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From Problematic Smartphone Use to Cognitive Decline: The Mediating Role of Doom Scrolling Among Students Receiving Sport Education, A Structural Model

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Abstract

Background

The pervasive use of smartphones has raised concerns about their cognitive and psychological consequences among young adults. Problematic smartphone use has been linked to attentional disruption and mental fatigue, while *doom scrolling*—the repetitive consumption of distressing online content—has emerged as a maladaptive digital behavior that may intensify cognitive strain. Despite growing interest in digital fatigue, studies simultaneously examining problematic smartphone use, doom scrolling, and brain rot—defined as perceived cognitive fatigue resulting from excessive digital consumption—remain limited, particularly among sport sciences students whose academic and performance demands require sustained attention and cognitive flexibility.

Objective

This study examined whether problematic smartphone use predicts brain rot and tested the mediating role of doom scrolling among university students receiving sport education.

Methods

A cross-sectional design was used with 491 sport sciences students. Participants completed validated measures of problematic smartphone use, doom scrolling, and brain rot. Data were analyzed using Structural Equation Modeling (SEM), and mediation effects were tested using bootstrapping procedures.

Results

Problematic smartphone use positively predicted brain rot ($\beta = 0.62$, $p < .001$). It also significantly predicted doom scrolling ($\beta = 0.61$, $p < .001$), which in turn predicted brain rot ($\beta = 0.20$, $p < .05$). The indirect effect was significant, indicating partial mediation.

Conclusion

Problematic smartphone use contributes to cognitive fatigue both directly and indirectly through doom scrolling. These findings suggest that interventions should address maladaptive digital behaviors, not only screen time, to protect cognitive well-being.

1. Introduction

The profound influence of the integration of digital technologies into everyday life on individuals' cognitive, emotional and behavioural processes has been extensively documented (Carr 2010; Kuss and Griffiths 2017; Wilmer et al. 2017; Montag and Diefenbach 2018). Smartphones, in particular, have been shown to impose an unprecedented burden on attentional systems and cognitive resources (Ward et al. 2017; Wilmer et al. 2017). This is due to a number of factors, including their constant accessibility, personalised content delivery, and uninterrupted stream of stimuli. In this context, scholarly interest has increasingly shifted towards the psychological and cognitive consequences of digital technologies, not only in terms of usage duration but also with respect to patterns and modes of use.

Problematic smartphone use has been defined as a difficulty in regulating smartphone use, the disruption of daily functioning, and the association of such use with psychological distress (Kwon et al. 2013; Billieux et al. 2015; Elhai et al. 2017, 2020; Montag et al. 2021). As demonstrated in previous research, problematic smartphone use has been shown to be associated with a number of cognitive outcomes, including attentional distraction, cognitive failures and mental fatigue (Hadlington 2015; Wilmer et al. 2017). In particular, it has been demonstrated that persistent exposure to notifications and engagement in multitasking behaviours contribute to the fragmentation of cognitive resources and a decline in attentional performance (Ophir et al. 2009; Ward et al. 2017).

However, a substantial portion of extant literature has primarily examined problematic smartphone use in relation to outcomes such as general psychological well-being, anxiety, and depression (Elhai et al. 2016; Thomée 2018; Horwood and Anglim 2019; Sohn et al. 2019), while comparatively limited attention has been paid to cognitive wear and mental fatigue processes. This imbalance indicates a conceptual and empirical discrepancy in the understanding of the cognitive dimension of digital technology use.

A concept that has gained increasing prominence in recent literature is that of 'doom scrolling', which refers to the uncontrolled and repetitive consumption of digital content that is predominantly negative, threatening, or anxiety-inducing (Garfin et al. 2020; Bendau et al. 2021). Although initially motivated by the pursuit of information, doom scrolling can gradually evolve into a habitual pattern that intensifies cognitive and emotional load (Shabahang et al. 2024).

Despite the evidence from preceding studies indicating an association between doom scrolling and symptoms of anxiety, stress and emotional exhaustion (Garfin et al. 2020; Bendau et al. 2021), the cognitive consequences of this practice remain an area that requires further investigation. In particular, despite theoretical assertions that continuous exposure of the attentional system to negative content hinders cognitive recovery and exacerbates mental fatigue (Sweller 2020), the role of doom scrolling in processes of cognitive deterioration has been examined empirically only to a limited extent.

The concept of "brain rot," which has recently emerged as a subject of discussion within the domain of digital culture, signifies a perceived state of cognitive fatigue, diminished attention, and mental exhaustion arising from excessive and substandard digital content consumption (Carr 2010; Ward et al. 2017; Firth et al. 2019). Despite the prevalence of this concept in popular discourse, systematic academic investigations of brain rot remain limited. Nevertheless, cognitive load theory and the digital

attention literature provide a robust theoretical framework for explaining the mechanisms underlying the concept of brain rot (Ward et al. 2017; Sweller 2020).

As demonstrated in the extant research, the ingestion of excessive digital content exerts a chronic load on the cognitive system, thereby heightening perceptions of mental fatigue over the long term (Eppler and Mengis 2004; Wilmer et al. 2017; Firth et al. 2019; Kushlev and Leitao 2020). However, the extent to which these phenomena are associated with specific digital behaviours, such as problematic smartphone use and doom scrolling, remains to be fully elucidated, particularly within young adult populations.

As indicated in the extant literature, university students are frequently examined in academic discourse as one of the groups with the most intensive use of digital Technologies (Lepp et al. 2014; Roberts et al. 2014; Samaha and Hawi 2016; Elhai et al. 2017; Hawi et al. 2018; Panova and Carbonell 2018; Twenge 2019; Montag and Elhai 2020). Nevertheless, the assumption of homogeneity among university students may impose significant limitations in terms of explaining the cognitive consequences of digital behaviours. It is particularly important to note that students enrolled in Faculties of Sport Sciences represent a unique and strategically relevant sample for examining processes of digital cognitive fatigue. This is due to the fact that they undergo an intensive educational trajectory that demands not only academic engagement but also physical performance, motor learning, sustained attention, and cognitive–psychomotor coordination.

