User Priorities for VR Fitness Features Among Malaysian Runners: A Task–Technology Fit and Multi-Criteria Decision Methods Perspective

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ABSTRACT

Virtual reality (VR) fitness applications are gaining traction for their ability to enhance motivation, enjoyment, and immersion during exercise. However, limited research examines which specific VR features users value most when performing running tasks. Guided by the Task Technology Fit (TTF) perspective, this study evaluates five commonly used VR running features: interactive VR environments, real-time feedback, endurance tracking, enjoyment elements, and progress monitoring. A total of 141 Malaysian respondents with running experience and familiarity with digital fitness tools participated in the survey. Each feature was rated across five criteria: effectiveness, practicality, usability, motivation, and engagement. The Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) method was used to construct a structured ranking of all feature and criterion combinations. Results show a consistent pattern: effectiveness and practicality dominate user priorities, with interactive VR environments, real-time feedback, and endurance tracking emerging as the highest ranked features. Enjoyment elements and progress monitoring were positively perceived but demonstrated a weaker match to immediate running needs. The findings highlight how users differentiate between performance related and enjoyment related VR capabilities and illustrate how TTF can be applied at the feature level. Practically, the results provide clear direction for system developers and product teams to prioritise performance supportive features in VR fitness design. Theoretically, the study extends the application of TTF to VR fitness evaluation and shows how multi-criteria decision methods can translate user perceptions into structured feature prioritisation.

Keywords
Virtual Reality Fitness; Task Technology Fit; TOPSIS; Multi-Criteria Decision Making; Running Applications

Introduction

Virtual Reality (VR) is increasingly recognised as a transformative tool in fitness due to its ability to enhance enjoyment, engagement, and immersion during exercise. A growing body of research demonstrates that VR can significantly increase exercise motivation by transforming physical activity into a more stimulating and interactive experience rather than a repetitive routine. Users consistently report higher enjoyment, stronger intention to continue exercising, and deeper immersion when using VR-based platforms compared to traditional exercise methods (Ijaz et al., 2020; Rahayu et al., 2026). In addition, VR environments can distract users from physical discomfort, enabling them to exercise for longer durations and at higher intensities (McClure & Schofield, 2020; Matsangidou et al., 2019). Within fitness contexts, VR has been applied across various activities, including rehabilitation, cycling, and guided workouts. More recently, VR technologies have been extended to running-related applications. Studies have developed VR running systems that simulate outdoor environments in indoor settings using head-mounted displays, virtual landscapes, and redirected walking techniques (Fujita et al., 2024). Other implementations incorporate virtual jogging partners, augmented visual cues, and gamified elements to support motivation, improve performance, and enhance user experience (Siriaraya et al., 2023; Hamada et al., 2022). VR has also been shown to reduce perceived exertion during walking and running tasks, making it easier for individuals to sustain regular exercise routines (Yamamoto et al., 2024). These findings collectively highlight the potential of VR to improve both the experiential and performance aspects of running.

Despite these advancements, existing studies predominantly focus on overall VR experience, motivational outcomes, or physiological responses. Comparatively less attention has been given to examining VR systems at the feature level, particularly in the context of specific tasks such as running. While prior research identifies elements such as immersive environments, interactivity, gamification, and real-time feedback as important contributors to user engagement (Zhang et al., 2025; Palmieri & Deutsch, 2025; Shah et al., 2023), these elements are typically discussed in general exercise contexts rather than being systematically evaluated as distinct functional features within running activities. Consequently, there remains limited empirical understanding of which specific VR features are prioritised by users when performing running tasks.

This gap is important because user evaluation of technology is inherently task-dependent. Features that enhance enjoyment may not necessarily support performance, while features that improve tracking or feedback may not directly increase engagement. Without a structured understanding of feature-level priorities, developers may face challenges in designing VR fitness systems that effectively support real world exercise needs, potentially limiting user adoption and long-term usage.

