

Understanding primary school children's physical activity during the COVID-19 Pandemic: Exploring the role of sport self-concept, enjoyment and mood regulation

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Abstract

Cognitive and affective factors play an important role in the initiation and maintenance of physical activity (PA), even in childhood. The COVID-19 pandemic has been a physically and mentally stressful time for children. However, little is known about the relevance of PA-related cognitive and affective variables regarding children's PA during this time. Therefore, this study investigated how primary school children's sport self-concept, PA enjoyment, and PA-related mood regulation were related to their PA levels during the COVID-19 pandemic. Data were collected from 838 students with a mean age of 9.59 years ($SD = 0.81$) via questionnaires during a period of changing pandemic containment measures in Germany, late May to mid-June 2021. Data were analyzed using a linear mixed model. Controlling for context and demographic variables, results showed a significant predictive role of sport self-concept in children's PA ($b = 0.34, p = 0.02$). PA enjoyment as well as PA-related mood regulation did not show a significant predictive value in this context. The shown sport self-concept's resilience in maintaining children's PA, even under the pandemic's challenging conditions, emphasizes its crucial role for childhood development. The insignificant results regarding the affect-related variables (i. e., PA enjoyment, and PA-related mood regulation) might be attributed to the pandemic's unique psychological and social impacts, which could alter the children's perceptions and enjoyment of PA. Furthermore, the results suggest the need for future research to explore the causal relationships between these psychological constructs and PA in children, contributing to the development of targeted interventions to address physical inactivity in this age group.

Key Words: Social Cognitive Framework, Affect, Childhood, Self-Report, Regression Analysis

Introduction

The emergence of the COVID-19 pandemic caused a unique public health emergency (WHO, 2022). Different strategies were implemented to restrict pandemic's spread. Among these strategies, certain interventions were of a temporary nature but had a lasting impact (e.g., implementation of lockdowns, enforcement of quarantine measures), while others were conceived as permanent measures that occasionally established themselves as social rules in parts of the society (e.g., the ubiquitous use of facial masks and widespread diagnostic testing). The multifaceted interventions aimed at suppressing viral transmission affected individuals regardless of age, influencing various mental and physical health aspects (e.g., Ludwig-Walz et al., 2022, 2023; Samji et al., 2022).

A particularly pertinent factor to both mental and physical well-being, which underwent a substantial alteration due to restrictions imposed during the pandemic, pertains to PA levels, especially in children and adolescents (Schmidt et al., 2020). While several studies have investigated the relationship between children's and adolescents' mental health and PA during the pandemic (Wunsch et al., 2021) there remains a lack of knowledge about the associations and potential effects of PA-specific cognitive and affective variables (e.g., physical self-concept) on PA levels, especially among children. Despite the known positive effect of these variables on children's PA (Dreiskämper et al., 2022; Haas et al., 2021), the associations of these variables within the context of the pandemic are not well understood.

Investigating these relationships in this specific context can provide relevant and insightful contributions for several reasons. On the one hand, the fields of sports pedagogy and psychology should be poised to offer evidence-based guidance to address the repercussions of future pandemics, such as a potential decline in children's PA levels (Lavie et al., 2021). On the other hand, this situation provides an opportunity to examine the association of these variables in a context where (re-)initiation of physical activity (PA) may be considerably more challenging and demand greater psychological effort compared to pre-pandemic or post-pandemic periods. For instance, the pandemic created additional barriers that made it more difficult for children to stay physically active, such as social distancing, or to become physically active again, such as new habits like

using digital media (Schmidt et al., 2020). The focus of this study was on the children's physical self-concept and PA-enjoyment as well as on their perceived ability to regulate their mood through PA, the PA-related mood regulation. The physical self-concept is a component of the non-academic self-concept and can broadly be described as one's cognitions about his or her body and its abilities (Marsh et al. 1994). It is a multi-dimensional and hierarchical construct. In PA research, the focus is often on the aspect of the physical self-concept that is based on one's evaluations of their physical abilities, fitness, or competence in specific domains (e.g., coordination, flexibility) or sports in general (Marsh & Redmayne, 1994). There is broad evidence, that physical self-concept is consistently associated with PA in childhood and youth (Babic et al., 2014). For example, Dreiskämper et al. (2015) could show that children's self-perceptions of such domains correlate with the children's actual motor performance in these domains and that their general sport self-concept correlates with motor performance in all domains except flexibility. Regarding the development over time, Garn et al. (2019) showed that only the sport self-concept could predict PA, not the other domains of the physical self-concept in children.

