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Technostress in Motion: How Social Features in Running Apps Trigger Anxiety through Social Comparison

[1]Rony Mohamad Rizal*, [1]Akhmad Sobarna, [1]Sumbara Hambali, [4]Silvy Juditya

Abstract: This study examined how intensity of social feature use in digital running applications (such as Strava) predicts performance-related anxiety among recreational runners, grounded in the technostress framework and social comparison theory. A cross-sectional online survey involving 58 recreational runners in Indonesia assessed social feature usage intensity, social comparison orientation, and performance-related anxiety using validated psychological instruments. Results revealed a significant positive relationship between social feature use and anxiety levels. While social comparison orientation was associated with usage intensity, it did not significantly mediate the relationship with anxiety, likely attributable to limited statistical power from the small sample size. Findings indicate that digital visibility and social comparison pressures within fitness platforms adversely affect users' psychological well-being. In Indonesia's collectivist cultural context, where public image maintenance and peer validation are strongly emphasized, these adverse effects may be substantially amplified. The study offers important practical implications for users, psychologists, and platform developers concerned with safeguarding mental health in digital sport environments.

Keyword: Technostress; Social Comparison; Sport Anxiety; Sport Psychology; Strava

Address Correspondence: STKIP Pasundan
*Email: ronymrizal@stkipapasundan.ac.id

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AUTHOR INFORMATION

Corresponding Author Phone Number (*Whatsapps*): Ex. 082119086333	Affiliation	Country	Email
Rony Mohamad Rizal	STKIP Pasundan	Indonesia	ronymrizal@stkippsundan.ac.id
Akhmad Sobarna	STKIP Pasundan	Indonesia	akhmadsobarna9@gmail.com
Sumbara Hambali	STKIP Pasundan	Indonesia	sumbarahambali8@gmail.com
Silvy Juditya	STKIP Pasundan	Indonesia	sjuditya@gmail.com

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INTRODUCTION

In the last decade, the landscape of sport and health has undergone a fundamental shift driven by the pervasive adoption of digital technology. This phenomenon, known as the Quantified Self movement, refers to the practice individuals tracking various aspects of their lives, from daily steps and sleep patterns to heart rate using technological devices to achieve a deeper self understanding (Esmonde, 2019; Feng et al., 2021; Lupton, 2016; Toner et al., 2023). Amidst this wave, running, particularly among recreational athletes, has become one of the most affected activities. The globally increasing popularity of running, including in Indonesia (Hongwei & Resza, 2021), goes hand in hand with the widespread use of wearable devices such as smartwatches and their connected fitness tracking applications (Mason et al., 2023).

These devices, initially perceived as passive tools for motivation and progress monitoring (Ho et al., 2022), have evolved into "orientation devices" that actively shape the user's experience and behaviour (Mertala & Palsa, 2024). Trough features such as goal setting, instant feedback, and gamification elements, this technology has proven effective in increasing physical activity and motivation (Feng et al., 2021; Griffiths et al., 2024; Ringeval et al., 2020). However, alongside these motivational benefits, an emerging body of literature highlights the "dark side" of constant self-tracking (Feng et al., 2021; Griffiths et al., 2024; Toner, 2018). A growing counter narrative suggests that continuous interaction with performance data can trigger adverse psychological consequences, such as increased stress, anxiety, affective states such as guilt, and even compulsive or addictive behaviours (Beckett et al., 2025; Eikey, 2021; Maxwell et al., 2021; Pingo & Narayan, 2019; Spotswood et al., 2020).

One of the key psychological mechanisms hypothesised to link the use of sport technology with the emergence of psychological distress is social comparison (Lupton, 2019). Modern running applications like Strava function not only personal digital logbooks but also as social network designed for interaction and comparison (Franken et al., 2023). Features such as leaderboards, activity sharing, and the provision of "kudos" (s form of one-click social support) inherently create a virtual arena where runners can perpetually compare their performance in terms of pace, distance, and frequaency with treir peers (Couture, 2021; Diel et al., 2021; Franken et al., 2023). The theoretical framework of technostress, stress arising from an inability to adapt to new technology (Ayyagari et al., 2011), this concept is very relevant for understanding the dynamics of digital device use in daily activities, including sports (Werner & Bischof, 2024). In this context, social features on smartwatches and fitness tracking apps such as leaderboards, automatic notification, or sharing running results on social media can act as technostressors (Naga & Ebardo, 2025). These elements often trigger comparison pressure and digital visibility, which can ultimately cause psychological stress for users (Werner & Bischof, 2024).