To address this gap, this study adopts the Task–Technology Fit (TTF) perspective, which posits that technology delivers greater value when its capabilities align with task requirements (Goodhue & Thompson, 1995). In the context of VR running, this involves examining how specific VR features support key running-related needs such as pacing, endurance monitoring, feedback, and motivation. Prior research has shown that TTF influences the adoption of fitness applications (Chang et al., 2023) and shapes user preference for VR-based exercise compared to conventional methods (Sun & Ke, 2025). However, limited studies have applied TTF within VR fitness contexts, particularly at the level of individual system features.

In addition, this study incorporates a Multi-Criteria Decision Making (MCDM) approach, specifically the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), to evaluate and prioritise VR features based on multiple user-defined criteria. This approach enables the translation of user perceptions into structured rankings, allowing for a more systematic assessment of how well each feature aligns with task requirements.

Therefore, this study aims to (1) identify key VR features relevant to running, (2) evaluate these features across multiple criteria reflecting task requirements, and (3) determine their relative priority using a structured decision-making approach. By combining the TTF framework with MCDM techniques, this study provides practical guidance for VR fitness development and extends existing literature by offering a feature-level perspective on task–technology alignment in immersive exercise environments.

Literature Review

VR Fitness Applications

VR is increasingly used for fitness activities such as running, cycling, and guided workouts. VR fitness systems place users in immersive environments that make exercise more engaging and game like (Rahayu et al., 2026; Mocco et al., 2024). Studies show that VR based exercise can deliver comparable or better physiological outcomes than traditional training, including improvements in performance, body composition, and cardiorespiratory fitness (Ng et al., 2019; Godoy Cumillaf et al., 2025). In running-related work, VR has been used to simulate outdoor routes indoors and to provide augmented feedback for training (Fujita et al., 2024; Caramenti et al., 2018; Siriaraya et al., 2023).

Users generally report higher enjoyment, motivation, and willingness to continue exercising in VR, partly because immersive environments reduce perceived fatigue (McClure & Schofield, 2020; Rahayu et al., 2026). Systems that incorporate real-time feedback, social elements, or competition further strengthen engagement and adherence (Palmieri & Deutsch, 2025).

Despite these advantages, several challenges persist. Complex locomotion and hardware setups can reduce usability (Tanaka et al., 2020), while motion sickness and visual discomfort limit how long users can train (Chattha et al., 2020; Adhanom et al., 2025). In addition, research prototypes and commercial apps often differ in design focus, leading to inconsistent support for structured training goals (Elsholz et al., 2025). These mixed findings highlight the need for systematic evaluation of specific VR fitness features, particularly for running.

Key VR Features

Research on VR-based exercise consistently highlights several core features that shape user experience, motivation, and performance. Drawing from recent findings in VR fitness, exergaming, rehabilitation, and endurance training studies, five feature categories are particularly relevant for evaluating VR running applications: (1) interactive VR environments, (2) real-time feedback, (3) endurance tracking, (4) enjoyment metrics, and (5) progress monitoring. These features align with capabilities shown to enhance immersion, engagement, and training outcomes across VR exercise studies.

Interactive environments are central to VR fitness systems because they create a sense of presence and autonomy. Real-time feedback, delivered through visual, auditory, or haptic cues, plays a strong role in regulating user effort, improving movement quality, and increasing exercise satisfaction. Endurance-related features such as duration, pace, distance, and workout intensity are commonly supported by VR systems and have been linked to improved performance and energy expenditure. Enjoyment, as an affective response, strongly predicts motivation and future intention to exercise in VR settings. Finally, progress monitoring features help users track improvements, supporting consistency and long-term behaviour change.

Table 1 Summarises the five features, provides short definitions, and links each feature to supporting research.