From this standpoint, students enrolled in Faculties of Sport Sciences can be regarded not only as a group characterised by high levels of digital technology use, but also as a population that simultaneously manifests both risk and potential protective factors with respect to cognitive load. Despite the extensive emphasis in the literature on the protective effects of physical activity on cognitive functioning, it remains unclear whether problematic digital behaviours may still lead to cognitive deterioration despite this potential protective influence. Consequently, studies conducted with sport sciences students facilitate a more sensitive and nuanced examination of digital cognitive fatigue.

To summarise, the extant literature has predominantly examined the psychological outcomes of problematic smartphone use, doom scrolling, and digital content consumption within samples of general university students. However, studies that investigate these variables within a single model, in the context of cognitive deterioration (*brain rot*), among a student group requiring high levels of cognitive and physical performance, and through mediating mechanisms, remain limited. This discrepancy signifies a substantial theoretical and empirical deficiency within the extant literature, particularly with regard to students enrolled in Faculties of Sport Sciences.

The objective of this study is to examine the impact of problematic smartphone use on cognitive decline among students enrolled in Faculties of Sport Sciences, and to assess the mediating role of doom scrolling in this relationship using structural equation modeling. In this respect, the study seeks to offer original contributions to the digital media literature as well as to the fields of sport psychology and sport

education by addressing the cognitive consequences of digital behaviours within a performance-oriented student profile.

2. Material and Method

2.1. Research Pattern

The present study employed a cross-sectional research design using a convenience sampling method, and data were analysed through Structural Equation Modeling (SEM) in accordance with contemporary methodological recommendations (Kline 2016). In the proposed model, problematic smartphone use was specified as the exogenous variable, while brain rot was defined as the endogenous outcome variable. The concept of "doom scrolling" was theorised as a mediating variable, thereby elucidating the underlying mechanism through which problematic smartphone use exerts its influence on cognitive decline.

2.2. Participants

The present study employed a cross-sectional survey design, with data collected through the utilisation of standardised self-report instruments. The data collection process was conducted during the fall semester of 2025 among university students receiving sport education and enrolled in Faculties of Sport Sciences at public universities in Türkiye. Prior to the survey administration, participants were informed about the purpose of the study, advised that participation was voluntary, and provided informed consent in accordance with the principles of the Declaration of Helsinki. The administration of the questionnaires was conducted anonymously via an online format over a period of six weeks, with strict adherence to the principles of confidentiality, voluntariness, and the right to withdraw.

The analyses were conducted on a total of 491 valid questionnaires obtained within the scope of the study. In order to ascertain whether sufficient statistical power had been achieved for structural equation modeling (SEM) and mediation analyses, an a priori sample size estimation was performed using G*Power 3.1 software (Faul et al. 2007). Assuming a medium effect size ($f^2 = 0.15$), a significance level of $\alpha = 0.05$, and a statistical power of 95% ($1 - \beta = 0.95$), and accounting for an anticipated invalid response rate of approximately 20%, the minimum required sample size was calculated as 380. The final sample of 491 participants exceeded this threshold, thereby providing adequate statistical power for the proposed analyses.

The participants in this study ranged in age from 18 to 27 years, with a mean age of 20.68 ± 2.30, reflecting a distribution consistent with that of a typical university student population. The sample demonstrated a relatively balanced gender composition, with 45.8% of participants identified as female (n = 225) and 54.2% as male (n = 266). The participants were all university students who were enrolled in a programme of sports education and were actively engaged in both theoretical and practical components of the course.

2.4. Data Collection Tools

Problematic Use Mobile Phones Scale

The assessment of problematic smartphone use was conducted utilising a validated self-report scale, which was specifically designed to evaluate excessive, uncontrolled, and functionally impairing smartphone-related behaviours. The scale, developed by Koç et al. (2019), consists of 20 items rated on a five-point Likert-type format (e.g., *"My mobile phone use has caused problems in my relationships"*) and represents a unidimensional factor structure (Koç et al. 2019). Responses are provided on a Likert-type scale, with higher scores indicating greater levels of problematic smartphone use. The reliability of the scale was then determined by calculating the Cronbach's alpha coefficient, which yielded a result of .93.

Doom Scrolling Scale

The assessment of the phenomenon of "doom scrolling" was conducted utilising the Doomscrolling Scale (DS), a self-report instrument developed by Satıcı et al. (2023) (Satici et al. 2023). This instrument was designed to evaluate individuals' propensities to consume content that is characterised by negativity and anxiety-inducing characteristics within online environments, in a repetitive and uncontrolled manner. The Doomscrolling Scale is available in two versions, each comprising 15 items and 4 items respectively. The long version was employed in the present study in order to obtain more precise and comprehensive results. It is evident that elevated scores on the aforementioned scale are indicative of heightened intensity with regard to the behaviours exhibited by individuals engaging in doom scrolling.

The scale under consideration consists of 15 items, which are to be rated on a seven-point Likert scale. This scale is unidimensional in nature.

Brain Rot Scale

The assessment of brain rot was conducted utilising the Brain Rot Scale, a scale developed by Batmaz, et al. (2025), which quantifies perceived levels of cognitive fatigue, attentional distraction, and mental exhaustion associated with the consumption of digital content (Batmaz et al. 2025). It is evident that elevated scores on the scale are indicative of heightened levels of cognitive deterioration. The scale consists of eight items, which are rated on a five-point Likert scale (e.g., *"Because I constantly read and watch digital media content, I have difficulty focusing on other things (e.g., my tasks and responsibilities)"*). The scale comprises two subdimensions: cognitive fatigue and mental exhaustion.

The reliability of the scale was then determined by calculating the Cronbach's alpha coefficient, which yielded a result of .90. The psychometric properties of all scales utilised in the study were subjected to a re-evaluation through confirmatory factor analysis conducted within the current sample. The results of this analysis are reported in the Results section.

