethics Committee, College of Physiotherapy, Dayananda Sagar University, Bengaluru (approval no. ISC/Intern/DSU/2026/1302, dated 03-02-2026). Participation was voluntary. All participants were met in person; the study procedure was explained to all subjects, and written informed consent was obtained prior to enrolment. Postgraduate students were informed that participation or refusal would not affect their academic assessment. Names were removed before analysis, responses were documented and small categories were merged in reporting to prevent identification of individual respondents.

2.5 Statistical Analysis

Completed responses were entered into MS Excel and verified against the original questionnaires before analysis. Categorical variables are presented as frequencies and percentages, and continuous variables as mean±SD and median (IQR). Because item responses were ordinal with three levels and the subscale scores were not normally distributed (Shapiro–Wilk $p < 0.001$ for both), non-parametric tests were used for the primary analysis; means are reported alongside medians for comparability[21]. Associations were assessed with Spearman's ρ and percentile bootstrap 95% CIs (10,000 resamples). The PU–PEU association was also examined separately in VR users and non-users, and as a partial rank correlation adjusted for VR use, qualification and practice setting (Fisher-z 95% CI). Two-group comparisons (VR use, qualification and gender) used the Mann–Whitney U test, with effect size $r = |z|/\sqrt{N}$ and the mean difference with its 95% CI. Practice settings were compared with the Kruskal–Wallis test (effect size ε^2), followed by Dunn's test with Bonferroni adjustment[22]. The proportion of VR users across settings was compared with the χ^2 test.

To control for multiple testing, the Holm method[23] was applied across the nine primary tests (the PU–PEU correlation and eight group comparisons); unadjusted and Holm-adjusted p-values are both reported. Sensitivity analyses repeated the main analyses with parametric tests (Pearson correlation, independent t-test, one-way ANOVA) and after excluding the four participants younger than 25 years. In addition, PU was regressed on PEU, VR use, qualification and practice setting. Analyses were performed in Python 3.13 (SciPy 1.18, NumPy 2.5). A two-sided $p < 0.05$ was considered statistically significant.

Internal consistency of each six-item subscale was assessed with Cronbach's α, calculated as $\alpha = [k/(k-1)]$

× [1 − (sum of the item variances / variance of the total score)], where k = 6, from the item scores (1–3) of all 96 participants; 95% CIs were obtained by Feldt's method[24]. Values between 0.70 and 0.90 were considered acceptable, with values above 0.90 suggesting item redundancy[20]. Corrected item–total correlations and α-if-item-deleted were also examined. This analysis was important because PU and PEU were analysed as summed scores of adapted items, one of which differed from the original TAM item set, so it was necessary to show that the items within each subscale measured a common construct before their totals were compared. Internal consistency was estimated in the same 96 participants whose responses addressed the study objectives. This is appropriate because α is a property of the scores obtained from a specific sample rather than a fixed property of an instrument, and should therefore be calculated for the data actually analysed[20]. Furthermore, α was used only to describe reliability: no item was removed or modified on the basis of the reliability analysis, so the same responses were not used both to shape the subscales and to test the study objectives.

Table 1. Characteristics of participants (n = 96)

Characteristic	n (%) or mean ± SD (range)
Age, years	29.98 ± 4.26 (23–42)
Experience, years	5.53 ± 3.82 (1–18)
Gender	
Male	51 (53.1)
Female	45 (46.9)
Qualification	
BPT	49 (51.0)
MPT	47 (49.0)
Specialisation (MPT)	
Musculoskeletal, orthopaedic and sports	28 (29.2)
Neurological	15 (15.6)
Other (cardiopulmonary, paediatric, community-based rehabilitation)	4 (4.2)
None (BPT)	49 (51.0)
Practice setting	
Clinic	54 (56.3)
Hospital	23 (24.0)
Rehabilitation centre	19 (19.8)
Aware of VR	96 (100.0)
Uses VR for patient feedback	
Yes	68 (70.8)
No	28 (29.2)

Specialisations with fewer than three respondents were merged to protect anonymity. BPT, Bachelor of Physiotherapy; MPT, Master of Physiotherapy; SD, standard deviation; VR, virtual reality.