Feature	Short Definition	Key Findings from Literature	Selected References
Interactive VR Environment	Immersive virtual spaces that support natural movement and interaction.	Open-world and immersive settings increase enjoyment, autonomy, and engagement.	Ijaz et al. (2017), Ijaz et al. (2020), Elor et al. (2020)
Real-Time Feedback	Instant cues on movement or performance.	Reduces perceived exertion, improves technique, and increases enjoyment through supportive or continuous feedback.	Mestre et al. (2011), Oagaz et al. (2022), Kim & Timmerman (2018)
Endurance Tracking	Measures duration, distance, pace, or intensity during exercise.	VR conditions increase duration, distance, and energy expenditure; supports sustained endurance training.	Chuang et al. (2003), Siriaraya et al. (2023), Rahayu et al. (2026)
Enjoyment Metrics	Features that enhance or capture users' positive emotional responses.	Enjoyment strongly predicts motivation, affect, and intention to continue VR exercise.	Ijaz et al. (2020), Ekpezu et al. (2024), Teixeira et al. (2025)
Progress Monitoring	Tracks performance trends or improvements over time.	Adaptive and data-driven monitoring increases engagement and helps maintain long-term exercise participation.	Sindhu et al. (2026), Pandi et al. (2025), Lee et al. (2020)

Table 1 identifies the five key VR features selected for evaluation in this study. These features were derived from common design elements highlighted across VR exercise and exergaming literature. Each feature corresponds to a specific mechanism shown to influence user behaviour.

Interactive VR environments contribute to immersion and autonomy, which are strong predictors of engagement. feedback supports motor learning and regulates exertion, making it essential for running tasks. Endurance tracking reflects performance-related measures often used in VR cycling, running, and cardiopulmonary training systems. Enjoyment metrics capture the affective dimension of the VR experience, which has repeatedly been shown to drive continued use. Progress monitoring aligns with behavioural reinforcement principles, where visible improvement increases adherence and long-term motivation.

These features collectively provide a grounded basis for evaluating user perceptions of VR running applications and align with the types of functional supports recommended in VR exercise design research.

Task–Technology Fit (TTF)

Task–Technology Fit (TTF) explains the extent to which a technology supports the tasks that users intend to perform. The central premise of TTF is that technology delivers greater performance benefits when its functional capabilities align closely with task requirements (Goodhue & Thompson, 1995). The original TTF model, illustrated in Figure 1, conceptualises this relationship through the interaction between task characteristics and technology characteristics, which together influence utilisation and performance impacts.

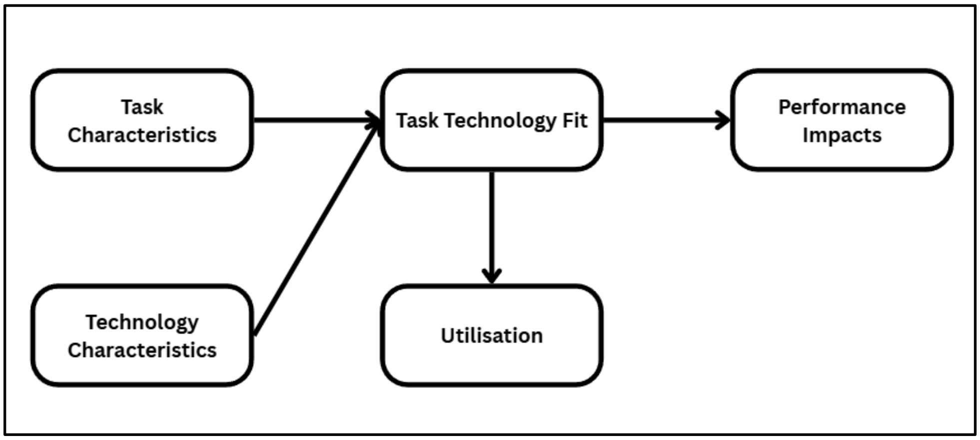

Figure 1. Task-Technology Fit (TTF) theoretical model for the study (Goodhue & Thompson, 1995)

In the context of VR fitness, and particularly running, TTF provides a suitable theoretical lens because running is a structured, goal-oriented activity that requires continuous feedback, pacing control, endurance monitoring, and sustained motivation. These task requirements make it essential to evaluate not just the presence of VR technology, but how well specific system functionalities support the execution of running tasks. As such, TTF enables a more precise assessment of the alignment between user needs and technological capabilities compared to general technology acceptance models.