Data Anlysis

The structural equation modeling (SEM) approach was implemented utilising the AMOS 24 and SPSS 25 statistical software packages. SEM is a multivariate statistical technique that relies on several fundamental assumptions, including the following: normality, the absence of outliers, linearity, multicollinearity, and adequate sample size (Byrne 2010).

As part of the preliminary analyses, the following were examined: descriptive statistics, correlation analyses, and the assumptions of normality, linearity, and multicollinearity. The assessment of normality was conducted through the analysis of skewness and kurtosis values, while the evaluation of multicollinearity was facilitated by the utilisation of Variance Inflation Factor (VIF) and tolerance values.

Prior to conducting structural equation modeling (SEM), confirmatory factor analysis (CFA) was performed to assess the validity of the measurement model. The evaluation of model fit was conducted using the chi-square statistic (CMIN), degrees of freedom (df), the CMIN/df ratio, the Root Mean Square Error of Approximation (RMSEA), the Comparative Fit Index (CFI), the Tucker–Lewis Index (TLI), the Goodness-of-Fit Index (GFI), and the Incremental Fit Index (IFI). The interpretation of fit indices was undertaken in a flexible manner, with consideration given to the complexity of the model. Following the demonstration of an acceptable level of fit in the measurement model, structural model analysis was conducted in order to test the hypotheses proposed.

In order to test the mediating role of doom scrolling in the relationship between problematic smartphone use and brain rot, the bootstrap method was employed. In light of the potential violation of the multivariate normality assumption, the use of bootstrapping was deemed to be the superior approach, as it has been demonstrated to provide more robust standard errors and confidence intervals in structural equation modelling (Bollen and Stine 1992; Byrne 2010). Bootstrap analyses were conducted using 5,000 resamples. This approach facilitates more reliable estimation of indirect effects, particularly in cases where the assumption of multivariate normality is not fully satisfied.

The statistical significance of indirect effects was determined by the absence of zero within the 95% confidence intervals. This approach is consistent with contemporary statistical practices recommended for structural equation modeling and mediation analyses.

Research Ethics

The research process was conducted in accordance with the principles of the Declaration of Helsinki (World Medical Association, 2013). Informed consent was obtained from all participants, and strict adherence was maintained to the principles of confidentiality and anonymity. It is important to note that no ethical violations occurred during the course of the study.

Ethical approval

to administer the scales and collect data was granted by the Non-Interventional Research Ethics Committee of … University (Approval Date: 19.12.2025 and number 2025/12; E-485671, decision number; 69). Participation in this study was entirely voluntary.

Hypotheses

In this study, the relationships among problematic smartphone use, doom scrolling, and brain rot among university students receiving sport education were tested based on the theoretical framework and existing empirical evidence. Within this context, the following hypotheses were formulated:

H1. Among university students receiving sport education, problematic smartphone use positively and significantly predicts levels of brain rot.

H2. Among university students receiving sport education, problematic smartphone use positively and significantly predicts doom scrolling behavior.

H3. Among university students receiving sport education, doom scrolling behavior positively and significantly predicts levels of brain rot.

H4. Among university students receiving sport education, doom scrolling plays a mediating role in the relationship between problematic smartphone use and brain rot.

3. Results

The hypotheses generated in the study were examined, and the resulting findings are presented below. The results of the correlation analysis and the assumptions underlying the structural equation model lend support to the proposed model among the study variables (see Table 1).

Table 1
Descriptive Statistics, Correlations, Linearity, Normality, and Multicollinearity (N = 491)

Variable	Mean	SD	Skew.	Kurt.	BR	PUMP	DS	VIF	Tolerance	C'Alpha
BR	2.79	.93	0.80	0.85	-	.60*	.55*	-	-	0.90
PUMP	2.53	.79	-0.56	-0.15		-	.47*	1.451	0.689	0.93
DS	2.76	1.36	-0.24	-0.93			-	1.451	0.689	0.95
**BR: Brain Rot, PUMP: Problematic Use Mobile Phones, DS: Doom Scrolling*										
**p < 0.05*										

The descriptive statistics, the correlation matrix, and the results related to normality and multicollinearity for the study variables are presented in Table 1. The mean scores obtained from the examination indicated that Brain Rot (M = 2.79, SD = 0.93), Problematic Smartphone Use (PUMP) (M = 2.53, SD = 0.79), and Doom Scrolling (M = 2.76, SD = 1.36) exhibited moderate levels (Fig. 1). For all variables, the skewness and kurtosis values falling within the ± 1 range indicate that the data approximately satisfied the assumption of normal distribution.

A thorough examination of the intercorrelations among the variables indicated a favourable and statistically significant relationship between Problematic Smartphone Use and Brain Rot ($r = .60$, $p < .05$). In a similar vein, moderate, positive, and significant correlations were observed between Doom Scrolling and Brain Rot ($r = .55$, $p < .05$), as well as between Problematic Smartphone Use and Doom Scrolling ($r = .47$, $p < .05$). The fit indices of the measurement model are presented in Fig. 2. The findings suggest a correlation between the increasing prevalence of problematic smartphone use and the practice of doom scrolling, and the corresponding deterioration in cognitive function.

The assumption of multicollinearity was evaluated using Variance Inflation Factor (VIF) and tolerance values. The findings of the study indicated that the VIF values for Problematic Smartphone Use (PUMP) and Doom Scrolling were 1.451, while the corresponding tolerance values were 0.689. These values fall well within the accepted thresholds (VIF < 5; Tolerance > 0.20), indicating that there is no evidence of multicollinearity issues in the model.

Measurement Model Fit Indices

Following the preliminary analyses, confirmatory factor analysis (CFA) was conducted to test the proposed model.

The analysis results indicate that the model fit indices for the constructs were within acceptable ranges. It was established that all standardized factor loadings exceeded .50, with a range from .57 to .85. The composite reliability (CR) values ranged between .85 and .90, indicating satisfactory internal consistency. The average variance extracted (AVE) values exceeded .50 for all constructs, thereby supporting convergent validity. Discriminant validity was established using both the Fornell–Larcker criterion and the heterotrait–monotrait (HTMT) ratio. The square roots of the AVE values exceeded the inter-construct correlations, and all HTMT values remained below the conservative threshold of .85 (Fornell and Larcker 1981; Henseler et al. 2015).

