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Correlations between motor competencies, physical activity and self-concept in children with intellectual disabilities in inclusive education

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Abstract

Background: Reciprocal relationships exist between motor competencies, physical activity and self-concept.

Aims: Using a structural equation model, this study examined whether these relationships also appear in children with intellectual disabilities, how they can be validly measured, and if there are differences between children with and without intellectual disabilities.

Materials & Methods: Data from a cross-sectional research project involving 121 children with intellectual disabilities and 1721 without intellectual disabilities were analysed.

Results: The results demonstrate that reciprocal relationships also apply to children with intellectual disabilities and can be elucidated if inverse items are omitted.

Discussion: Children with intellectual disabilities have less developed motor competencies and are less physically active but have a higher general self-concept compared to children without intellectual disabilities. The sport-related ability self-concept of both groups is comparable.

Conclusions: The results are broadly consistent with extant research and illustrate that the development of motor competencies, physical activity and self-concept in children with intellectual disabilities must be encouraged.

KEYWORDS

intellectual disabilities, motor competencies, physical activity, self-concept, structural equation model

1 | INTRODUCTION

Motor competencies are a prerequisite for physical activity and fundamental to participation in sports (Wälti et al., 2022). They are related to physical activity (Feitoza et al., 2022) and various health aspects such as well-being, weight and fitness (de Meester et al., 2020). Motor competencies are therefore an essential health resource (Dreiskämper et al., 2020) and are the basis for an active and healthy lifestyle (Strotmeyer et al., 2020). Motor competencies are also crucial for physical, social and cognitive development (Benzing et al., 2021) and influence self-concept (Dreiskämper et al., 2020). For children with intellectual

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disabilities,[1] motor competencies are of particular importance as they typically have lower motor competencies (Maïano et al., 2019b), are less physically active (Maïano et al., 2019a) and are more likely to be obese than children without intellectual disabilities (Maïano et al., 2016), and are therefore particularly at risk in terms of their health (Maïano et al., 2019a).

Research into motor competencies has multiplied in recent years, mostly referring to the conceptual model of Stodden et al. (2008) (see also Barnett et al., 2022). It is assumed that there is a developmentally dynamic and reciprocal relationship between motor competencies and physical activity (Izaskun et al., 2022), mediated by perceived motor competencies and health-related fitness, and negative associations between all these variables and body weight (Barnett et al., 2022). The relationships proposed in this model have been examined in numerous longitudinal and cross-sectional studies, and various meta-analyses are available (Barnett et al., 2022). For example, the reciprocal relationship between motor competencies and physical activity across different age groups has been confirmed in several meta-analyses (Figueroa & An, 2017; Holfelder & Schott, 2014; Jones et al., 2020; Logan et al., 2015; Lubans et al., 2010). Reciprocal relationships between motor competencies and perceived motor competencies were demonstrated in a meta-analysis (De Meester et al., 2020) as well as between physical activity and perceived motor competencies in children, adolescents and adults (Babic et al., 2014). Regarding the mediation effect of perceived motor competencies on the relationship between motor competencies and physical activity, the results are mixed (Feitoza et al., 2022).

Whether reciprocal relationships between motor competencies, physical activity and self-concept also exist in children with intellectual disabilities is unclear, as no such studies on the topic are currently available (Maïano et al., 2019a). Although it can be assumed that the relationships between motor competencies, physical activity and self-concept are similar for children with intellectual disabilities as for children without intellectual disabilities, it is important to examine these relationships further. This is especially important given that children with intellectual disabilities are disadvantaged regarding motor competencies (Maïano et al., 2019b), physical activity (Maïano et al., 2019a) and self-concept (Maïano et al., 2018) and are particularly vulnerable in terms of their health and well-being, social participation, emotional and social development.

This study examined the motor competencies, physical activity and self-concept of children with intellectual disabilities and without intellectual disabilities, and the relationships between these aspects. It also examined how these relationships can be validly measured in children with intellectual disabilities and if there are differences between the two groups. An understanding of these three aspects, the relationships between them and the possible differences between these two groups is essential to the promotion of these three aspects in children with intellectual disabilities, and, thereby, to the promotion of their health, social participation and development.