For VR running, task characteristics include key functional needs such as pacing feedback, distance and endurance tracking, performance awareness, motivation support, and visibility of progress. Technology characteristics, in this study, are represented by five specific VR features identified from prior literature: interactive environments, feedback, endurance tracking, enjoyment elements, and progress monitoring. Mapping these features directly to task requirements allows for a more granular evaluation of how individual system components contribute to task performance.

Unlike most prior studies that apply TTF at the system level, this study operationalises TTF at the feature level. This approach enables the identification of which specific VR functionalities provide the strongest support for running tasks, rather than treating VR systems as a single homogeneous construct. Such a feature-level perspective is particularly relevant in VR fitness design, where different components of the system may serve distinct functional roles.

Empirical studies in digital health and fitness technologies have shown that the alignment between task and technology characteristics significantly influences perceived usefulness, motivation, and continued usage (Chang et al., 2023; Yu & Chen, 2019; Salhieh, 2025). Similar relationships have been observed in AI-enabled health services, where TTF predicts user acceptance through perceived usefulness (Fianu et al., 2024). These findings support the applicability of TTF in evaluating user perceptions of emerging health-related technologies, including VR fitness systems.

In this study, the TTF model is adapted to focus on perceived fit rather than actual utilisation. This adjustment is appropriate because the study is based on user evaluations and does not include behavioural usage data. Prior research has demonstrated that perceived fit alone is a meaningful predictor of expected performance outcomes and behavioural intention in technology adoption contexts. Therefore, the adapted model, presented in Figure 2, positions running-related needs as task characteristics and the selected VR features as technology characteristics, which jointly determine perceived task–technology fit.

Perceived fit is then linked to expected performance impacts, including motivation, engagement, and intention to continue using VR fitness applications. This adapted structure provides a theoretically grounded basis for evaluating how well individual VR features support the task of running and forms the foundation for subsequent feature prioritisation analysis.

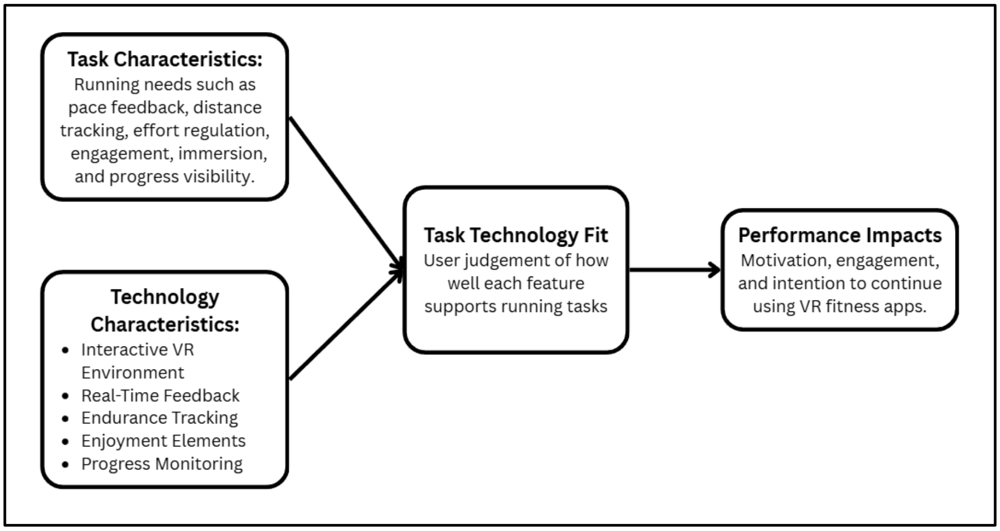

Figure 2. Adapted Task–Technology Fit Model for VR Running Features

Multi-Criteria Decision Methods

Multi-Criteria Decision Making (MCDM) methods support decisions that involve several evaluation criteria simultaneously. They are particularly useful when options cannot be judged using a single indicator. In technology evaluation, MCDM helps organise criteria, assign relative importance, and generate prioritised rankings.

This study uses the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), which ranks alternatives according to their distance from an ideal and a worst-case solution. TOPSIS is transparent, easy to apply, and suitable for studies based on user perceptions. In the context of VR running, users may value immersion, feedback, endurance support, enjoyment, and progress tracking differently. MCDM allows these preferences to be combined into a single structured assessment.