Structural Equation Model

The analyses were initiated with the specification of the initial model corresponding to Hypothesis 1 (H1). The path diagram of this model is presented in Fig. 3.

The findings indicated that problematic smartphone use significantly predicted brain rot and that the model demonstrated an acceptable level of fit for Hypothesis 1 (H1) ($\beta = 0.62$; $p < .001$). The corresponding path diagram is presented in Fig. 2. The results of the structural path analysis further revealed that Problematic Smartphone Use (PUMP) exerted a significant and strong predictive effect on Brain Rot ($\beta = 0.62$; $p < .001$). This finding suggests that increases in the level of problematic smartphone use are associated with a significant increase in brain rot among individuals.

Upon evaluating the overall model fit, it was determined that the covariance-based fit indices indicated an acceptable to good model fit. Accordingly, the fit indices calculated for the model were as follows: The results of this analysis indicate that CMIN = 554.797, df = 228, CMIN/df = 2.43, RMSEA = 0.054, CFI =

0.944, GFI = 0.908, and TLI = 0.938. Specifically, a CMIN/DF value below 3, an RMSEA value below .06, and CFI and TLI values exceeding .90 are indicative of a satisfactory model fit to the observed data.

The findings obtained demonstrate that Problematic Smartphone Use is a significant determinant of Brain Rot, indicating that the proposed structural model is statistically valid and theoretically supportable. The subsequent path diagram related to the mediation analysis is presented in Fig. 4.

Examination of the analysis results related to the structural model indicated that all regression coefficients included in the model were statistically significant ($p < .05$). Within the structural model, Problematic Smartphone Use (PUMP) was found to exert a strong and positive effect on Doom Scrolling ($\beta = 0.61$; $p < .001$). Similarly, the direct effect of PUMP on Brain Rot was also statistically significant ($\beta = 0.50$; $p < .001$). In addition, Doom Scrolling was found to significantly predict Brain Rot, albeit with a relatively smaller effect size ($\beta = 0.20$; $p < .05$).

Upon examination of the explained variances of the variables, it was observed that Problematic Smartphone Use (PUMP) and Doom Scrolling jointly accounted for a significant proportion of the variance in Brain Rot, indicating that the explanatory power of the model was adequate. In the measurement model, the majority of item factor loadings exceeded .50, demonstrating an acceptable level of representational strength for the corresponding latent constructs.

A subsequent examination of the fit indices for the structural equation model indicated that the model demonstrated an acceptable to good fit to the data (CMIN = 1539.976; df = 655; CMIN/df = 2.35; RMSEA = 0.053; CFI = 0.92; GFI = 0.85; TLI = 0.92; and IFI = 0.92). Specifically, an RMSEA value below .06 and CFI, TLI, and IFI values exceeding .90 are indicative of a satisfactory model fit. Despite the relatively low GFI value, this was deemed to be acceptable in view of the model's complexity and the substantial number of items. Given the intricacy of the model and the number of observed variables, fit indices marginally below 0.95 were considered adequate (Marsh et al. 2004).

The findings demonstrate that Problematic Smartphone Use influences Brain Rot both directly and indirectly through the practice of Doom Scrolling. This suggests that Doom Scrolling functions as a partial mediator in this relationship (see Table 2).

Table 2
The result of Bootstrapping Analyses

Model pathways	Coefficient	Lower – 95% CI	Upper – 95% CI
Direct effects			
PUMP → DS	0.61	0.53*	0.68*
PUMP → BR	0.50	0.38*	0.60*
DS → BR	0.20	0.08*	0.31*
Indirect effects			
PUMP → DS → BR	0.12	0.05*	0.19*
BR: Brain Rot ,PUMP: Problematic Use Mobile Phones, DS: Doom Scrolling -			
Note. *Bootstrap confidence intervals are based on 5,000 resamples. Confidence intervals that do not include zero indicate statistically significant effects. In accordance with contemporary SEM reporting standards, mediation pathways were presented using explicit variable labels rather than numerical codes in order to enhance interpretability (Hayes, 2017).*			

The results of the bootstrap mediation analysis are presented in Table 2. The findings indicated that Problematic Smartphone Use (PUMP) exhibited a direct and statistically significant effect on Brain Rot ($\beta = 0.49$; 95% CI [0.38, 0.60]; $p < .05$). In addition, the direct effect of PUMP on Doom Scrolling was found to be statistically significant ($\beta = 0.61$; 95% CI [0.53, 0.68]; $p < .05$). Furthermore, Doom Scrolling was identified as a significant predictor of Brain Rot ($\beta = 0.20$; 95% CI [0.08, 0.31]; $p < .05$).

The indirect effects were examined, revealing that the mediating role of Doom Scrolling in the relationship between Problematic Smartphone Use (PUMP) and Brain Rot was tested using the bootstrap method. The findings of the study indicated that the total indirect effect of PUMP on Brain Rot was statistically significant ($\beta = 0.12$; 95% CI [0.05, 0.19]; $p < .05$). The non-zero value of the confidence interval indicates a statistically significant mediation effect.

In line with these findings, the bootstrap analyses demonstrated that problematic smartphone use exerted both a significant direct effect on brain rot and a significant indirect effect through doom scrolling. The significance of the indirect effect, evidenced by a 95% confidence interval that excluded zero, indicates that doom scrolling functions as a partial mediator in this relationship.

In summary, the findings indicate that the effect of Problematic Smartphone Use on Brain Rot is not only direct but also occurs indirectly through the practice of Doom Scrolling. The findings of this study lend support to the hypothesis that Doom Scrolling exerts a partial mediating effect on the relationship between PUMP and Brain Rot, thereby validating the proposed mediation structure within the model.