Social comparison theory posits that individuals possess an innate drive to evaluate themselves by comparison with others (Crusius et al., 2022). While this can be motivating, it also carries a high risk of triggering negative effects. Specially, upward social comparison, comparing oneself to someone perceived as superior, can elicit a range of negative emotions such as anxiety, shame, feelings of inferiority, and threats to self-esteem (Franken et al., 2023; Pennington & Dam, 2023). In the context of sport, the pressure arising from this constant comparison is a significant technostress factor, wich may erode the enjoyment of exercise and even increase the risk of injury due to the urge to push beyond safe limits (Perry, 2018; Werner & Bischof, 2024)

This phenomenon is particularly slient in the Indonesian context, where the use of the Strava application is not only popular but has also given rise to viral trends such as the "Stava Jockey", the practise of buying and selling running data to gain social validation (Dewi & Winardi, 2024; Matteo, 2024). This trend may indicate a strong social pressure to present an active and accomplished self-image on digital platforms, which could potentially exacerbate performance-related anxiety (Abel et al., 2016; Ajewumi et al., 2024). Although the general relationship between social media and mental health has been widely discussed (Naslund et al., 2020; Zsila & Reyes, 2023), a research gap remains concerning the specific psychological

pathways from social feature usage on running applications to performance-related anxiety among Indonesian recreational runners.

Therefore, this study aims to address this lacuna by empirically testing the relationship between the intensity of social feature usage on running applications and levels of performance-related anxiety. Furthermore, this study will investigate the role of social comparison orientation as mediator in this relationship. Based on the theoretical framework presented, this study proposes the following hypotheses:

(1) There is a significant positive relationship between the instensity of social feature usage on running applications and performance-related anxiety levels among recreational runners.
(2) Social comparison orientation significantly mediates the realationship between the intensity of social feature usage on running applications and performance-related anxiety levels.

METHOD

Participants and Procedure

This study employed a cross-sectional survey design. Participants were recruited via convenience sampling from a running community facilitated by a local Indonesian sportswear brand Ento Apparel. This community regularly holds joint training sessions for its costumers, and a link to the online questionnaire was distributed through the community's internal communication group. The inclusion criteria were (1) being over 18 years of age, (2) actively running at least twice a week, and (3) having used a smartwatch or fitness tracker connected to a running application (e.g., Strava, Garmin Connected) for at least the past six months.

Instruments

(1) Social Feature Usage Intensity Scale (SFUIS). This scale was developed specifically for this study and consists of six items to measure the frequency of social feature usage on running applications (e.g., "I view activity details uploaded by friends or other people on my running app"). Respondents answered using a five-point Likert scale (1 = Never to 5 = Very Often). In the current sample, the scale demonstrated good internal consistency (α =.746).
(2) Performance-Related Anxiety (SAS-2-PR). We used the Sport Anxiety Scale-2 (Smith et al., 2006), which has been validated for the Indonesian athlete population (Putra et al., 2021). Given that our population consists of recreational runners, we performed a contextual adaptation of the items by replacing the term "competition" with "running session" or "running performance" to enhance content validity. This scale consistsof 15 items measuring three dimensions: Concentartion Disruption, Somatic Anxiety, and Worry, using a four-point Likert scale (1 = Not at All to 4 = Very Much). The scale showed excellent internal consistency in this study (α =.925).
(3) Social Comparison Orientation (INCOM). We used the 6 item short version of the Iowa Netherlands Comparison Orientation Measure (Gibbons & Buunk, 1999) as recommended by (Schneider & Schupp, 2011) due to its efficiency and sound psychometric properties. This scale measures an individual's tendency to compare themselves with others regarding abilities and opinions, using a five-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). The scale demonstrated strong internal consistency in our sample (α =.843).