3. Results

3.1 Participant Characteristics and Use of VR

Ninety-six physiotherapists participated (Table 1). Awareness of VR was universal (100%), and more than two-thirds (68, 70.8%) reported using it for patient feedback. Use was highest in rehabilitation centres (16/19, 84.2%) and clinics (40/54, 74.1%) and lower in hospitals (12/23, 52.2%), although the difference across settings did not reach statistical significance ($\chi^2(2) = 5.80$, $p = 0.055$).

3.2 Perceived Usefulness and Perceived Ease of Use

For every PU item, most respondents (71.9–80.2%) rated VR as quite or extremely useful, and for every PEU item most (68.8–81.3%) rated it as quite or extremely easy to use (Tables 3 and 4). 'Quite' was the most frequent and the median response for all 12 items, and up to one third of respondents chose 'extremely'—most often for 'Using VR in my job would enable me to accomplish tasks more quickly' (31.3%) and 'Learning to operate VR would be easy for me' (32.3%). The items with the most room for

Table 2. Conditions in which VR was used, among VR users (n = 68; multiple responses)

Condition	n (% of users)
Stroke	24 (35.3)
ACL injury or reconstruction	12 (17.6)
Cerebral palsy	12 (17.6)
Shoulder injury or rehabilitation	6 (8.8)
Other knee conditions (osteoarthritis, knee pain, knee rehabilitation)	5 (7.4)
Arthritis	2 (2.9)
Other ligament and ankle injuries	2 (2.9)
Guillain–Barré syndrome	1 (1.5)
Pain management	1 (1.5)
Parkinson's disease	1 (1.5)
Post-fracture rehabilitation	1 (1.5)
Reaction-time training	1 (1.5)
Spinal cord and nerve injuries	1 (1.5)

Free-text responses were harmonised into categories. One respondent reported two conditions (stroke and Parkinson's disease), so the 69 responses exceed 68 and percentages sum to more than 100. Conditions named by the 28 non-users are not shown. 'Reaction-time training' is reported as entered; it is a training goal rather than a condition. ACL, anterior cruciate ligament.

VR users applied it across a wide range of neurological and musculoskeletal conditions, most often stroke (n = 24, 35.3%), anterior cruciate ligament (ACL) injury or reconstruction (n = 12, 17.6%) and cerebral palsy (n = 12, 17.6%) (Table 2).

Table 3. Responses to Perceived Usefulness (PU) items (n = 96)

PU item	Slightly (1) n (%)	Quite (2) n (%)	Extremely (3) n (%)	Mean (SD)
1. Using VR in my job would enable me to accomplish tasks more quickly	24 (25.0)	42 (43.8)	30 (31.3)	2.06 (0.75)
2. Using VR would improve my job performance	19 (19.8)	65 (67.7)	12 (12.5)	1.93 (0.57)
3. Using VR in my job would increase my productivity	25 (26.0)	51 (53.1)	20 (20.8)	1.95 (0.69)
4. Using VR would enhance my effectiveness in my job	25 (26.0)	49 (51.0)	22 (22.9)	1.97 (0.70)
5. Using VR would make it easier to do my job	27 (28.1)	65 (67.7)	4 (4.2)	1.76 (0.52)
6. I would find VR useful in my job	26 (27.1)	43 (44.8)	27 (28.1)	2.01 (0.75)

Each item offered only these three response options (no neutral or negative options). Median response for every item = 2 (quite). Items adapted from Davis (1989); 'VR' = virtual reality.

Table 4. Responses to Perceived Ease of Use (PEU) items (n = 96)

PEU item	Slightly (1) n (%)	Quite (2) n (%)	Extremely (3) n (%)	Mean (SD)
1. Learning to operate VR would be easy for me	27 (28.1)	38 (39.6)	31 (32.3)	2.04 (0.78)
2. I would find it easy to get VR to do what I want it to do	18 (18.8)	64 (66.7)	14 (14.6)	1.96 (0.58)
3. My interaction with VR would be clear and understandable	30 (31.3)	50 (52.1)	16 (16.7)	1.85 (0.68)
4. I would find VR clear and understandable	28 (29.2)	49 (51.0)	19 (19.8)	1.91 (0.70)
5. It would be easy for me to become skilful at using VR	29 (30.2)	65 (67.7)	2 (2.1)	1.72 (0.50)
6. I would find VR easy to use	28 (29.2)	42 (43.8)	26 (27.1)	1.98 (0.75)

Each item offered only these three response options (no neutral or negative options). Median response for every item = 2 (quite). Items adapted from Davis (1989); 'VR' = virtual reality. PEU item 4 replaces Davis's 'flexible to interact with' item.