Research in digital health shows that users typically weigh multiple factors, including task fit, usefulness, ease of use, and goal support when evaluating technologies (Chang et al., 2023; Yu & Chen, 2019). Studies on wearable health devices similarly report that better fit between user needs and system functions increases continued use (Salhieh, 2025). TOPSIS complements the TTF perspective by converting user judgements into a ranking that reflects how closely each feature matches ideal task support (Goodhue & Thompson, 1995; Fianu et al., 2024).

Overall, combining TTF with TOPSIS offers a structured way to assess user priorities and identify which VR running features provide the strongest task–technology alignment.

Methods

Research Design

This study adopts a quantitative research design to evaluate how users perceive key VR running features and how well these features support running-related tasks. Guided by the Task–Technology Fit (TTF) perspective, the study conceptualises VR features as technology characteristics and evaluation criteria as task characteristics, allowing for a structured assessment of perceived fit at the feature level.

Given that the study involves evaluating multiple features across several criteria simultaneously, a Multi-Criteria Decision Making (MCDM) approach was employed. Traditional statistical methods are limited in their ability to generate prioritised rankings when multiple evaluation dimensions are involved. In contrast, MCDM provides a systematic framework for integrating multiple criteria into a single decision structure, making it particularly suitable for feature prioritisation problems.

Among MCDM techniques, the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) was selected due to its suitability for ranking alternatives based on their relative distance to an ideal solution. TOPSIS is computationally efficient, transparent in its procedure, and well-suited for perception-based data, making it appropriate for this study, which relies on user evaluations rather than objective performance measures.

Five VR features were evaluated against five criteria, forming a 5 × 5 decision matrix. Participants rated all feature–criterion combinations using a structured online questionnaire.

Participants and Sampling

Purposive sampling was used to recruit Malaysian participants who engage in regular running or jogging and have familiarity with digital fitness tools. While prior VR experience was considered desirable, it was not made a strict requirement to allow the inclusion of broader user perspectives on VR fitness features.

A total of 231 responses were collected via Google Forms distributed through WhatsApp, email, and Telegram. After screening for completeness and relevance, 141 valid responses were retained for analysis. Participants were aged between 19 and 45, representing a demographic group commonly associated with active fitness participation and early adoption of digital fitness technologies.

VR Features Evaluated

Five VR features commonly reported in VR fitness and exergaming literature were selected for evaluation:

- Interactive VR Environment
- Real-Time Feedback
- Endurance Tracking
- Enjoyment Elements
- Progress Monitoring

These features represent core technology characteristics associated with immersion, feedback, performance tracking, affective engagement, and behavioural reinforcement. Their selection was guided by recurring themes identified across prior VR fitness studies, ensuring that the features reflect commonly implemented and theoretically relevant system functionalities.

Evaluation Criteria

Participants evaluated each feature using five criteria representing task characteristics within the TTF framework:

- Engagement
- Motivation
- Practicality
- Effectiveness
- Usability

Each feature–criterion combination was rated using a five-point Likert scale. The use of a Likert scale is appropriate for capturing subjective user perceptions and allows respondents to evaluate multiple feature–criterion combinations independently without the cognitive burden associated with pairwise comparison methods such as the Analytic Hierarchy Process (AHP). This approach is particularly suitable in studies involving multiple alternatives and criteria, where pairwise comparisons may lead to respondent fatigue and inconsistent judgements.

The questionnaire was developed based on established constructs in VR fitness and technology evaluation literature. Each criterion was operationalised through clear and context-specific descriptions to ensure consistent interpretation among respondents (see Table 2).

Table 2 Definitions of the Evaluation Criteria.

Criterion	Definition
Engagement	Ability to hold user attention and immersion
Motivation	Encourages continued running and persistence
Practicality	Realistic and functional for running tasks
Effectiveness	Supports training outcomes such as pace or performance
Usability	Ease of use and clarity during exercise

Data Analysis

Respondent Demographics

A total of 141 valid responses were analysed after screening for completeness and running frequency. Most respondents were male (60.71 percent), and females represented 39.29 percent. The sample consisted mainly of young adults, where 53.57 percent were aged 19 to 24 and 38.57 percent were aged 25 to 34. Only 8.57 percent were above 35.