Data Analysis

Data analysis was perfomed using IBM SPSS Statistics version 26. First, descriptive statistics and internal reliability tests (Cronbach's Alpha) were conducted for all scales. Second, Pearson's correlation was used to the test the relationships between variables. Third, to the mediation hypothesis, we used the PROCESS Macro for SPSS (Model 5) by Andrew F. Hayes (Hayes, 2022; Igartua & Hayes, 2021). A bootstrapping procedure with 5,000 samples was used to test the significance of the indirect effect. The mediation effect was considered significant if

the 95% confidence interval (CI) did not include zero.

RESULT

Preliminary Analysis

The internal reliability analyses yielded acceptable to axcellent Cronbarch's Alpha coefficients for all 16les used: SFUIS (α =.746), SAS-2-PR total (α =.925), and the INCOM short version (α =.843). Descriptive statistics and correlations among the variables are pr20nted in Table 1. The correlation results indicate that Social Feature Usage Intensity (SFUIS) was significantly and positively correlated with Social Comparison significantly and positively correlated with SAS-2-PR.

17

Table 1. Descriptive statistics and pearson correlation Matrix

Variable	M	SD	1	2
SFUIS	17.91	05.03	-	
INCOM	17.34	5.75	.419**	-
SAS-2-PR	25.66	8.61	.278*	.340**

Notes:
N = 58. * p <.05, ** p <.01.
SFUIS = Social Feature Usage Intensity;
INCOM = Social Comparison Orientation;
SAS-2-PR = Performance-Related Anxiety of Running.
M and SD data were taken from SPSS output

29diation Hypothesis Test

The results of the mediation analysis using the PROCESS Macro (see Figure 1 for the conceptual model) are detailed as follows:

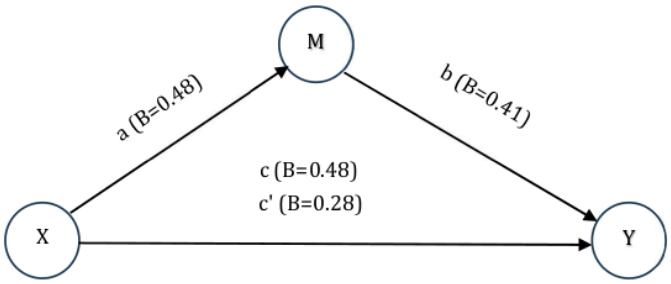

Figure 1. Conceptual Model

First, a significant total effect of Social Feature Usage Intensity on 37rformance -Related Anxiety was found (path c: $B = 0.4764$, $p = .0346$), indicating that more intense use of social features is associated with higher level anxiety.

Next, the mediation path analyisis showed that Social Feature Usage Intensity significantly predicted Social Comparison Orientation (path a: $B = 0.4795$, $p = .0010$). However, Social Comparison Orientation did not significantly predict Performance-Related Anxiety after controlling for the independent variable (path b: $B = 0.4058$, $p = .0546$).

Most importantly, the indirect effect of Social Feature Usage Intensity on Performance-Related Anxiety trough Social Comparison Orientation was not statistically significant, with the 95% bootstrap confidence interval crossing zero (indirect effect = 0.1946, 95% CI [-0.0109, 0.5421]). After the mediator was included, the direct effect of Social Feature Intensity on Anxiety became non-significant (path c': $B = 0.2818$, $p = .2382$).

DISCUSSION

This study aimed to examine the psychological pathway linking the use of social features on running applications to performance-related anxiety, focusing on the mediating role of social comparison orientation. The findings present a nuanced picture. In line with our first hypothesis, a significant total relationship was found between the intensity of social feature usage and levels of performace-related anxiety. This confirms the basic premise that interactions within the digital sports ecosystem are linked to the psychological state of users (Eikey, 2021; Feng et al., 2021). This study also found strong evidence that the use of social features significantly increase the tendency to engage in social comparison (Path a), supporting the argument that the design of these platforms indeed encourages comparative behaviour (Werner & Bischof, 2024).

This finding reinforces the theoretical relevance of the technostress framework, which suggest that new technological features, particularly those that promote constant connectivity and visibility, can function as digital stressors (Ayyagari et al., 2011). In this context, social features such as leaderboard rankings and activity feeds serve not merely as motivational tools but also as triggers for performance-related anxiety by encourageing upward comparison and perceived social evaluation (Franken et al., 2023). These findings align with the conceptualization of "techno-insecurity" and "techno-invasion" in (Ayyagari et al., 2011) model, wich posits that technology can create psychological vulnerability by overexposing users to judgment and performance standards.