[1]The term 'intellectual disabilities' is widely used but also controversial and often carries negative connotations. In this article, it is used to describe children who, based on an assessment (usually a standardised assessment procedure), were found to have intellectual disabilities, and who therefore deserve a special education status, and the eligibility for special educational measures.

2 | THEORETICAL FRAMEWORK

2.1 | Motor competencies

Motor competencies refer to 'the individual's ability to execute different motor actions, including coordination of both fine and gross motor skills that are necessary to manage everyday life' (Lopes et al., 2021, p. 3). Since there is no universally accepted definition of human motor skills, various terms (e.g., motor proficiency, motor abilities, motor performance) are used synonymously and inconsistently. For this paper, the commonly used term 'motor competencies' has been used.

Various factors influence children's motor competencies, as numerous studies have shown (Wälti et al., 2022). In a meta-analysis, Barnett et al. (2016) demonstrated that motor competencies improve with age. Children's motor competencies also differ based on sex, with girls having higher locomotor skills and lower object control skills compared to boys (Wälti et al., 2022). Furthermore, there is a negative correlation between body weight and motor competencies (Wälti et al., 2022) and a positive correlation between motor competencies and socioeconomic status (Barnett et al., 2016). In addition, a positive association between motor competencies and physical activity could be demonstrated in several meta-analyses (Maïano et al., 2019b).

2.2 | Motor competencies of children with intellectual disabilities

Only a few studies have examined the motor competencies of children with intellectual disabilities. This is the result of a meta-analysis that included 17 studies between 1951 and 2017, which suggested that children with intellectual disabilities tend to have deficits in their motor competencies, resulting in less physical activity (Maïano et al., 2019b). However, this research can only be considered preliminary owing to the few studies available and to their limitations (e.g., longitudinal studies only, low methodological quality, lack of generalizability of the results, examination of different aspects of motor competencies).

2.3 | Physical activity

Physical activity is understood as 'all forms of movement, whether undertaken voluntarily (exercise and sport), unavoidably (occupational and domestic chores) or deliberately (adoption of an active lifestyle)' (Shephard, 1999, p. 2). Accordingly, this includes a wide range of activities. From a sports perspective, physical activity consists of all forms of sport that are practised in an informal or organised manner (e.g., running, cycling and training in sports clubs; Babic et al., 2014). Various factors influence the extent of physical activity, with two critical factors being motor competencies (Schmidt et al., 2015) and self-concept (Babic et al., 2014).

2.4 | Physical activity of children with intellectual disabilities

A meta-analysis by Hinckson and Curtis (2012), which included 30 studies from America, Asia, Europe and Australia, suggested that children with intellectual disabilities are significantly less physically active than children without intellectual disabilities. Children with intellectual disabilities are also underrepresented in sports clubs (Klenk et al., 2019) and are more often overweight than children without intellectual disabilities (Maïano et al., 2016).

2.5 | Self-concept

The study of self-concept has a long research tradition across various disciplines (Conzelmann & Schmidt, 2020); thus, the terminologies, models and approaches are numerous (Hellmich & Günther, 2011). According to Langenkamp (2018), Shavelson et al.'s (1976) self-concept model is the most frequently used model. In this model, self-concept is understood as a person's self-perception, shaped by their experiences with the environment (Maïano et al., 2018). The self-concept is a multidimensional, hierarchical construct with the general self-concept at its pinnacle. Specific self-concept dimensions, such as academic, social, emotional and physical self-concept, influence the general self-concept (Maïano et al., 2018). The physical self-concept, which has been empirically evidenced to have the greatest influence on the general self-concept (Rubeli et al., 2020), comprises physical attractiveness and the sport-related ability self-concept. The latter is significant for the present article and provides information on how one's sportsmanship is assessed.

The general self-concept and its subdimensions are influenced by various factors (Burrmann, 2021). For example, young children have an inflated self-concept that becomes increasingly realistic and differentiated as they get older (Douma et al., 2022), and boys tend to have a higher self-concept than girls (Maïano et al., 2018). Of particular importance for the self-concept, however, is the social environment (e.g., peers, family, educational context; Douma et al., 2022). This is where comparison processes take place, through which, according to Festinger's Social Comparison Theory (Festinger, 1954) the self-concept of individuals is formed. In these comparison processes, individuals compare themselves with others (Douma et al., 2022).