Table 5. Perceived usefulness and perceived ease of use subscale scores (n = 96)

Subscale (possible range 6–18)	Mean ± SD	Median (IQR)	Range	Score ≥ 12 (average 'quite' or higher), n (%)	Cronbach's α (95% CI)
Perceived Usefulness (PU)	11.68 ± 3.08	12 (9.75–14)	6–17	58 (60.4)	0.86 (0.81–0.90)
Perceived Ease of Use (PEU)	11.46 ± 3.02	12 (9–14)	6–17	58 (60.4)	0.84 (0.79–0.89)

Items scored slightly = 1, quite = 2, extremely = 3. Cronbach's α calculated from the item scores of all 96 participants; 95% CI, confidence interval; IQR, interquartile range; SD, standard deviation.

improvement were 'Using VR would make it easier to do my job' (PU) and 'It would be easy for me to become skilful at using VR' (PEU).

The mean PU score was 11.68±3.08 (median 12, IQR 9.75–14) and the mean PEU score 11.46 ± 3.02 (median 12, IQR 9–14); both ranged from 6 to 17 out of a possible 6–18 (Table 5). Six in ten respondents (58/96, 60.4% for both PU and PEU) had a subscale score of 12 or more, equivalent to an average rating of 'quite' or higher. Both subscales showed good internal consistency (Cronbach's α: PU 0.86, 95% CI 0.81–0.90; PEU 0.84, 95% CI 0.79–0.89). Every item correlated adequately with the rest of its subscale (corrected item–total r = 0.51–0.74 for PU and 0.52–0.76 for PEU), and deleting any single item did not meaningfully increase α (maximum α-if-item-deleted 0.86 for PU and 0.84 for PEU).

3.3 Association between PU and PEU

PU and PEU were not correlated (ρ = 0.07, 95% CI −0.13 to 0.26; p = 0.522; Holm-adjusted p =1.000) (Table 6), indicating that physiotherapists' judgements of the usefulness of VR were independent of how easy they expected it to be to use. The absence of an association was consistent among VR users (ρ = 0.00, p = 0.988) and non-users (ρ = 0.17, p = 0.374), and after adjustment for VR use, qualification and practice setting (partial ρ = 0.07, 95% CI −0.14 to 0.27; p = 0.497).

3.4 Comparisons by VR use, Qualification, Gender and Practice Setting

VR users rated PU higher than non-users (12.06±3.01 vs 10.75±3.10; r=0.19), a difference that approached but did

Table 6. Spearman correlation between perceived usefulness and perceived ease of use

Variables	n	ρ	95% CI	p	Holm-adjusted p
PU–PEU, all participants	96	0.07	−0.13 to 0.26	0.522	1.000
PU–PEU, VR users	68	0.00	−0.22 to 0.23	0.988	—
PU–PEU, non-users	28	0.17	−0.21 to 0.50	0.374	—
PU–PEU, partial (adjusted for VR use, qualification and setting)	96	0.07	−0.14 to 0.27	0.497	—

95% CIs by percentile bootstrap (10,000 resamples), except the partial correlation (Fisher z). Holm adjustment was applied across the nine primary tests; subgroup and partial correlations are secondary analyses and were not adjusted. PU, perceived usefulness; PEU, perceived ease of use; VR, virtual reality.

Table 7. Comparison of perceived usefulness and perceived ease of use by VR use, qualification and gender