4. Discussion

The objective of this study was to examine the impact of problematic smartphone use on cognitive decline and to investigate the mediating role of doom scrolling behaviour in this relationship. The findings indicate that problematic smartphone use significantly predicts brain rot, both directly and indirectly through the practice of doom scrolling. The results of the present study are largely consistent with the contemporary literature addressing the cognitive and psychological consequences of digital media use.

The Relationship Between Problematic Smartphone Use and Brain Rot

The research findings demonstrate that problematic smartphone use exerts a strong predictive effect on brain rot, thereby supporting Hypothesis 1 (H1). This finding is consistent with the results of previous studies suggesting that intensive and uncontrolled smartphone use leads to outcomes such as cognitive fatigue, attentional distraction, and mental exhaustion. It is evident that continuous exposure to digital stimuli has a detrimental effect on individuals' attentional resources, thereby imposing an excessive load on the cognitive system. This condition has been linked to prolonged and purposeless digital content consumption, which has been shown to result in declines in cognitive performance and heightened perceptions of mental fatigue c(Hadlington 2015; Ward et al. 2017; Wilmer et al. 2017). For instance, the relationship between problematic smartphone use and attentional distraction, as well as reduced cognitive performance, has been consistently reported in the digital attention literature (Hadlington 2015; Wilmer et al. 2017). In addition, experimental and cross-sectional studies have consistently demonstrated that excessive smartphone usage leads to elevated mental fatigue levels, a consequence of the significant strain imposed on cognitive resources (Ward et al. 2017).

In this context, the notion of "brain rot" can be conceptualised as a distinct form of cognitive deterioration, precipitated by excessive exposure to digital content. This phenomenon transcends the conventional conceptualisations of cognitive burnout or attentional fatigue, encompassing a more sophisticated and nuanced understanding of mental degradation in the digital era. Furthermore, the present study makes significant contributions to the existing literature in two key areas. Firstly, it provides a comprehensive examination of a phenomenon that has previously been addressed primarily under labels such as "attentional distraction" or "cognitive exhaustion," by situating it within the conceptual framework of brain rot. Secondly, the study provides empirical evidence that the cognitive consequences of problematic smartphone use are not solely related to usage duration, but are also associated with specific patterns of digital behaviour.

Direct Effects in the Structural Model

The findings indicate that problematic smartphone use significantly and positively predicts doom scrolling behavior, thereby supporting Hypothesis 2 (H2). This finding aligns with earlier research suggesting that doom scrolling constitutes a digital behaviour pattern that primarily manifests through mobile devices and is closely associated with the intensity of smartphone use. The perpetual accessibility of smartphones, coupled with the algorithmically curated dissemination of content, has the effect of engendering repeated exposure to negative and anxiety-inducing information. Consequently,

media consumption that initially begins with the intention of information seeking may gradually evolve into an uncontrolled pattern of doom scrolling (Garfin et al. 2020; Bendau et al. 2021; Shabahang et al. 2024).

Furthermore, the findings indicate that doom scrolling behaviour exerts a direct and statistically significant effect on brain rot, thereby providing support for Hypothesis 3 (H3). This finding suggests that the phenomenon of doom scrolling is not confined to emotional outcomes, but is also associated with processes of cognitive fatigue and mental deterioration. The continuous consumption of negative content has been demonstrated to chronically stimulate the attentional system and hinder cognitive recovery. This, in turn, has been shown to lead to the depletion of cognitive resources and an increased perception of mental fatigue. These findings are consistent with propositions in cognitive load theory and the digital attention literature, which suggest that excessive information exposure adversely affects cognitive performance (Wilmer et al. 2017; Sweller 2020).

The Mediating Role of Doom Scrolling

One of the most notable findings of the study is that doom scrolling plays a partial mediating role in the relationship between problematic smartphone use and brain rot. The substantial rise in "doom scrolling" – the practice of repeatedly viewing distressing or anxiety-inducing content on social media – is indicative of individuals utilising smartphones not solely for communication or entertainment purposes, but also for the uninterrupted monitoring of such content. This finding is directly consistent with studies suggesting that doom scrolling is a form of digital behaviour that predominantly emerges through mobile devices. As demonstrated in previous research, individuals are repeatedly and compulsively exposed to negative content via their smartphones. This behaviour has been shown to intensify particularly during periods of crisis (Garfin et al. 2020; Bendau et al. 2021).

Furthermore, the phenomenon of "doom scrolling" has been demonstrated to be associated with anxiety, stress, and psychological distress. This association is primarily attributed to the uncontrolled and repetitive nature of content consumption (Shabahang et al. 2024). Such continuous exposure has the potential to contribute to the depletion of the attentional system, reduced cognitive flexibility, and increased mental fatigue. Consequently, the impact of doom scrolling on cognitive decline can be attributed not only to the nature of the consumed content but also to the repetitive and uncontrolled patterns of content consumption.

The observed mediation finding indicates that the cognitive consequences of digital media use are not unidimensional; rather, they emerge indirectly through specific patterns of digital behaviour. This finding indicates that the impact of problematic smartphone use on cognitive decline is associated with not only the duration of usage but also the manner and the nature of the content consumed.

Theoretical Contributions

The present study proposes three significant theoretical contributions to the existing literature on digital media. Firstly, the conceptualisation of the cognitive consequences of problematic smartphone use within the framework of "brain rot" introduces a novel conceptual perspective to the digital fatigue literature. Secondly, it positions doom scrolling not merely as a digital habit but as a mechanism that triggers cognitive exhaustion. Thirdly, the study utilised a structural equation model to assess both the direct and indirect pathways of these relationships, thereby emphasising the multifaceted nature of digital behaviours.

When evaluated within the framework of digital cognitive load theory, the continuous consumption of negative content is argued to overstimulate the attentional system and hinder cognitive recovery (Sweller 2020). The present findings provide empirical support for this theoretical framework and contribute to our understanding of the impact of doom scrolling on cognitive decline.

In particular, the partial mediating role of doom scrolling indicates that models explaining the psychological effects of digital media use should place greater emphasis on behaviour-based mediators. This finding indicates that subsequent research endeavours should encompass not only the intensity of technology utilisation but also the particular patterns and modes of use.