2.6 | Self-concept of children with intellectual disabilities

The self-concept of children with intellectual disabilities has been examined in several studies since the mid-20th century (Maïano et al., 2018). The focus has been on differences in self-concept between children with intellectual disabilities and children without intellectual disabilities, school placement effects on self-concept, and self-concept correlates (Maïano et al., 2018). The results of the studies, which were partially inconclusive, demonstrate that children with intellectual disabilities have a significantly lower general and academic self-concept than children without intellectual disabilities and that no significant differences exist with regard to physical appearance and social self-concept. The results also indicate that children with intellectual disabilities who attend special classes in mainstream schools tend to have a lower general, behavioural and academic self-concept than children without intellectual disabilities. However, these results do not allow any conclusions to be drawn about the effects of school placement, since no direct comparison with children schooled in different settings was made (Maïano et al., 2018). Regarding correlates of self-concept, the research results are inconsistent and the relationships between the various self-concept dimensions remain an open question. The same applies to the connections between self-concept, age and gender (Maïano et al., 2018). As mentioned previously, this research must be considered preliminary as most of the studies lacked information on reliability and validity, sample size and the extent of intellectual disabilities. Furthermore, different constructs were used to assess self-concept, only one of the studies considered had a longitudinal design, and most of the studies were conducted in North America, which made the application of the results to other countries challenging. Thus, further research is required to obtain reliable results on the self-concept of children with intellectual disabilities and the factors that influence it.

2.7 | Relationships between motor competencies, physical activity and self-concept

Numerous studies have examined the relationships between motor competencies, physical activity and self-concept in children and adults (Hands et al., 2020). For example, the meta-analysis of Babic et al. (2014) illustrated a positive correlation between physical activity and physical self-concept and its sub-dimensions. The effect sizes range from low to moderate (Rubeli et al., 2020). Positive correlations with small effect sizes were found between motor competencies and physical self-concept (Dreiskämper et al., 2020). The correlations between motor competencies and physical self-concept, as well as physical activity and physical self-concept, are influenced by different moderator variables (e.g., age, gender, weight; Lodal & Bond, 2016, Babic et al., 2014). Several meta-analyses demonstrated a positive correlation between motor competencies and physical activity (Maïano et al., 2019b). According to Jekauc et al. (2017), the effect sizes are not solid but consistent. In various cross-sectional and longitudinal studies (Barnett et al., 2008; Barnett et al., 2011; Barnett et al., 2015; Slykerman et al., 2016), the relationships between motor competencies, physical activity and physical self-concept were examined. The physical self-concept, based on the model by Stodden et al. (2008), was mostly considered to be a mediator of the effect between physical activity and motor competencies (Herrmann et al., 2017). This mediation effect was

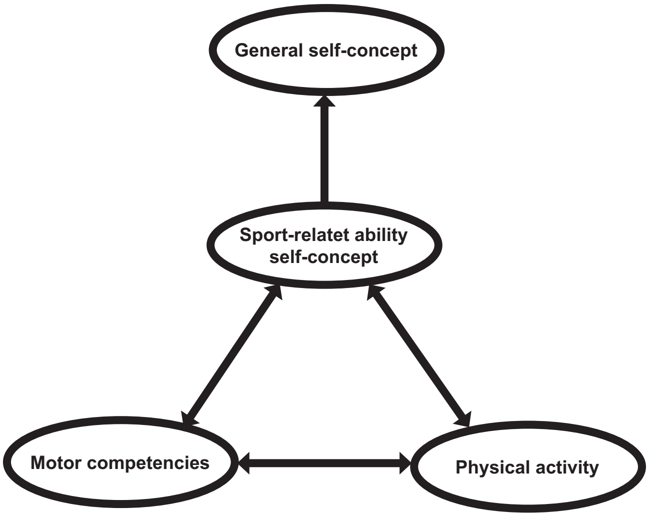

FIGURE 1 Reciprocal Effects Model.