Regarding running habits, 31.21 percent of respondents ran daily while 68.79 percent ran weekly. VR experience was mixed, as 42.55 percent had used VR before. However, a large majority (85.78 percent) used digital fitness tools such as smartwatches during running. This indicates that the sample comprises active runners who are generally familiar with technology supported exercise.

Evaluation Criteria and Data Preparation

Five criteria were selected for evaluating VR running features, namely Usability, Engagement, Motivation, Practicality and Effectiveness. Respondents rated the importance of each criterion on a five point Likert scale. In addition, each of the five VR features was evaluated against all five criteria using the same scale, generating a complete twenty-five cell evaluation matrix.

Descriptive statistics were used to examine the distribution of raw ratings across criteria and features. These descriptive patterns were not interpreted at this stage; instead, they provided the foundation for Multi-Criteria analysis.

As this study focuses on evaluating feature-level perceptions rather than latent constructs measured using multiple indicators, reliability analysis such as Cronbach's alpha was not conducted. Each evaluation criterion was measured using clearly defined, single-item indicators to ensure direct and unambiguous interpretation by respondents. This approach is consistent with prior studies that employ single-item measures for concrete and well-defined constructs in technology evaluation contexts.

Decision Matrix Construction

A decision matrix was constructed by calculating the mean rating for each feature and criterion combination. The rows represented the five VR features, and the columns represented the five evaluation criteria. This matrix reflects the perceived suitability of each feature and serves as the input for the TOPSIS computation.

In addition to the suitability ratings, a separate importance matrix was constructed based on the respondents' ratings of the five criteria. These importance scores were used as weights during the TOPSIS procedure, ensuring that more important criteria have a stronger influence on the final rankings.

TOPSIS Analysis Procedure

The Technique for Order Preference by Similarity to Ideal Solution was used to rank both the criteria and the VR features. The following steps were carried out:

1. Normalisation of the decision matrix to place all ratings on a comparable scale.
2. Application of weights derived from the importance ratings of the criteria.
3. Identification of ideal and negative ideal values for each criterion.
4. Computation of the separation distances of each feature from the ideal and negative ideal points.
5. Calculation of the closeness coefficient for each feature and criterion combination.

The closeness coefficient ranges from zero to one, where higher values indicate a feature that more closely meets the optimal criteria. This analysis was performed using Python to ensure consistency and accuracy.

Results

Importance of Evaluation Criteria

Respondents rated all five criteria as important, but with clear differences in priority. Effectiveness received the highest importance ratings, where 76.60 percent of respondents marked it as Important or Very Important. Practicality also scored strongly with 46.10 percent rating it Important and 21.28 percent rating it Very Important. Usability, Motivation and Engagement were also valued but received fewer Very Important ratings. The TOPSIS analysis produced the ranking shown below in Table 3.

Table 3 Criteria Importance Ranking and Scores

Rank	Criterion	Score
1	Effectiveness (Impact on Performance)	0.723
2	Practicality	0.547
3	Usability	0.494
3	Motivation	0.494
5	Engagement	0.454

Effectiveness clearly dominates as the most critical evaluation criterion, followed by Practicality. Usability and Motivation are tied as mid-level factors, while Engagement is comparatively less influential. This similarity in scores between Usability and Motivation may indicate that respondents perceive ease of use and motivational influence as equally important in supporting VR running activities, particularly in contexts where both functional simplicity and psychological encouragement are required simultaneously during exercise.

Perceived Suitability of VR Features

The five VR features evaluated were Interactive VR Environment, Real-time Feedback, Endurance Tracking, Enjoyment Metrics and Progress Monitoring. Across all features and criteria, most ratings fell under Good and Excellent, with a substantial portion under Average. Very few responses fell under Poor or Very Poor, indicating generally positive perceptions.

