

The effect of grit on leisure time physical activity. An application of the Theory of Planned Behaviour

Authors' Contribution:

- A Study Design
- B Data Collection
- C Statistical Analysis
- D Data Interpretation
- E Manuscript Preparation
- F Literature Search
- G Funds Collection

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abstract

Background: Grit as a personal trait has an important role in achieving different behavioural outcomes. The present study aimed to test the validity of an extended model of the Theory of Planned Behaviour, in which domains of grit, such as perseverance of effort and consistence of interest are mediators between the attitude and intention, and between attitude and self-reported leisure time physical activity behaviour.

Material and methods: The participants were school children: 106 boys (M age = 13.00, SD = 0.98) and 240 girls (M age = 13.13, SD = 0.95) Structural equation modelling (SEM) was used to test the effects of perseverance of effort, consistency of interest, attitude, and intention on leisure time physical activity.

Results: The model demonstrated acceptable fit with the data. Direct relationships between the perceived attitude and dimensions of grit were statistically significant. Attitude related directly and indirectly via intention to self-reported physical activity. A significant indirect effect from attitude to leisure time physical activity via perseverance of effort followed.

Conclusions: Beyond the attitude, perseverance of effort is an important predictor of leisure time physical activity among schoolchildren.

Key words: physical activity, grit, attitude, intention, school children.

article details

Article statistics: **Word count:** 2,487; **Tables:** 2; **Figures:** 1; **References:** 30

Received: January 2020; **Accepted:** March 2020; **Published:** March 2020

Full-text PDF: <http://www.balticsportscience.com>

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Indexation: Celdes, Clarivate Analytics Emerging Sources Citation Index (ESCI), CNKI Scholar (China National Knowledge Infrastructure), CNPIEC, De Gruyter - IBR (International Bibliography of Reviews of Scholarly Literature in the Humanities and Social Sciences), De Gruyter - IBZ (International Bibliography of Periodical Literature in the Humanities and Social Sciences), DOAJ, EBSCO - Central & Eastern European Academic Source, EBSCO - SPORTDiscus, EBSCO Discovery Service, Google Scholar, Index Copernicus, J-Gate, Naviga (Softweco, Primo Central (ExLibris), ProQuest - Family Health, ProQuest - Health & Medical Complete, ProQuest - Illustrata: Health Sciences, ProQuest - Nursing & Allied Health Source, Summon (Serials Solutions/ProQuest, TDOne (TDNet), Ulrich's Periodicals Directory/ulrichsweb, WorldCat (OCLC)

Funding: This work was supported by the Estonian Research Council grant [PUT1542].

Conflict of interests: Authors have declared that no competing interest exists.

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INTRODUCTION

Physical activity (PA) is associated with numerous health benefits (e.g., better mental health and cardiorespiratory fitness, less fat gain) [1]. One of the important goals of contemporary physical education is to educate students for long lasting physical activity. A certain personal trait may positively influence its attainment as that was the case in academic performance, where the role of grit as a predictor of academic performance was highlighted [2,3]. Given the importance of long-lasting physical activity on health benefits there is a need to know how the non-cognitive factors like personality traits are related to leisure time physical activity (LTPA). In the domain of physical exercise, it was found that players with more grit dedicated more time to sport activities and demonstrated better results on perceptual-cognitive skills tests compared with players with less grit [4]. In the present study an attempt was made to propose and test a model based on the Theory of Planned Behaviour (TPB) [5] explaining the processes by which attitude, grit dimensions and intention are related to LTPA.

Grit, as one of the personality traits, is characterized by two different domains that enable measuring an individual's perseverance of effort and consistency of interest [6]. Consistency of interest and perseverance of effort are considered to be more important than talent, intelligence and any other human capacity in achieving any long-term objective [7]. Perseverance of effort is viewed as the tendency to overcome initial failures to achieve long-term goals, while consistency of interest focuses on an individuals' tendency to pursue the same goals over time [6].