confirmed in some studies (e.g., Barnett et al., 2008, 2011; Chan et al., 2019; Feitoza et al., 2022; Fu & Burns, 2018; Jaakkola et al., 2019; Jekauc et al., 2017), in others partially (e.g., Capio & Eguia, 2021; Emadirad et al., 2021; Kohaverdi et al., 2016) or not at all (e.g., Barnett et al., 2015; Crane et al., 2015; De Meester et al., 2018; Hall et al., 2019; Slykerman et al., 2016). However, in a more recent meta-analysis by Barnett et al. (2022), in which longitudinal studies have been examined since 2015, these effects could not be confirmed. Thus, it remains unclear whether sport-related ability self-concept mediates the effect between physical activity and motor competencies (Herrmann et al., 2017). Due to the uncertainty regarding the mediation effect of the physical self-concept, in this article the frequently used process-oriented *Exercise and Self-esteem Model* (EXSEM) of Sonstroem and Morgan (1989) is used to analyse the relationships between physical activity, motor competencies and self-concept. It is based on the self-concept model of Shavelson et al. (1976) and the self-efficacy theory of Bandura (Bandura, 1977; Conzelmann & Schmidt, 2020). The EXSEM is based on the following four premises:

1. Physical activity improves motor competencies.
2. The improvement of motor competencies is perceived.
3. The perceived improvement of motor competencies increases the sport-related ability self-concept.
4. The increased sport-related ability self-concept leads to an improvement of the general self-concept (Herrmann & Seelig, 2017).

Based on the EXSEM, which can partially be empirically supported (Conzelmann & Schmidt, 2020), three hypotheses are discussed to explain the relationships between motor competencies, physical activity and self-concept (Dreiskämper et al., 2020). First is the *skill development approach*. Following the premise of EXSEM in terms of a bottom-up process, it assumes that physical activity improves motor competencies, which is leads to an increase in self-concept. Second, is the *self-enhancement approach* developed as part of the further development of EXSEM. This approach assumes the opposite direction of action in a top-down process, wherein a higher self-concept leads to increased physical activity, which improves motor competencies. Since neither the skill development nor the self-enhancement approach has been empirically established, reciprocal effects between physical activity, motor competencies and self-concept are assumed today. This third approach is known as the *Reciprocal Effects Model* (Herrmann & Seelig, 2017). In the following analyses, this approach, as illustrated in Figure 1, is used to examine relationships between motor competencies, physical activity and self-concept.

2.8 | Relationships between motor competencies, physical activity and self-concept in children with intellectual disabilities

There are no studies available on the relationships between motor competencies, physical activity and self-concept in children with intellectual disabilities, as demonstrated in a meta-analysis by Maïano et al. (2019a). Thus, it is unclear whether the assumed effects of the Reciprocal Effects Model also apply to children with intellectual disabilities. To date, only specific associations have been investigated. For example, two studies established a positive relationship between physical activity and object control in children with intellectual disabilities (Maïano et al., 2019a).

2.9 | Research questions

In this study, the reciprocal relationships between motor competencies, physical activity and self-concept and the influence of the sport-related ability self-concept on the general self-concept assumed in the Reciprocal Effects Model in children with intellectual disabilities were examined. It was also examined how these relationships can be validly measured in children with intellectual disabilities and whether there are differences between children with and without intellectual disabilities. The focus was on the following research questions:

1. How can the reciprocal relationships between motor competencies, physical activity and self-concept, and the influence of the sport-related ability self-concept on the general self-concept assumed in the Reciprocal Effects Model for children with intellectual disabilities be validly measured?
2. How do children with intellectual disabilities and without intellectual disabilities differ in terms of these relationships (according to the Reciprocal Effects Model), their motor competencies, self-concept and physical activity?

3 | METHODOLOGICAL APPROACH

A multi-group structural equation model (MGSEM) was used to answer the research questions using the Mplus software (version

8.7). This analytical approach allowed for theoretical testing assumptions, simultaneously considered relationships between different variables, and analysed statistical relationships on the level of latent constructs (Werner et al., 2016). Additionally, an MGSEM makes it possible to analyse differences between groups (Weiber & Mühlhaus, 2014).