A consistent pattern emerged across features:

- Effectiveness and Practicality consistently received the highest suitability ratings.
- Usability, Motivation and Engagement showed more Average ratings, indicating areas that may require refinement.

These findings reinforce earlier indications that users evaluate VR features primarily based on performance impact and real-world feasibility.

TOPSIS Rankings by Feature and Criterion

TOPSIS was applied individually to each feature to determine which evaluation criteria mattered most for that feature. The rankings show a highly consistent pattern:

- For Interactive VR Environment, Effectiveness ranked first with a score of 0.6826 followed by Practicality with a score of 0.5991.
- For Real-time Feedback, Effectiveness ranked first with 0.6708 followed by Practicality at 0.5605.
- For Endurance Tracking, Effectiveness ranked first with 0.6618 and Practicality ranked second with 0.5871.
- For Enjoyment Metrics, Effectiveness scored 0.6393 and Practicality scored 0.5685.
- For Progress Monitoring, Effectiveness ranked first with 0.6051 and Practicality ranked second with 0.5652.

These results show that for every feature, Effectiveness is consistently the strongest criterion, while Practicality is consistently the second strongest. Usability, Motivation and Engagement consistently occupied the lower positions with smaller closeness coefficients.

Overall Ranking of All Feature and Criterion Combinations

When all twenty-five feature and criterion combinations were ranked together, the structure became even clearer:

- The top five positions were all Effectiveness ratings across the five features. The highest scores were Interactive VR Environment (0.6826) and Real-time Feedback (0.6708).
- The next group was dominated by Practicality scores, again led by Interactive VR Environment (0.5991).
- Progress Monitoring achieved the highest Usability score of 0.4762, indicating strong clarity and ease of use.
- Enjoyment Metrics achieved the highest Motivation score of 0.4689 and the highest Engagement score of 0.4685, suggesting that it contributes strongly to enjoyment and emotional involvement.
- Real-time Feedback and Endurance Tracking performed strongly on Effectiveness and Practicality but scored lower on Usability and Engagement, indicating some complexity in operation.

Summary of Overall Findings

Overall, the results indicate that users prioritise performance impact and practical usefulness above all other aspects of VR running features. Features that support structured feedback and performance tracking, such as Progress Monitoring, Endurance Tracking and Interactive VR Environments, demonstrate the strongest structural performance. Enjoyment oriented features do enhance motivation and engagement but are not viewed as primary drivers of usefulness.

These results provide a structured basis for prioritising VR running feature development and offer clear direction for refining performance-oriented and engagement-oriented system components.

Discussions

Interpretation through the Task–Technology Fit Perspective

The ranking results provide a clear indication of how well each VR feature supports the core task of running. High-performing features such as Interactive VR Environment, Real-time Feedback, and Endurance Tracking demonstrate strong task–technology fit, as they directly address essential running requirements, including pace regulation, immersion, and performance monitoring. Their consistently high TOPSIS scores suggest that users perceive these features as functionally relevant and practically useful during running activities.

In contrast, lower-ranked features exhibit comparatively weaker alignment with immediate task demands. While features such as Enjoyment Metrics and Progress Monitoring contribute to user engagement and long-term motivation, they do not directly support the continuous and performance-oriented nature of running. This distinction highlights an important insight: users differentiate between features that enhance task execution and those that support affective or secondary outcomes.

Overall, the findings reinforce the central premise of the Task–Technology Fit framework. Features that closely match the functional requirements of running tasks achieve higher perceived fit, while features that are less directly aligned with task execution receive lower prioritisation. This suggests that effective VR fitness design should prioritise functional alignment over purely experiential enhancements.

Practical Implications

The findings provide actionable direction for VR fitness developers and product teams, particularly those targeting Malaysian users. Given that the strongest task–feature alignment is associated with performance-related capabilities, developers should prioritise enhancing real-time feedback and endurance tracking functionalities. These features are likely to deliver the most immediate value, especially for users who rely on performance metrics to regulate pace and stamina in physically demanding conditions.

At the same time, usability and engagement should not be overlooked. The relatively lower ranking of these criteria suggests that current VR implementations may still present usability challenges or cognitive load during exercise. Simplifying interface design, improving feedback clarity, and ensuring seamless interaction can enhance user experience without disrupting task execution.