A meta-analysis of studies [8] employing the TPB [5], a prototypical theory of social cognition, established a statistically significant relationship between intention to be physically active and physical activity behaviour. According to the TPB, intention is the most immediate determinant of subsequent behaviour, and that intention is a function of three sets of beliefs: attitudes, norms and perceived behavioural control, from which the attitude is related most strongly to intention to be physically active [9]. A positive attitude is a driving force to move forward in a certain action, to persevere when others are retreating in the face of change and hardship [10]. The relationships between attitude and perseverance of effort as a personal trait were found by Huitt and Cain [11]. Attitudes towards lifelong learning and general strategies for learning were also proved to predict perseverance of effort [12]. Attitude, as one of the components of beliefs and intention, reflects individuals' evaluation of their future participation in certain behaviour [8], whereas personal trait reflects generalized dispositions that are relatively stable and enduring and predispose individuals to certain patterns of behaviour [13].

Previously, to explain the mechanism for predicting leisure time physical activity, several researchers [14,15] have incorporated cognitive components, like self-identity, to the model of TPB. Recently, researchers have started to examine whether grit is related to health-related behaviour, including physical activity behaviour [16]. For instance, an examination the relationships of grit and conscientiousness with exercise behaviour in respect of different intensity in the four stages (pre-contemplation, preparation, action, and maintenance) showed that grit significantly predicted high intensity and moderate intensity exercise stage while conscientiousness did not [16].

However, there is still limited understanding of the impact of personality traits, such as grit, on LTPA. Only one study addressed the role of intention as mediators between grit dimensions and physical activity in leisure time [17].

In this study, it was found that from two dimensions of grit only perseverance of effort functioned as a significant mediator between intention and objectively measured LTPA. Nevertheless, it is unclear whether and how the attitude may act as an antecedent of intention via dimensions of grit and whether the effect of intention on self-reported physical activity is mediated via grit dimensions. Therefore, the purpose of the study was to test the validity of an extended TPB model, in which perseverance of effort and consistence of interest act as mediators between the attitude and intention, and between attitude and self-reported leisure time physical activity behaviour.

MATERIAL AND METHODS

PARTICIPANTS

The participants were school children: 106 boys ($M\ age = 13.00, SD = 0.98$) and 240 girls ($M\ age = 13.13, SD = 0.95$) from Estonia. Participants were recruited from 16 government-run schools. The schools were selected based on a convenience approach from four different districts. The study was approved by the local University research ethics committee. Permission from school administrators was obtained prior to data collection. Participants and their parents gave written informed consent for participation in the study.

METHODS AND MEASUREMENTS

The present study included the 8-item short Grit Scale [7] to assess learners' consistency of interests and perseverance of efforts. Consistency of interests was measured by four items, such as "I have difficulty maintaining my focus on projects that take more than a few months to complete". These items were reverse coded. Perseverance of effort was measured by items, such as "I'm hard-working". The grit scores were calculated by averaging across items on a scale of 1 to 4.

Measures of the theory of planned behaviour constructs were developed based on guidelines by Ajzen [18]. The measure of attitude comprised three 7-point semantic differential scales with bipolar adjectives: bad-good, unenjoyable-enjoyable, and useless-useful in response to the common stem: "Participating in active sports and/or vigorous physical activities during my leisure-time in the next 5 weeks is...". Intentions were measured by two items (e.g., "I intend to do active sports and/or vigorous physical activities during my leisure-time in the next 5 weeks").

Five weeks later, according to the design of Hagger et al. [19], self-reported physical activity was assessed using an adapted version of Godin and Shepherds' leisure-time exercise questionnaire [20] with two items (e.g., "How frequently have you participated in vigorous physical activities during your leisure time in the course of the past five weeks for at least 20 minutes at a time?") with responses reported on a 6-point scale (1 = never and 6 = all of the time).

STATISTICAL ANALYSIS

Data were analysed using IBM SPSS 23.0 [21], and IBM SPSS AMOS 23.0 [22]. Descriptive statistics, including means and standard deviations, were calculated for each study variable. The composite reliability index for each scale and zero-order correlations among study variables were computed [23].