The present study determined that doom scrolling plays a partial mediating role in the relationship between problematic smartphone use and brain rot. This finding is consistent with contemporary models suggesting that the cognitive and psychological effects of digital media use emerge through indirect pathways. As demonstrated in previous research (Elhai et al. 2020; Montag and Elhai 2020), the psychological outcomes of problematic digital technology use are often shaped through specific digital behaviours.

In this context, the present study posits that doom scrolling functions as a behavioural mechanism that helps to elucidate the cognitive consequences of problematic smartphone use. This mediation structure, which has received scant attention in the extant literature, underscores the importance of examining digital behaviours not only in terms of addiction severity but also with respect to content type and patterns of consumption.

The extant literature pertaining to digital well-being interventions has predominantly concentrated on the reduction of screen time. However, recent studies have highlighted that patterns of use may be more indicative of substance use than the duration of use alone (Kushlev et al. 2017; Kushlev and Leitao 2020) (Kushlev et al., 2020). The present study posits that the targeting of specific digital behaviours, such as doom scrolling, may prove more efficacious in the promotion of cognitive well-being.

5. Conclusion

This study examined the relationship between problematic smartphone use and brain rot among sport sciences students and tested the mediating role of doom scrolling. The findings show that problematic smartphone use significantly predicts brain rot both directly and indirectly, with doom scrolling

functioning as a partial mediator. These results indicate that cognitive fatigue associated with digital technology use is shaped not only by usage intensity but also by specific behavioral patterns, particularly the repetitive consumption of negative online content.

Focusing on sport sciences students strengthens the relevance of the findings, as this group requires sustained attention, cognitive flexibility, and mental resilience for both academic and athletic performance. The observed associations therefore highlight potential risks of maladaptive digital behaviors for performance-related cognitive functioning.

From an applied perspective, interventions aimed at improving digital well-being should extend beyond reducing screen time and instead target behavior-specific patterns such as doom scrolling. Awareness and self-regulation strategies may help protect cognitive performance in this population.

Finally, the cross-sectional design limits causal interpretation. Future longitudinal and experimental studies incorporating behavioral and digital usage data are recommended to clarify causal pathways and deepen understanding of digital cognitive fatigue processes.

Declarations

Availability of Data and Materials

All datasets on which the results of an article were based were included as part of the submission. Available from the corresponding author upon reasonable request

Author Contributions

Conceptualization: Sak.T., Sac.T., and Y.A.; methodology: Y.A., and F.H.Y.; software: B.C.; validation: H.B. and F.H.Y.; formal analysis: M.O. and B.Y.; investigation: H.B. and Sac.T.; resources: Sak.T.; data curation: F.H.Y. and S.T.; writing—original draft preparation: F.H.T., Sak.T., Y.A., Sac.T., and B.C.; writing—review and editing: Sac.T., Y.A., M.O., T.V.A. and U.I.; visualization: F.H.Y. and B.C.; supervision: Y.A. and B.C.; project administration: Sak.T.; funding acquisition: None.

Ethics Approval and Consent to Participate

The study was conducted according to the rules of the Declaration of Helsinki and approved by the ethics committee for scientific research of … University (at its meeting on 19.12.25 and number 2025/12; E-485671, decision number; 69).

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Conflict of Interest

The authors declare that they have no conflicts of interest.