For product managers, the results offer a structured basis for resource prioritisation. High-performing features should be emphasised in development roadmaps, while lower-ranked features such as enjoyment elements can be refined to better complement task-oriented functionalities. This balance is particularly important in ensuring both immediate usability and long-term user retention.

Theoretical Implications

This study contributes to VR fitness and information systems research by demonstrating how Multi-Criteria Decision Making (MCDM), specifically TOPSIS, can be integrated with the Task–Technology Fit framework to evaluate technology at a more granular level. By translating user perceptions into structured rankings, the study extends TTF beyond traditional system-level analysis to a feature-level perspective.

This feature-level application provides a more nuanced understanding of how individual technological components contribute to task performance. It highlights that not all system features contribute equally to task–technology fit, reinforcing the importance of evaluating technologies based on their functional roles rather than treating them as homogeneous systems.

Furthermore, by situating the analysis within a Malaysian context, the study provides insights into how user expectations, environmental conditions, and familiarity with digital fitness tools may shape perceptions of task–technology alignment. This contextual perspective enriches the applicability of TTF in emerging technology domains and supports its extension into immersive fitness environments.

Conclusion

This study evaluated the suitability of key VR running features using the Task–Technology Fit framework and the TOPSIS method, focusing on how Malaysian runners perceive the usefulness of VR capabilities. By analysing ratings across five evaluation criteria, the study identified which features offer the strongest support for real running tasks.

The results present a clear and consistent pattern. Effectiveness and practicality emerged as the highest priority criteria, and features such as Interactive VR Environment, Real-time Feedback, and Endurance Tracking achieved the strongest task–technology alignment. Enjoyment Metrics and Progress Monitoring were also positively perceived but showed weaker alignment with immediate running demands. These differences highlight how Malaysian users distinguish between performance-driven and enjoyment-driven VR features.

The TOPSIS rankings provide practical direction for VR fitness development. They identify which features are essential for supporting performance improvement and which require further refinement. Developers, designers, and product teams especially those targeting Malaysian or Southeast Asian users can use these rankings to prioritise improvements, optimise resource planning, and design systems that better support movement, feedback, and engagement during VR running.

Overall, the study reinforces the importance of incorporating user preferences into VR innovation. Features that align closely with the real needs of runners deliver stronger task fit, higher satisfaction, and increased potential for long-term adoption. These findings offer valuable guidance for system development and contribute to a structured foundation for future research on VR fitness evaluation in Malaysian and broader regional contexts.

Limitations and Future Studies

This study has several limitations that should be acknowledged. First, the sample consisted of 141 Malaysian respondents, which may not fully represent the broader population of runners or VR users within Malaysia or internationally. A larger and more diverse sample would improve the generalisability of the findings and allow for more robust subgroup analysis.

Second, a proportion of respondents did not have prior experience using VR. While this may affect the accuracy of experiential evaluations, the study captures both experienced and prospective user perspectives, which are relevant in understanding early-stage adoption and expectations of VR fitness features. Future studies may focus specifically on users with direct VR experience or incorporate behavioural usage data to provide deeper insights into actual task–technology interaction.

Third, the study evaluated only five VR features. Although these features were selected based on their relevance and support from prior literature, VR fitness systems offer a wider range of capabilities, including social interaction, adaptive difficulty, safety indicators, and biomechanical feedback. The exclusion of these features means that the current findings do not fully capture the entire spectrum of VR functionalities in fitness contexts.

Future research can extend this work by including more diverse participant groups across different regions, age groups, and levels of VR exposure. Incorporating objective performance data, such as running speed, physiological responses, or stride metrics, would further strengthen the validation of VR feature effectiveness beyond self-reported perceptions. In addition, comparative studies across VR platforms and device types may provide further insights into how system design, accessibility, and affordability influence user preferences and task–technology alignment.

Such extensions would contribute to a more comprehensive understanding of how VR fitness applications can be designed to better support users and enhance the effectiveness of immersive exercise experiences.

Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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