Following Ekkekakis' (2013) definitions of emotion and affect, PA enjoyment can be considered an emotion directed toward PA characterized by experiencing positively valenced affects (i.e., pleasure). In line with Pekrun et al. (2023), PA enjoyment can be categorized more precisely as activity achievement emotion, as it has an object focus (i.e., PA) and is positively connotated (i.e., joy). PA enjoyment is often attributed to a state of intrinsic motivation and is shown to be consistently associated with PA in children and adolescents (Greule et al., 2023). There is also preliminary evidence that PA enjoyment can predict future PA in this age group (Nasuti & Rhodes, 2013). For example, Haas et al. (2021) demonstrated that (high) PA enjoyment can reduce the age-related decline in PA in children in middle to late childhood (i.e., 8-15).

PA-related mood regulation constitutes a component of PA-related health competence (Sudeck & Pfeifer, 2016). It is the ability to actively enhance one's affective well-being through PA. Individuals exhibiting high PA-related mood regulation consciously select and engage in PA when experiencing negative moods, employing it as a tool to counteract these emotions. Additionally, they possess the ability to adjust their PA (e.g., in terms of its intensity) to ensure a positive affective response. While the effect of PA-related mood regulation on PA is comparatively well studied in adults (Carl et al., 2020), only one study investigated these variables in children and adolescents, finding a positive association (Lindemann et al., 2023).

Regarding the level of abstractions of these three constructs, it becomes apparent, that the fitness-related domains of the physical self-concept focus on different motor dimensions (e.g., strength), whereas PA enjoyment and mood regulation focus on PA in general. To make a comparison of the relationships between the constructs and the children's PA possible and plausible, it made sense to focus on the domain of sport self-concept (i.e. perception of one's own sport ability). In addition, sport self-concept proved to be the best predictor of PA in children compared to the other domains of the physical self-concept (Garn et al., 2019).

While existing studies have provided valuable insights about the relations of sport self-concept and PA as well as PA enjoyment and PA in children, only a few studies have examined the prediction of sport self-concept and PA enjoyment simultaneously. Doing so enables to compare the specific predictive value of each construct. Furthermore, there is nothing known about the importance of these constructs regarding children's PA during the COVID-19 pandemic. As research on children's PA-related health competence is still very young, there is limited evidence on the relationship between facets of this competence, either before, during or after the pandemic. This study attempts to contribute to the existing literature by investigating the associations of the physical self-concept, PA-enjoyment, and PA-related mood regulation with children's PA during the COVID-19 pandemic controlling for context and demographic variables.

Materials and Methods

Data Collection

Data acquisition took place during the period spanning late May through mid-June in the year 2021. The Oxford Stringency Index (Hale et al., 2021) during this period was 75.0. Following the initiation of Germany's second lockdown at the close of 2020, a gradual relaxation of measures ensued, significantly impacting the domain of sports activities. Up until early March, recreational and amateur sports activities at public and private sports facilities remained suspended. Subsequently, starting from this juncture, outdoor sports participation was permitted for children under 14, albeit constrained to fixed groups of ten. This regulation was extended to include individuals up to 18 years of age, with group sizes expanded to 30 children and adolescents by mid-May. The resumption of indoor sports involving more than two people from different households was first authorized at the beginning of May, in strict compliance with hygiene protocols.

The situation within schools exhibited a similarly dynamic character (Ministry of Education and Cultural Affairs Lower Saxony, 2020). Physical education (PE) classes were sporadic and limited in frequency. At the time of data collection, students were still required to wear masks and adhere to physical distancing protocols. Some schools adopted the practice of dividing classes and providing instruction on a weekly basis.

Within the context of this study, data from primary school students in classes three and four were acquired through paper-and-pencil questionnaires. 838 students with an average age of 9.59 years ($SD = 0.81$)

from 10 schools and 48 classes filled out the questionnaire¹. The administration of these questionnaires transpired during regular classroom sessions. Uniformity and clarity in questionnaire presentation were ensured by the survey team, adhering to a standardized manual. The survey team remained readily accessible throughout the data collection process, providing prompt responses to inquiries. Participation in the survey was voluntary, with prior informed consent obtained from the respective parents or guardians as well as school administrations.

The sample selection process was guided by the availability of pre-established contact between the schools and the research team, often stemming from prior collaborations or involvement in student internships. As a result, the sample is characterized as a convenience sample. This methodological choice is attributed to the constraints of conducting research during the pandemic, a circumstance that has caused the reliance on convenience sampling methodologies in numerous concurrent studies (Brand et al., 2022)

Measures

All data were collected in a manner that ensured participant anonymity, precluding any potential identification of individual respondents. The students' gender and age were assessed through the questionnaire. Students were also asked to indicate whether they were currently actively training in a sports club. Contextual data (e.g., whether regular normal PE classes are held at the time of assessment, and to which grade the participants belonged) were added by information from the teachers and via a single item question regarding the active training in a sports club.