Outcome: comparison	Group (n)	Mean ± SD	Median (IQR)	Mean difference (95% CI)	U	p	r	Holm p
PU: VR use	Users (68)	12.06 ± 3.01	12 (10–14.25)	1.31 (−0.05 to 2.66)	721.5	0.062	0.19	0.492
	Non-users (28)	10.75 ± 3.10	11.5 (8–12.25)					
PEU: VR use	Users (68)	11.75 ± 2.76	12 (10.75–14)	1.00 (−0.34 to 2.34)	800	0.215	0.13	1.000
	Non-users (28)	10.75 ± 3.53	11 (7–14)					
PU: qualification	BPT (49)	12.27 ± 2.86	12 (11–14)	1.20 (−0.03 to 2.43)	915	0.081	0.18	0.568
	MPT (47)	11.06 ± 3.21	12 (8–13.5)					
PEU: qualification	BPT (49)	11.33 ± 2.89	12 (10–13)	−0.27 (−1.50 to 0.96)	1066	0.527	0.06	1.000
	MPT (47)	11.60 ± 3.18	12 (9–14)					
PU: gender	Male (51)	11.57 ± 3.23	12 (9–14)	−0.23 (−1.49 to 1.02)	1106	0.761	0.03	1.000
	Female (45)	11.80 ± 2.94	12 (10–14)					
PEU: gender	Male (51)	11.51 ± 2.91	12 (10–14)	0.11 (−1.12 to 1.34)	1110.5	0.785	0.03	1.000
	Female (45)	11.40 ± 3.17	12 (9–14)					

Mann–Whitney U test (U = smaller of the two U statistics); effect size r = $|z|/\sqrt{N}$ (0.1 small, 0.3 medium, 0.5 large). Mean difference = first group − second group. Holm p, Holm-adjusted p across nine primary tests. Scores range 6–18. BPT, Bachelor of Physiotherapy; MPT, Master of Physiotherapy.

Table 8. Comparison of perceived usefulness and perceived ease of use by practice setting

Practice setting / statistic	Perceived usefulness (PU): mean ± SD; median (IQR)	Perceived ease of use (PEU): mean ± SD; median (IQR)
Clinic (n = 54)	12.41±2.81; 12 (11–14)	11.17±2.77; 12 (9.25–12.75)
Hospital (n = 23)	9.61±3.20; 9 (7–12)	11.39±3.95; 12 (7–15)
Rehabilitation centre (n = 19)	12.11±2.66; 12 (11–14)	12.37±2.31; 12 (12–13)
Kruskal–Wallis H (df = 2)	11.77	1.87
p	0.003	0.392
ε^2	0.12	0.02
Holm-adjusted p	0.025	1.000
Pairwise (Dunn, Bonferroni-adjusted p)		
Clinic vs hospital	0.002	1.000
Clinic vs rehabilitation centre	1.000	0.514
Hospital vs rehabilitation centre	0.084	1.000

Kruskal–Wallis test with Dunn's post hoc test (Bonferroni adjustment for three comparisons). Scores range 6–18. IQR, interquartile range; SD, standard deviation.

not reach statistical significance (p = 0.062); PEU was also higher among users (11.75±2.76 vs 10.75±3.53), but not significantly (p = 0.215) (Table 7). PU was slightly higher among BPT- than MPT-qualified physiotherapists (12.27 ± 2.86 vs 11.06±3.21; p = 0.081), and PEU was similar across qualifications (p = 0.527). PU and PEU were similar in men and women.

PU differed by practice setting (H (2) = 11.77, p = 0.003, ε^2 = 0.12; Holm-adjusted p = 0.025), with higher median PU in clinics and rehabilitation centres (both 12) than in hospitals (9). Hospital-based physiotherapists reported lower PU than those in clinics (Bonferroni-adjusted p = 0.002); the difference from rehabilitation centres was in the same direction but not statistically significant (p =

0.084), and clinics and rehabilitation centres did not differ (p=1.000). PEU was similar across settings (H(2) = 1.87, p = 0.392) (Table 8). In the regression adjusted for PEU, VR use and qualification, hospital setting remained associated with lower PU (B = −2.43, 95% CI −3.98 to −0.89; p = 0.002).

3.5 Sensitivity Analyses

Parametric tests confirmed the same pattern of results (Pearson r for PU–PEU = 0.05, p = 0.660; setting: PU F = 7.89, p < 0.001; PEU F = 1.12, p = 0.330; VR use: PU p = 0.058, PEU p = 0.141). The findings were also robust to excluding the four participants younger than 25 years (n = 92) (PU–PEU ρ = 0.08, p = 0.467; PU by setting p = 0.004; PU by qualification p = 0.108; PU and PEU by VR use p = 0.100 and p = 0.195).