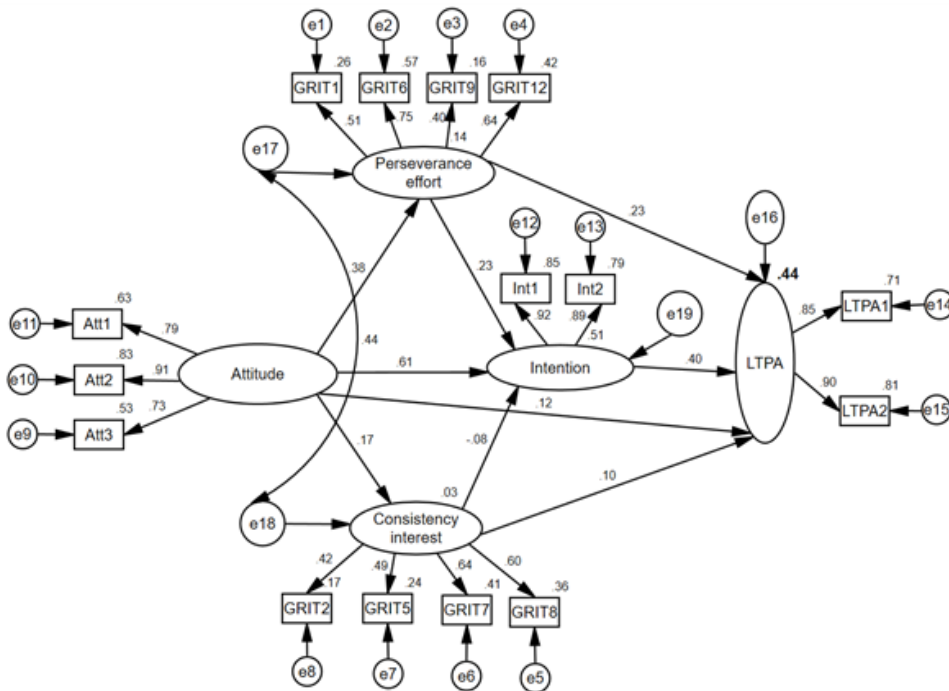


Fig.1. Structural model predicting leisure time physical activity from the attitude, the dimensions of grit and intention

Note: Grit1 = I have overcome setbacks to conquer an important challenge; Grit2 = New ideas and projects sometimes distract me from previous ones; Grit5 = I have been obsessed with a certain idea or project for a short time but later lost interest; Grit6 = I am hard-working; Grit7 = I often set a goal but later choose to pursue a different one; Grit8 = I have difficulty maintaining my focus on projects that take more than a few months to complete; Grit9 = I finish whatever I begin; Grit12 = I am diligent.

The Short Grit Scale does not contain the items 3, 4, 10 and 11 from the initial version.

Abbreviations e1 - e18 are error terms associated with each measured variable, LTPA = leisure time physical activity.

Structural equation modelling (SEM) with the maximum likelihood estimation method was used to test the hypothesized model presented in Figure 1. The adequacy of the fit of the model was estimated by the Comparative Fit Index (CFI), Non-Normed Fit Index (NNFI), and Root Mean Squared Error of Approximation (RMSEA) with its 90% confidence intervals (CI_{90}). According to Hu and Bentler [24], a model that fits the data well is indicated when values for CFI and NNFI are ≥ 0.95 . The values ≤ 0.06 for RMSEA indicate good fit, with values ≤ 0.10 for its upper limit of CI_{90} . The SEM using bootstrapping analysis recommended by Preacher and Hayes [25] enabled determining the standardized estimates and significance levels for indirect effects in the model. If the 95% confidence interval for the indirect effect did not include zero, the indirect effect was considered statistically significant.

RESULTS

An inspection normal distribution of data indicated that Mardia's normalised coefficient value deviated from multivariate normality (75.26, critical ratio = 30.99). Subsequently, we used a bootstrapping procedure to provide a more accurate estimation of the parameter estimates [25, 26]. Descriptive statistics, correlations among study variables and composite reliability coefficients for all measures are presented in Table 1. The composite reliability coefficient (ρ) were satisfactory for all scales ranging from 0.62-0.98. The composite reliability coefficient of greater than 0.60 is considered acceptable [27].