3.1 | Sample

In 2018 and 2019, about 950,000 schoolchildren attended obligatory school in Switzerland, of which around 4.8% (45,600) had special education needs due to disabilities (BFS, 2020). Although there is no precise statistical information on the exact number of schoolchildren with intellectual disabilities in Switzerland, it can be assumed in view of the comparable situation in Germany that around 16% (7300) of these children have intellectual disabilities (Müller et al., 2020). Compared to the total student body, this corresponds to a proportion of 0.8% and thus corresponds to the assumed prevalence of school-age children with intellectual disabilities (Speck, 2016). In the SoPariS-project, on whose data this article is based, 132 children with intellectual disabilities were surveyed. They attended 109 inclusive mainstream classes from 13 German-speaking Swiss cantons. These inclusive mainstream classes, which were identified by the responsible cantonal authorities, included at least one child with intellectual disabilities and comprised 1884 pupils (132 children with intellectual disabilities and 1752 children without intellectual disabilities); 430 of the children without intellectual disabilities received special educational measures (e.g., speech therapy). At the time of the survey, the children were in grades three to six. For the following analyses, data from 121 children with intellectual disabilities (age: $M = 11.90$, $SD = 1.17$; min $= 9$, max $= 14$; gender: female $= 50$, male $= 71$) and 1721 children without intellectual disabilities (age: $M = 11.28$, $SD = 1.10$, min $= 8$, max $= 14$; gender: female $= 884$, male $= 837$) were obtained. Among those excluded due to the Mahalanobis distance were 42 children (11 children with intellectual disabilities and 31 children without intellectual disabilities), who were determined using the software SPSS (version 28.0.1.0). To determine whether the sample is sufficient to detect the effects assumed in the Reciprocal Effect Model, an a priori power analysis was conducted using pwrSEM (version 0.1.2; Wang & Rhemtulla, 2021). A structural equation model according to the Reciprocal Effect Model and the instruments used in the SoPariS-Project and described below was specified. The parameter values were set according to the previously described research results (e.g., moderate correlation between physical activity and sport-related ability self-concept). The model defined in this way was tested using different sample sizes, with 10,000 simulations being calculated. The analysis demonstrates that a sample size of 93 is sufficient to achieve a power value >.8 at a significance level of .05 for all relationships of interest. It can therefore be assumed that the sample in the study is large enough.

3.2 | Survey implementation

The children's statements were collected using paper questionnaires. Their parents or legal guardians gave their written consent to the survey. To avoid difficulties in comprehension, the questions were read aloud by trained project employees, and the possible answers were illustrated with visualisations. Project staff, teachers and special needs educators were available to provide support and answer any questions. The physical education teachers were interviewed by means of an online questionnaire.

3.3 | Measuring instruments

3.3.1 | General self-concept

The children's general self-concept was assessed using the self-esteem scale, which consists of five items and records the degree of acceptance of oneself. It has been used in various studies with good test quality criteria, such as the Paderborn SET study (sports engagement and development of children; An evaluation of the Paderborn talent model; Brettschneider & Gerlach, 2004). Based on reliability analyses, an inverse item that was unsuitable for the survey of children with intellectual disabilities was excluded and the scale was reduced to four items (Schluchter et al., 2021).[2] The children rated the items on a 4-point Likert scale ranging from disagree (0) to exactly agree (3). The internal consistency of the adapted scale, measured with Cronbach's alpha (α), was good for both groups (children with intellectual disabilities: $\alpha = .82$; children without intellectual disabilities: $\alpha = .86$). The results of the confirmatory factor analyses presented in Table 1 also confirm the suitability of the adapted instrument.

3.3.2 | Sport-related ability self-concept

The sport-related ability self-concept as one of two dimensions of the physical self-concept was assessed using the *physical self-concept* subscale from the *perceived competence scale for children* (Harter, 1985). The scale, which assesses general sporting abilities, included six items and was used successfully in the SET study (Brettschneider & Gerlach, 2004). Based on reliability analyses (Schluchter et al., 2021), the scale was reduced to four items,[3] and two inverse items were excluded. The questions were answered on a 4-point Likert scale ranging from disagree (0) to exactly agree (3). The internal consistency was satisfactory for both groups (children with intellectual disabilities: $\alpha = .77$; children without intellectual disabilities: $\alpha = .79$). The results

[2]Overall, I am very happy with myself (general self-concept 1), I feel fine (general self-concept 2), I have reason to be proud of myself (general self-concept 3), I like myself the way I am (general self-concept 4).

[3]I learn faster in sports than others my age (SASC1), I am at least as good at sports as others my age (SASC2), I am very good at sports (SASC3), I learn new exercises very quickly in sports (SASC4).