4. Discussion

This survey shows that VR is well established in the awareness and practice of the participating physiotherapists: all were aware of it, more than two-thirds used it for patient feedback, and they applied it across a broad range of neurological and musculoskeletal conditions, led by stroke, ACL and cerebral palsy rehabilitation. The predominance of stroke is consistent with the strong evidence base for VR in stroke rehabilitation, where VR added to usual care improves upper-limb function and VR offers a small benefit for activities of daily living[1]. Trials comparing VR with conventional or recreational therapy of the same dose show broadly similar outcomes[1,2], which supports the role of VR as an engaging adjunct within physiotherapy programmes.

Physiotherapists' perceptions of VR were positive overall. For every usefulness and ease-of-use item, between two-thirds and four-fifths of respondents rated VR as quite or extremely useful or easy to use, six in ten had an average rating of 'quite' or higher on both subscales, and up to one third rated VR as extremely useful for working more quickly and extremely easy to learn. These ratings are somewhat more positive than those of the Malaysian TAM survey, in which physiotherapists rated VR as slightly useful and were largely neutral about its ease of use18, although the different response scales limit direct comparison. Both subscales showed good internal consistency (α = 0.86 and 0.84), within the recommended range of 0.70–0.90, and every item contributed to its subscale[20]. This is important for interpreting the findings: because PU and PEU were analysed as summed scores of adapted items, the reliability analysis confirms that the items within each subscale measured a common construct and that combining them into single scores was justified. Because the response options covered only the positive half of the original TAM scale, these levels of endorsement should be confirmed with the full seven-point scale.

Contrary to our hypothesis and to the TAM proposition that ease of use strengthens perceived usefulness[14-16], PU and PEU were not correlated in this sample — overall, among users, among non-users or after adjustment. This suggests that physiotherapists judged the clinical value of VR independently of how easy they expected it to be to use, which is encouraging for implementation because usefulness appears to be recognised even where confidence in operating the technology is still developing. Methodological factors may also have contributed: the three-option, positive-only response format restricts the range of scores and can attenuate correlations, and respondents rated a heterogeneous set of VR systems. Re-examining the PU–PEU relationship with the full seven-point scale and a defined VR system is therefore an important next step.

VR users rated usefulness more highly than non-users, in line with our hypothesis; the difference had a small effect size and approached, but did not reach, statistical significance, while ease-of-use ratings were similar in the two groups. Practice setting was the factor most clearly associated with perceived usefulness and the only one that remained significant after correction: hospital-based physiotherapists rated VR as less useful than those in clinics, with the same pattern relative to rehabilitation centres, and they used VR least often. Differences in caseload, patient acuity, session time and access to equipment may explain this pattern; barriers of this kind have been synthesised previously[12], and measuring them directly would help to target implementation support to hospital settings. PU and PEU were similar across qualifications and in men and women, suggesting that acceptance of VR is broadly shared across these groups.

VR and augmented reality have been evaluated as teaching tools in physiotherapy and clinical education[25,26]. Building on the high awareness and positive perceptions found here, structured VR training during physiotherapy education and continuing professional development is a promising next step, and its effect on PU, PEU and clinical use should be evaluated.

5. Limitations

This study has several limitations. First, the response options covered only the positive half of the original

TAM scale, so neutral and negative attitudes could not be recorded and PU and PEU are likely overestimated. Second, one PEU item differed from the original TAM item set, and the adapted questionnaire was not piloted or formally validated; only its internal consistency was assessed. Third, participants were recruited by convenience sampling from a single city (Bengaluru), which limits generalisability to physiotherapists in India or elsewhere. Fourth, data were self-reported. Fifth, internal consistency was estimated in the study sample rather than in a separate pilot sample, and test–retest reliability was not assessed; although estimating α in the analysed sample is recommended, independent samples would provide stronger evidence. Cronbach's α also assumes that all items contribute equally, tends to be lower when there are few items or response categories, and indicates reliability but not validity. Sixth, non-users rated VR hypothetically, so their responses are not directly comparable with those of users. Seventh, use of VR was captured with a single yes/no item, without information on system type, frequency or training, and the conditions were reported as free text. Finally, the cross-sectional design does not allow causal inference, and four participants were younger than the planned minimum age, although excluding them did not change the results.

6. Conclusion

All physiotherapists in this sample were aware of VR, most used it clinically across neurological and musculoskeletal conditions, and most rated it as quite or extremely useful and easy to use. Perceived usefulness was rated independently of perceived ease of use, and was highest in clinics and rehabilitation centres and lowest in hospitals, identifying hospital settings as a priority for training and implementation support. Larger, multi-centre studies using the full seven-point TAM scale, a validated questionnaire and measures of training and equipment access will help to confirm and extend these findings.