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Figures

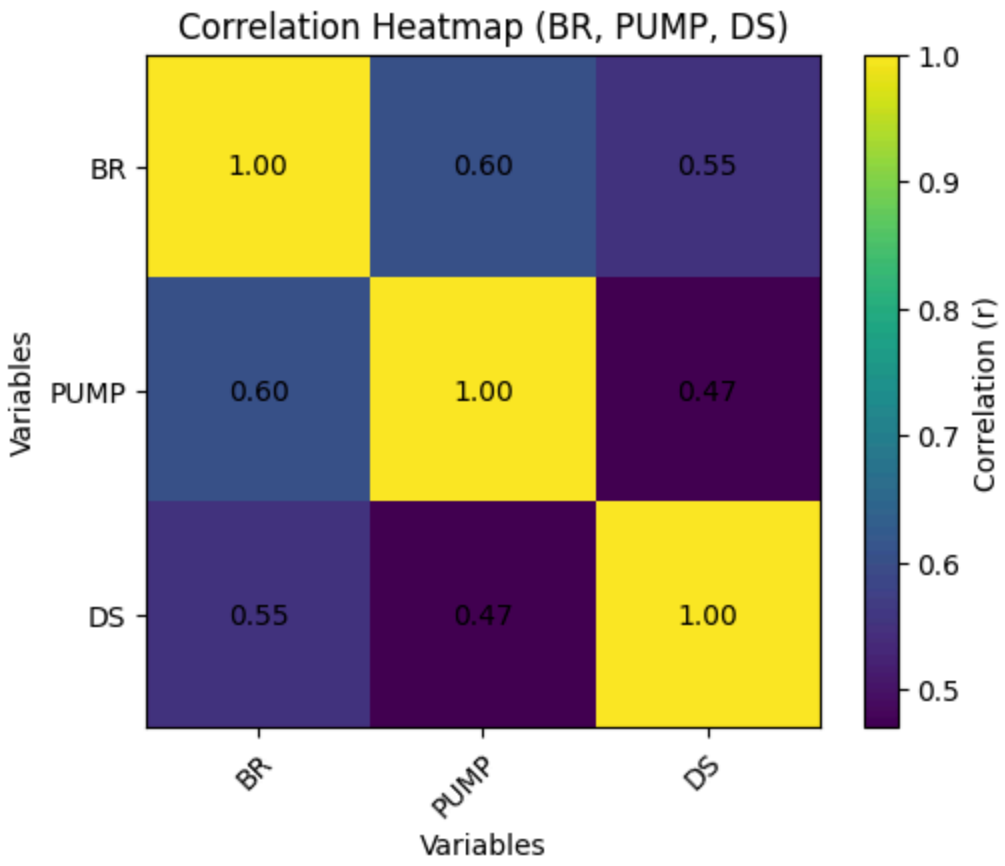


Figure 1

Correlation Heatmap of the Independent Variables

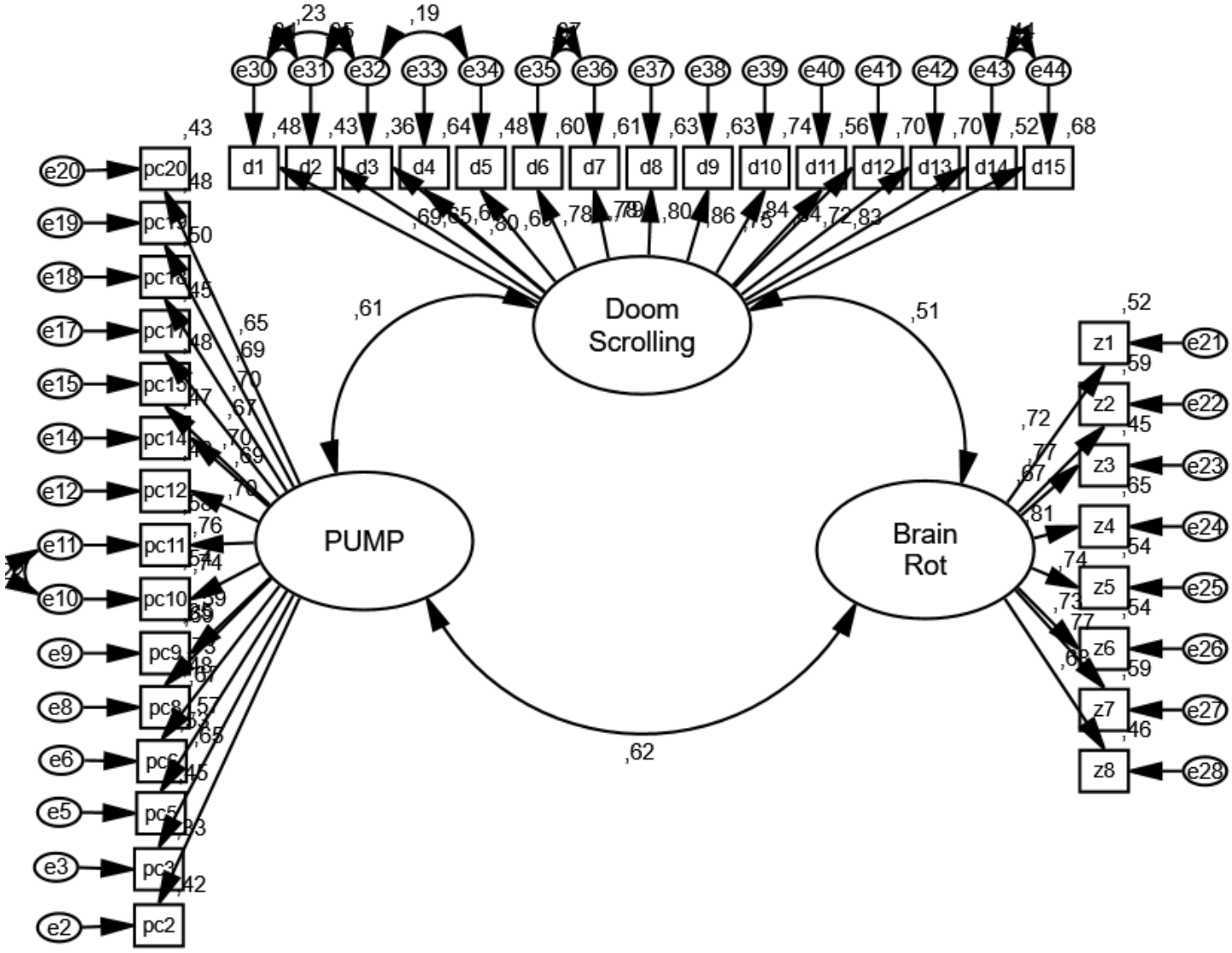
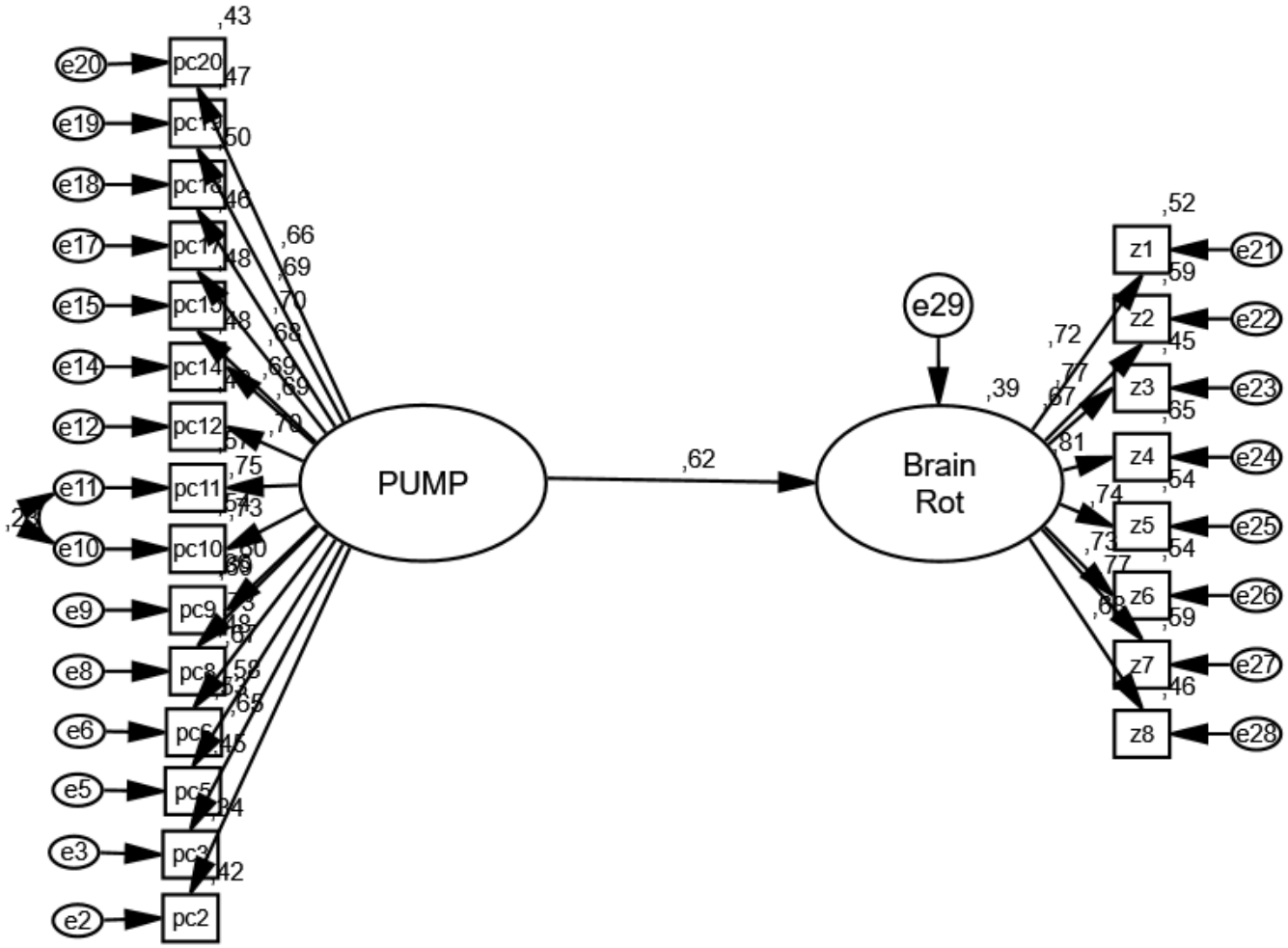