The assessment of students' physical activity (PA) levels employed two specific items sourced from the validated MoMo physical activity questionnaire (Jekauc, Wagner, et al., 2013). Initially, participants received a comprehensive explanation delineating the concept of PA, as detailed in Schmidt et al. (2016). Subsequently, the first item inquired about the frequency of days on which participants engaged in PA for a minimum of 60 minutes during a typical week throughout the COVID-19 pandemic period ("Over a typical or usual week during the coronavirus pandemic, on how many days are you physically active for a total of at least 60 min per day?"). The second item sought similar information but within the context of the preceding week. The selection of these specific items was deliberate, chosen to facilitate comparability with data obtained from the representative MoMo dataset both before and during the COVID-19 pandemic (Schmidt et al., 2020).

Sport Self-Concept was measured using the respective scale from a questionnaire for measuring the physical self-concept in childhood (PSK-K) (Dreiskämper et al., 2015). The scale consisted of three items (e.g., "I am good at sports") and was presented as a 4-point Likert scale ranging from 1 ("not true at all") to 4 ("exactly true").

Physical Activity Enjoyment was measured using five items from the German version of the Physical Activity Enjoyment Scale were used (Jekauc, Voelkle, et al., 2013). The scale starts with the stem "When I am physically active..." followed by statements about different feelings (e.g., "I enjoy it"). In order to stick to the same answer format, the scale was also presented as 4-point Likert scale ranging from 1 ("not true at all") to 4 ("exactly true").

To measure the children's control competence for PA-related mood regulation a scale originally developed by Sudeck and Pfeifer (2016) and adapted for children and adolescents by Lindemann et al. (2023) was used. The scale is part of a questionnaire to assess PA-related health competence. It consisted of four items (e.g., "When I'm in a bad mood, I move around and then I feel better again") and is presented as a 4-point Likert scale ranging from 1 ("not true at all") to 4 ("exactly true").

Data Analysis

All analyses were conducted using IBM SPSS 27 (IBM Corp., 2020) and RStudio (RStudio Team, 2023). For the analyses, the R packages lme4, lavaan, misty and psych were used.

First, we tested the factorial validity of the sport self-concept, PA enjoyment and PA-related mood regulation scales by confirmatory factor analysis, using a robust maximum likelihood estimator and full imputation maximum likelihood estimator for estimating missing values. Then, we calculated a mixed linear model to analyze the relations between, the psychological variables and PA, controlling for context and demographic variables. To account for the clustered data structure, random intercepts for schools and classes were included. Missing values were excluded listwise. Based on the model, we checked for multicollinearity using variance inflation factors (VIFs) and conditioning indices (CIs) (Tabachnick & Fidell, 2019).

Results

Preliminary analyses

Results of confirmatory factor analysis showed a good model fit of the three-factor model (i.e., CFI = 0.95; RMSEA = 0.09; SRMR = 0.06). The analysis of the variance inflation factors and conditioning indices revealed no indications for strong multicollinearity (i.e., VIFs under 3 and CIs under 30 for not more than one variable (Tabachnick & Fidell, 2019)). Reliability of the scales was also good (sport self-concept: $\omega = .86$, PA enjoyment: $\omega = .83$, PA-related mood regulation: $\omega = .83$). The results of the preliminary analyses allowed for future processing.

¹ The sample is a part of larger sample analyzed in another paper with a different research question (Braksiek et al., 2022).

Descriptive statistics and correlations

Table 1 reports the descriptive and correlation statistics. Boys and girls were approximately equally represented in the sample (48 % girls) and their mean age was 9.6 (SD = 0.8) years. On average, the children were active for at least 60 minutes on 4.2 days a week. A quarter of them (27 %) were actively training in a sports club at the time of the survey. Regular PE was possible for three quarters of them (75 %). The average values of the psychological variables were slightly higher than the theoretical mean of the scales (i.e., 2.5). Most of the correlation were low and insignificant. The psychological variables correlated moderately to strongly.

Table 1
Descriptive Statistics and Correlations for Study Variables

Variable	<i>n</i>	<i>M</i>	<i>SD</i>	1	2	3	5	6	7	8
1. Age	838	9.59	0.81	—						
2. Gender ^a	838	0.48	0.50	.00	—					
3. Physical Activity	838	4.23	2.14	.02	-.03	—				
4. Sports club training ^b	838	0.27	0.44	-.05	-.05	.10	—			
5. Physical education ^c	770	0.75	0.43	-.17**	.08*	-.14*	.01	—		
6. Physical self-concept	837	2.86	1.01	.08*	-.03	.05	-.08*	-.17**	—	
7. Mood-regulation	772	2.56	0.94	.05	.03	.09	-.02	-.22**	.53**	—
8. PA-Enjoyment	832	2.81	0.96	.07	.03	.06	-.09*	-.19**	.79**	.66**

^a 0 = male; 1 = female.

^b 0 = no training; 1 = training.

^c 0 = no physical education; 1 = regular physical education.