7. Reporting Guideline

This study is reported according to the STROBE statement for cross-sectional studies.

8. Data Availability Statement

The de-identified dataset is available from the corresponding author on reasonable request.

9. Funding / Conflicts of Interest

This was a self-funded study. Investigators declare no potential conflict of interest.

10. References

1. Laver KE, Lange B, George S, Deutsch JE, Saposnik G, Crotty M. Virtual reality for stroke rehabilitation. Cochrane Database Syst Rev. 2017; 11(11):CD008349. https://doi.org/10.1002/14651858.CD008349.pub4 PMid:29156493.
2. Saposnik G, Cohen LG, Mamdani M, Pooyania S, Ploughman M, Cheung D, *et al.,* Efficacy and safety of non-immersive virtual reality exercising in stroke rehabilitation (EVREST): a randomised, multicentre, single-blind, controlled trial. Lancet Neurol. 2016; 15(10):1019-1027. https://doi.org/10.1016/S1474-4422(16)30121-1 PMid:27365261 PMCid:PMC5108052.
3. Winter C, Kern F, Gall D, Latoschik ME, Pauli P, Käthner I. Immersive virtual reality during gait rehabilitation increases walking speed and motivation: a usability evaluation with healthy participants and patients with multiple sclerosis and stroke. J Neuroeng Rehabil. 2021; 18(1):68. https://doi.org/10.1186/s12984-021-00848-w PMid:33888148 PMCid:PMC8061882.
4. Gandolfi M, Geroin C, Dimitrova E, Boldrini P, Waldner A, Bonadiman S, *et al.,* Virtual reality telerehabilitation for postural instability in Parkinson's disease: a multicenter, single-blind, randomized, controlled trial. Biomed Res Int. 2017; 2017:7962826. https://doi.org/10.1155/2017/7962826 PMid:29333454 PMCid:PMC5733154.
5. Henríquez-Jurado JM, Osuna-Pérez MC, García-López H, Lomas-Vega R, López-Ruiz MC, Obrero-Gaitán E, *et al.,* Virtual reality-based therapy for chronic low back and neck pain: a systematic review with meta-analysis. EFORT Open Rev. 2024; 9(7):685-699. https://doi.org/10.1530/EOR-23-0197 PMid:38949175 PMCid:PMC11297406.
6. Lakshminarayanan K, Shah R, Daulat SR, Moodley V, Yao Y, Ezhil SL, *et al.,* Feasibility and usability of a virtual-reality-based sensorimotor activation apparatus for carpal tunnel syndrome patients. PLoS One. 2023; 18(10):e0292494. https://doi.org/10.1371/journal.pone.0292494 PMid:37819927 PMCid:PMC10566719.
7. Siette J, Adam PJ, Harris CB. Acceptability of virtual reality to screen for dementia in older adults. BMC Geriatr. 2024; 24(1):493. https://doi.org/10.1186/s12877-024-05115-w PMid:38840041 PMCid:PMC11151481.
8. Bateni H, Carruthers J, Mohan R, Pishva S. Use of virtual reality in physical therapy as an intervention and diagnostic tool. Rehabil Res Pract. 2024; 2024:1122286. https://doi.org/10.1155/2024/1122286 PMid:38304610 PMCid:PMC10834096.