The Indonesian cultural context may further intensity these effects. As a collectivist society, Indonesia places high value on social approval and group belonging (Hofstede, 2003). In such a cultural setting, digital fitness platforms are not solely tools for individual tracking but also arenas for social performance (Lupton, 2016), where users may feel substantial pressure to conform, impress others, and avoid "digital shame" (Sahal, 2024). The emergence of phenomena such as "Strava Jockey", buying or faking run data, illustrates how digital validation has become interwined with self-worth and group status, highlighting a culturally specific expression of technostress and anxiety (Matteo, 2024).

However, our main mediation hypothesis was not statistically supported. The indirect effect of social feature usage on anxiety through social comparison was not found to be significant. The most plausible interpretation for this finding is a limitation of statistical power due to the relatively small sample size (N = 58). Mediation effects, which are inherently smaller effects, often require large samples to be detected significantly (Hayes, 2022). This is reinforced by the finding that the relationship between social comparison and anxiety (Path b) show a trend that is close to significant ($p = 0.0546$). This value indicates that the effect is likely to exist, but this study does not have sufficient power to capture it definitively.

Another possible theoretical explanation is that social comparison is not the only mediator in this relationship. The psychological impact of sports technology is likely a multifactorial phenomenon. Other mechanisms such as Fear of Missing Out (FOMO) (Tekinbaş et al., 2023), pressure to maintain one's digital self-image, or even competitive gamification elements (Bai et al., 2024) may work in parallel or in conjuction with social comparison in triggering anxiety.

Although the mediation was not significant, these finding still make an important contribution. This is one of the first studies to quantitatively test this model in the unique cultural context of Indonesia, where phenomena such as "Strava jockeys" exist (Sahal, 2024) highlights the extreme social pressure for digital validation.

Practical Implications

These findings have important implications for several parties:

(1) For Runners: Runners should be encourage to develop an awareness of their habits in using these applications. Engaging with social features more mindfully, for instance by limiting time spent viewing others' activities and focusing more on personal progress (personal bets) rather than rankings, may help to mitigate negative psychological effects.

(2) For Sport Psychologists and Coaches: Practitioners can educate their clients or athletes on the potential "dark side" of this technology. Educational sessions could cover strategies for managing social comparison and for building more intrinsic and stable sources of motivation.
(3) For App Developers and Sport Brands: There is an opportunity for developers to design more psychologically healthy platforms. Brands such as Tiento Apparel, which facilitate running communities, are in a unique position to promote a healthy sporting culture. They can encourage the use of features that focus on participation and personal progress, rather than purely competitive metrics, thereby creating a more supportive and less anxiety inducing digital environment.

Limitation and Future Research Directions

This study has several limitations. First, the cross-sectional design does not permit causal inferences. Second, the data are self-reported and may be susceptible to social desirability bias. Third, the relatively small sample size (N = 58) limits statistical power and the generalisability of the findings.

Future research could address these limitations in several ways. A longitudinal study would be invaluable for tracking how anxiety levels and comparison orientation change over time in runners who are new to using an application (Neumann et al., 2025). An experimental study could directly manipulate the typr of feedback runners receive (e.g., social comparison-based vs. personal progress-based feedback) to test its causal impact on anxiety. Finally, qualitative research using in-depth interviews could provide a richer understanding of runners' lived experiences related to the pressures and anxieties arising from application use, as has been done in other contexts (Petróczi et al., 2025).

CONCLUSION

This study provides preliminary evidence that the intensity of social feature usage on running applications is associated with increased performance-related anxiety among recreational runners in Indonesia. Although the mediational pathway through social comparison was not statistically significant in this sample, the findings highlight the complexity of the relationship between technology, psychology, and sport behaviour. This underscores the importance of a balanced approach to the use of sports technology, where motivational benefits must be considered alongside potential psychological risks. With the increasing integration of technology into daily life, understanding how to design and use this technology healthily is becoming ever more crucial for the well-being of its users.

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