* $p < .05$. ** $p < .01$.

Regression Analysis

Table 2 shows the results of the linear mixed model. The context variables (i.e., sport club training and PE) as well as the demographic variables (i.e., age and gender) were not associated with the children’s PA. Regarding the psychological variables, only the sport self-concept predicted the children’s PA ($b = 0.34$). Whereas PA-related mood regulation clearly did not predict children’s PA, the upper limit of the confidence interval for the relation of PA enjoyment and PA was only slightly under zero.

Table 2
Regression Analysis

Effect	<i>b</i>	<i>SE</i>	95% CI		<i>p</i>
			LL	UL	
Fixed effects					
Intercept	3.55	1.15	1.37	5.86	0.00
Age	-0.03	0.10	-0.22	0.16	0.74
Gender ^a	-0.05	0.16	-0.33	0.27	0.76
Sports club training ^b	0.20	0.19	-0.20	0.60	0.28
Physical education ^c	-0.72	0.46	-1.77	0.22	0.14
Physical self-concept	0.34	0.14	0.03	0.62	0.02
Mood-regulation	-0.12	0.12	-0.35	0.11	0.31
Physical activity enjoyment	0.27	0.16	-0.06	0.60	0.09
Random effect variances					
Class	0.13	0.01			
School	0.48	0.03			

Note $N = 701$; CI = confidence interval; LL = lower limit; UL = upper limit.

^a 0 = male; 1 = female.

^b 0 = no training; 1 = training.

^c 0 = no physical education; 1 = regular physical education.

Discussion

This study aimed to explore the associations between sport self-concept, PA enjoyment, and PA-related mood regulation with primary school children's PA during the COVID-19 pandemic. Consistent with Garn et al. (2019), our findings underscore the important role of sport self-concept in predicting children's PA. The importance of sport self-concept in our findings, especially during the challenging period of the pandemic, emphasizes its importance in maintaining children's engagement in physical activities, despite external constraints such as lockdowns and social distancing. Contrary to the established relationship between PA enjoyment and PA in pre-pandemic research (e.g., Haas et al., 2021), our study did not find a significant predictive role for PA enjoyment. This could be attributed to the unique psychological and social challenges posed by the pandemic, potentially altering the way children perceive and enjoy PA. Although the mean values of both, PA enjoyment and sport self-concept, were above the theoretical mean value of the scales, they were lower than in comparable studies (Dreiskämper et al., 2015; Jekauc, Voelke, et al., 2013), indicating a potential negative effect of the pandemic-related conditions on these constructs. Moreover, the relevance of PA enjoyment for the prediction of children's PA is conditional on the other variables, including sport self-concept. Unlike in other studies, the predictive value of PA enjoyment in this study was calculated considering the impact of sport self-concept. This means that PA enjoyment had no additional explanatory value for children's PA when sport self-concept is also considered as predictor, suggesting that sport self-concept is a better predictor of PA in childhood than PA enjoyment. Given the cross-sectional design of the study and the unclear causal relationship between PA enjoyment and sport self-concept, this finding warrants cautious interpretation. Although recent research has discussed and tested reciprocal or mediated relations between sport self-concept, PA enjoyment and PA, preliminary results are mixed and complex, precluding definitive conclusions at this stage (Garn et al., 2019; Greule et al., 2023).

Regarding the investigation of children's PA-related mood regulation, our study did not find a significant predictive relationship with children's PA. This outcome contrasts with prior research indicating a positive association in older children and adolescents (Lindemann et al., 2023). Since this is the first study examining primary school children's PA-related mood regulation, it remains unclear whether there is generally no association or if its importance is minimal in the context of pandemic conditions. In comparison to PA enjoyment, while both constructs are affect-related, the hypothesized association between PA-related mood regulation and PA necessitates specific knowledge of effects (Sudeck & Pfeifer, 2016), which might not be sufficiently developed in primary school children to influence their PA level.

Our study's limitations include the convenience sampling strategy and the focus on a specific demographic, potentially affecting the generalizability of the findings. For example, the schools in the study were located in rural areas, which may have influenced children's PA during the pandemic, as indicated by other studies (e.g., Nigg et al., 2021). Additionally, the cross-sectional design precludes any claims about causal effects.

In conclusion, this study highlights the resilience of sport self-concept in maintaining children's PA during the COVID-19 pandemic. It underscores the need to promote children's sport self-concept in childhood. Future studies should further investigate the causal relationship among PA enjoyment, sport self-concept, and PA. This would enhance our understanding of these variables' roles in physical (in)activity in children and contribute to developing effective intervention strategies to combat inactivity in this population. Furthermore, the role of PA-related mood regulation as part of PA-related health competence in children should also be further instigated theoretically and empirically.

Conflicts of interest: The authors have no competing interests to declare that are relevant to the content of this article.

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