Figure 2

Measurement Model



CMIN=554,797; DF=228; p=,000; RMSEA=,054; GFI=,908; CFI=,944; TLI=,938; IFI=,944

Figure 3

Structural Model – Direct Effects of Problematic Use Mobile Phones

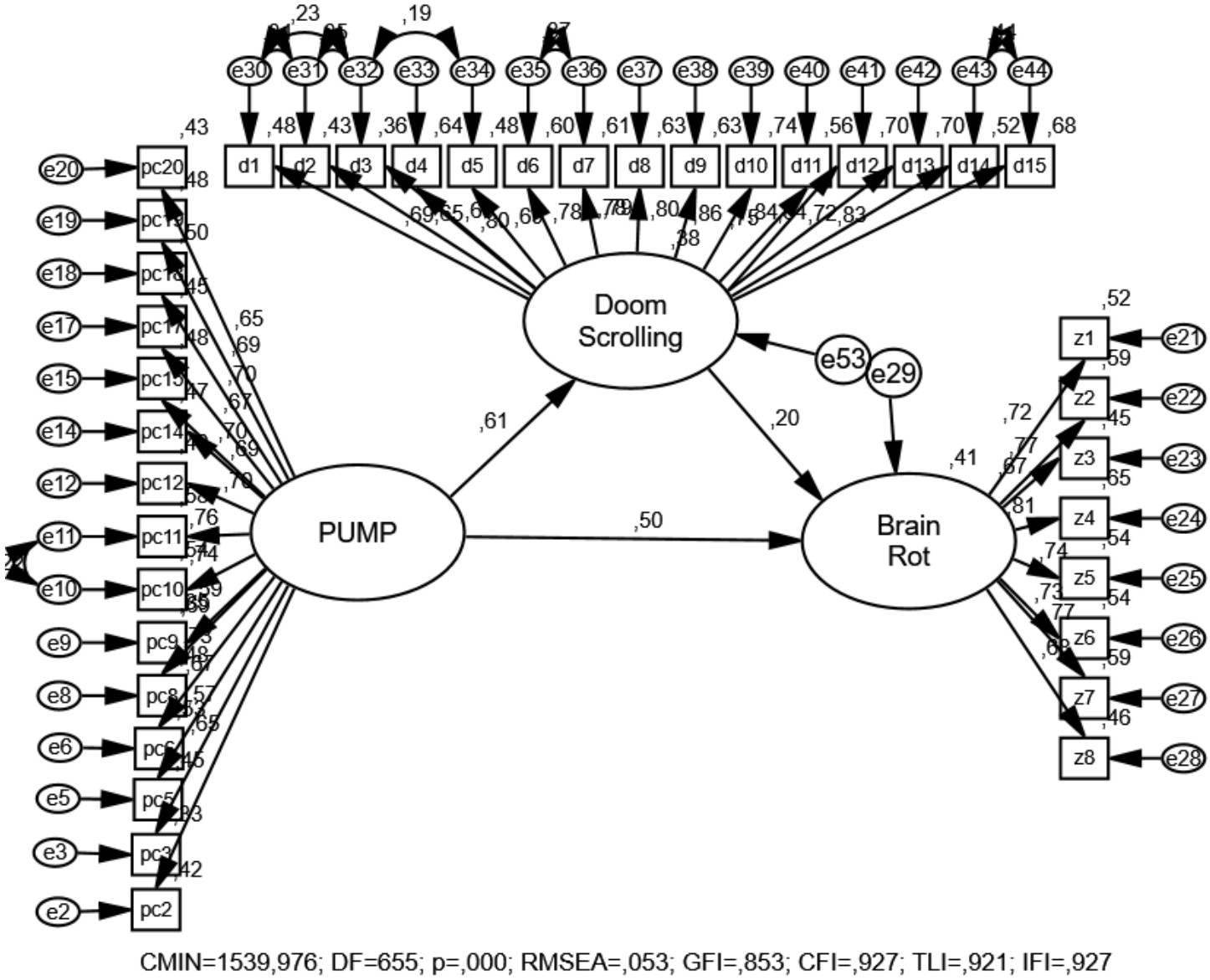


Figure 4

SEM Diagram Related to the mediation model