Table 1. Descriptive statistics, reliability and correlations among study variables

	Mean	SD	ρ_c	1	2	3	4	5
1. Perceived attitude toward physical activity	6.12	0.98	0.85	-				
2. Intention to be physically active	5.79	1.22	0.90	0.61**	-			
3. Consistency of interest	2.58	0.53	0.62	0.13*	0.10	-		
4. Perseverance of effort	2.99	0.52	0.67	0.29**	0.34**	0.30**	-	
5. Leisure time physical activity	4.51	0.97	0.73	0.41**	0.52**	0.22**	0.38**	-

Note: N = 346. * $p < .05$. ** $p < .01$. ρ_c = composite reliability coefficient.

Results of the structural model demonstrated acceptable fit with the data ($\chi^2 = 150.124$, $df = 80$; CFI = 0.964; NNFI = 0.952; RMSEA = .050; CI_{90} RMSEA = .038 -.063) (Fig. 1). Parameter estimates and bias-corrected bootstrapped 95% confidence intervals for the direct, indirect and total effects are presented in Table 2. Direct relationships between perceived attitude and dimensions of grit were statistically significant. Attitude directly and indirectly via intention related to self-reported LTPA. An indirect effect from attitude to LTPA via perseverance of effort was significant, whereas via consistency of interest was not.

Table 2. Standardized parameter estimates of direct, indirect and total effects for the Multiple-Mediator Model

			β	95% CI	
				LL	UL
Direct effects					
Perceived attitude	→	Perseverance of effort	0.375***	0.214	0.526
Perceived attitude	→	Consistency of interest	0.173*	0.007	0.341
Perceived attitude	→	Intention	0.614***	0.472	0.739
Perceived attitude	→	LTPA	0.116	-0.062	0.312
Perceived attitude	→	LTPA	0.404***	0.197	0.618
Perseverance of effort	→	Intention	0.231**	0.083	0.409
Perseverance of effort	→	LTPA	0.227**	0.055	0.397
Consistency of interest	→	Intention	-0.077	-0.233	0.055
Consistency of interest	→	LTPA	0.103	-0.052	0.271
Indirect effects					
Perceived attitude	→	Intention	0.073	0.021	0.153
Perceived attitude	→	LTPA	0.381	0.250	0.534
Perseverance of effort	→	LTPA	0.093	0.036	0.197
Consistency of interest	→	LTPA	-0.031	-0.113	0.017
Total effects					
Perceived attitude	→	LTPA	0.497	0.368	0.612
Perseverance of effort	→	LTPA	0.321	0.131	0.488
Consistency of interest	→	LTPA	0.072	-0.099	0.246

Note: N = 346. * $p < .05$. ** $p < .01$. *** $p < .001$. Leisure time physical activity LTPA; 95% CI = 95% confidence intervals of parameter estimates; LL = Lower limit of 95% CI; UL = Upper limit of 95% CI.

Several specific indirect effects based on significant single paths reported in Table 2 were estimated: two specific indirect effects from perceived attitude toward to LTPA via perseverance of effort, ($B = 0.082$; 95% CI = 0.023, 0.174 $p < 0.01$) and via intention ($B = 0.239$; 95% CI = 0.109, 0.430 $p < 0.001$) were

significant. A specific indirect effect from perceived attitude to intention via perseverance of effort was also significant ($B = 0.103$; 95% CI = 0.039, 0.218 $p < 0.001$), but via consistency of interest it was not ($B = -0.016$; 95% CI = -0.084, 0.007 $p < 0.142$). Specific indirect effect from attitude to LTPA via the sequence of perseverance of effort and intention was also significant ($B = 0.034$; 95% CI = 0.013, 0.083; $p < 0.01$). The proposed model accounted for 44% of the variance in LTPA.