9. Elser A, Ohse M, Frankenstein C, Leeuw M, Schiebler S, Schmieder S, *et al.,* Usage of virtual reality technology in physiotherapy in Germany: results from a survey. Bioengineering (Basel). 2025; 12(2):106. https://doi.org/10.3390/bioengineering12020106 PMid:40001626 PMCid:PMC11851382.
10. Ghrouz A, Herbawi F, Abualkhair D, Jaber R, Dhaidel H, Salah H, *et al.,* Awareness and perceptions of virtual reality in physiotherapy: a cross-sectional study among students and clinicians in Palestine. BMC Med Educ. 2025; 25(1):1524. https://doi.org/10.1186/s12909-025-08117-3 PMid:41168781 PMCid:PMC12574226.
11. Dejaco B, Brady N, Tankink A, Lewis J, van Goor H, Staal JB, *et al.,* Experiences of physiotherapists considering virtual reality for shoulder rehabilitation: a focus group study. Digit Health. 2024; 10:20552076241234738. https://doi.org/10.1177/20552076241234738 PMid:38414562 PMCid:PMC10898295.
12. Glegg SMN, Levac DE. Barriers, facilitators and interventions to support virtual reality implementation in rehabilitation: a scoping review. PM R. 2018; 10(11):1237-51.e1. https://doi.org/10.1016/j.pmrj.2018.07.004 PMid:30503231 PMCid:PMC6752033.
13. Siddiqui MF, Jabeen S, Alwazzan A, Vacca S, Dalal L, Al-Haddad B, *et al.,* Integration of augmented reality, virtual reality, and extended reality in healthcare and medical education: a glimpse into the emerging horizon in LMICs-a systematic review. J Med Educ Curric Dev. 2025; 12. https://doi.org/10.1177/23821205251342315. PMid:40452894 PMCid:PMC12123137.
14. Davis FD. Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Q. 1989; 13(3):319-340. https://doi.org/10.2307/249008.
15. Venkatesh V, Davis FD. A theoretical extension of the technology acceptance model: four longitudinal field studies. Manage Sci. 2000; 46(2):186-204. https://doi.org/10.1287/mnsc.46.2.186.11926.
16. Holden RJ, Karsh BT. The technology acceptance model: its past and its future in health care. J Biomed Inform. 2010; 43(1):159-72. https://doi.org/10.1016/j.jbi.2009.07.002 PMid:19615467.
17. Glegg SMN, Holsti L, Velikonja D, Ansley B, Brum C, Sartor D. Factors influencing therapists' adoption of virtual reality for brain injury rehabilitation. Cyberpsychol Behav Soc Netw. 2013; 16(5):385-401. https://doi.org/10.1089/cyber.2013.1506 PMid:23713844.
18. Krishnan Vasanthi R, Jie Li BC, Purushothaman VK, A K, Chinnusamy S, Karuppaiyan RK, *et al.,* Perceived usefulness and ease of using virtual reality during physiotherapy: a cross-sectional survey from physiotherapists' perspective. Electron J Gen Med. 2023;20(6):em530. https://doi.org/10.29333/ejgm/13519
19. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP; STROBE Initiative. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. Lancet. 2007; 370(9596):1453-1457. https://doi.org/10.1016/S0140-6736(07)61602-X PMid:18064739.
20. Tavakol M, Dennick R. Making sense of Cronbach's alpha. Int J Med Educ. 2011; 2:53-5. https://doi.org/10.5116/ijme.4dfb.8dfd PMid:28029643.
21. Norman G. Likert scales, levels of measurement and the "laws" of statistics. Adv Health Sci Educ Theory Pract. 2010; 15(5):625-632. https://doi.org/10.1007/s10459-010-9222-y
22. Dunn OJ. Multiple comparisons using rank sums. Technometrics. 1964; 6(3):241-52. https://doi.org/10.1080/00401706.1964.10490181.
23. Holm S. A simple sequentially rejective multiple test procedure. Scand J Stat. 1979; 6(2):65-70.
24. Feldt LS, Woodruff DJ, Salih FA. Statistical inference for coefficient alpha. Appl Psychol Meas. 1987; 11(1):93-103. https://doi.org/10.1177/014662168701100107
25. Lucena-Antón D, Fernández-López JC, Pacheco-Serrano AI, García-Muñoz C, Moral-Munoz JA. Virtual and augmented reality versus traditional methods for teaching physiotherapy: a systematic review. Eur J Investig Health Psychol Educ. 2022; 12(12): 1780-1792. https://doi.org/10.3390/ejihpe12120125 PMid:36547026 PMCid:PMC9778016.
26. Houser C, Goodman A, Mack J, Simon B. Efficacy and students' perceptions of virtual reality in clinical education: a narrative review. Cureus. 2025; 17(4):e82852. https://doi.org/10.7759/cureus.82852

Author Contribution

Dr. Kanchan S – Conceptualisation, Methodology, Supervision, Formal analysis; Writing – review and editing. Sheetal Rao K – Methodology, Data collection, Formal analysis, Writing – original draft. Mayuri Shukla - Writing – review and editing. All authors read and approved the final manuscript.

Access this journal online	
Website: www.informaticsjournals.co.in/index.php/JEOH/index	**Quick Response Code**