DISCUSSION

The present study tested the validity of an extended TPB model, in which perseverance of effort and consistence of interest act as mediators between the attitude and intention, and also between attitude and self-reported leisure time physical activity behaviour. According to notion of Ajzen [5], the condition for extended TPB model is that the inclusion of new constructs has an unique effect on intention and behaviour directly. In this study, the perseverance of effort was statistically significantly related to the intention and LTPA proving the extension of TPB model in respect of this construct. Direct relationships between attitude and grit dimensions in the current research is consistent with previous findings [11, 12]. To some extent, the existence of a direct relationship between perseverance of effort and LTPA confirms the finding in the academic context [28], where the grit predicted the academic course completion independently of the learners' intention to complete this course. In the proposed extended TPB model perseverance of effort was statistically significantly related to the intention and LTPA, but the consistency of interest was not. This finding is inconsistent with a previous study [17] where attitude as an antecedent of grit dimensions was not incorporated into the model, and only direct relationships of grit dimensions with intention and physical activity were observed. In this previous model [17], perseverance of effort was not directly related to moderate vigorous physical activity recorded by an accelerometer. This allows suggesting that influence of perseverance of effort on LTPA over a period of time may depend on the intensity of physical activity and measurement methods, for example, correspondence between the psychological constructs and the accelerometer measure. An explanation of absence of a direct effect from the consistency of interest to students' intention and LTPA may be that the high level of permanency of interest is less focused on engagement in activities because students do not want to try new things. On the other hand, to remain interested for a longer time, alternative activities and challenges should be constantly offered. However, it is important to consider that the maintaining consistent interest over some time does not specify whether interest is actually involved [29].

Inspection of the specific indirect effects from attitude to intention via two dimensions of grit indicated that the indirect effect through perseverance of effort was significant whereas through consistency of interest it was not. Consequently, as a personal trait, perseverance of effort performs an important mediation role between attitude and intention. Further, considering that the total effect of the perseverance of effort on LTPA was also significant highlights it as very a substantial personal trait in predicting LTPA. However, the total effect of attitude on LTPA was little higher than the total effect of perseverance of effort. Nevertheless, this does not diminish the role of grit in the model for predicting LTPA. A specific indirect effect of attitude to LTPA via the sequence of perseverance of effort and intention was also significant. The SEM model proposed in the present study, in which the construct of attitude was also incorporated, accounted for considerably larger amount of variance in LTPA (i.e., 44%) than the previous model without attitude [17]. Taken together, the current

research advanced knowledge about the role of grit dimensions as mediators between the attitude and LTPA, and between intention and LTPA within the TPB.

Despite the unique contribution of the study, some limitations need to be noted. The sample used in this study should be considered as a convenience sample that may not be representative of the student population in Estonia. Future studies should focus on randomly selected, stratified samples to permit better inference of findings to the population. The unequal number of girls and boys does not allow for greater generalizations and the results need to be treated with some caution.

A short period of time to estimate the impact of perseverance of effort was used. However, to estimate the effect of intention on behaviour in the TPB models in the long run is complicated, as, according to Ajzen's recommendations [18], intentions should be measured as closely as possible to the time at which the behaviour will be performed. Nevertheless, it will be valuable to test the stability of the pattern relationships of the model constructs at least over a year. Also, in this model an essential component of TPB, perceived behavioural control, was not involved, as it is generally not so strongly related to intention as attitude [30], allowing to keep the model more parsimonious.

Future work should explore how the grit dimensions affect physical activity by incorporating another personal trait in the model, like trait self-control, that may explain the mechanism of predicting leisure time physical activity more comprehensively. In this study, physical activity was measured using self-report measures, and therefore future research should consider alternative measures like an accelerometer to provide converging evidence for the proposed effects. In addition, future research might also determine whether the model is valid for older age groups.

CONCLUSION

Overall, findings of the present study are unique because they provide additional empirical support for the extension of the TPB model incorporating the construct of a personal trait, such as grit. More precisely, the unique contribution of this study is that beyond attitude, perseverance of effort, as a component of the extended model of TPB, has an important role in predicting LTPA among schoolchildren. This nuanced understanding of the role of grit dimensions in behavioural prediction, based on the TPB, can contribute to the design of intervention programs if the aim is to enhance perseverance of effort among students. Specifically, based on the results of the current study, intervention programs focusing on students' personal traits (i.e., fostering perseverance of effort) alongside with fostering their situation-specific beliefs about LTPA, specified in TPB, may be more effective in promoting students' LTPA than interventions focusing merely on situation-specific beliefs about LTPA.

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Cite this article as:

Hein V, Koka A, Kalajas-Tilga H, Tilga H, Raudsepp L.
The effect of grit on leisure time physical activity. An application of the Theory of Planned Behaviour
Balt J Health Phys Act. 2020;12(1):78-85
doi: 10.29359/BJHPA.12.1.08