TABLE 1 Results of the confirmatory factor analyses of the general self-concept scale.

Scale	Group	X^2 Value	df	p	RMSEA[a] Value	90% CI[d]	CFI[b]	SRMR[c]
General self-concept	Children with ID[e]	0.871	2	.647	0	[0.000, 0.141]	1	0.01
	Children without ID[f]	9.829	2	.007	0.048	[0.021, 0.079]	0.999	0.007

[a]Root-mean-square-error of approximation (RMSEA), threshold: RMSEA < 0.08.
[b]Comparative fit index (CFI), threshold: CFI ≥ 0.90.
[c]Standardised root mean square residual (SRMR), threshold: SRMR ≤ 0.10.
[d]Confident interval.
[e]Children with intellectual disabilities ($n = 121$).
[f]Children without intellectual disabilities ($n = 1721$).

TABLE 2 Results of the confirmatory factor analyses of the sport-related ability self-concept scale.

Scale	Group	X^2 Value	df	p	RMSEA[a] Value	90% CI[d]	CFI[b]	SRMR[c]
Sport-related ability self-concept	Children with ID[e]	1.453	2	.484	0	[0.000, 0.146]	1	0.014
	Children without ID[f]	24.236	2	.000	0.08	[0.054, 0110]	0.995	0.013

[a]Root-mean-square-error of approximation (RMSEA), threshold: RMSEA < 0.08.
[b]Comparative fit index (CFI), threshold: CFI ≥ 0.90.
[c]Standardised root mean square residual (SRMR), threshold: SRMR ≤ 0.10.
[d]Confident interval.
[e]Children with intellectual disabilities ($n = 121$).
[f]Children without intellectual disabilities ($n = 1719$).

of the confirmatory factor analysis presented in Table 2 suggest that the sport-related ability self-concept can be reliably measured with the items used.

3.3.3 | Motor competencies

The various aspects of motor competencies may be assessed using multiple diagnostic techniques (e.g., Movement Assessment Battery for Children, Test of Gross Motor Development). A distinction is made between motometric, motographic and motoscopic methods (Fischer, 2019). In the present study, the motor competencies of the children were assessed using the latter motoscopic methods. The physical education teachers answered questions on two scales developed by Valkanover (2005) based on Schilling's (1976) *Checklist of motor behaviour*. The *psychomotor inhibition* and *psychomotor clumsiness* scales were each reduced to three items for the following analyses. They were also recoded so that a child with expressive and skilful movement behaviour receives high values. The items of the *psychomotor uninhibitedness*[4] and *psychomotor skill*[5] scales were answered on a 5-point Likert scale ranging from strongly disagree (0) to totally agree (4). The internal consistency of the scale psychomotor uninhibitedness was good for both groups (children with intellectual disabilities: $\alpha = .80$, children without intellectual disabilities: $\alpha = .85$) and for the scale psychomotor skill, it was sufficient or good (children with intellectual disabilities: $\alpha = .78$, children without intellectual disabilities: $\alpha = .87$). The reliability of the scales could not be calculated with confirmatory factor analyses, since scales with only three items result in just identified models that do not provide meaningful results. However, since the analyses by Valkanover (2005) indicate a corresponding factor structure and the internal consistency of the scales is sufficient to good, they were used nonetheless.

3.3.4 | Physical activity

The children rated their physical activity based on two items. The first item, informal physical activity, is related to the extent of informal sporting leisure activities such as cycling or jogging. The children answered the question of how often they engage in sports during their free time each week on a 5-point Likert scale ranging from less than once (0) to five or more times (4). To check the validity of these statements, the information on the extent of informal sporting leisure activities was compared with information on the number of weekly sporting hours practiced during leisure time. The children's statements correlate significantly with a strong effect according to Cohen (1988); children with intellectual disabilities: $r_s = .72$, $p = <.001$, $n = 118$; children without intellectual

[4]PU: The child's movement behaviour in self-chosen movement tasks is: lively (psychomotor uninhibitedness 1), active (psychomotor uninhibitedness 2), timid (psychomotor uninhibitedness 3) (-).
[5]PS: The child's movement behaviour in self-chosen movement tasks is: clumsy (psychomotor skill 1) (-), awkward (psychomotor skill 2) (-), agile (psychomotor skill 3).

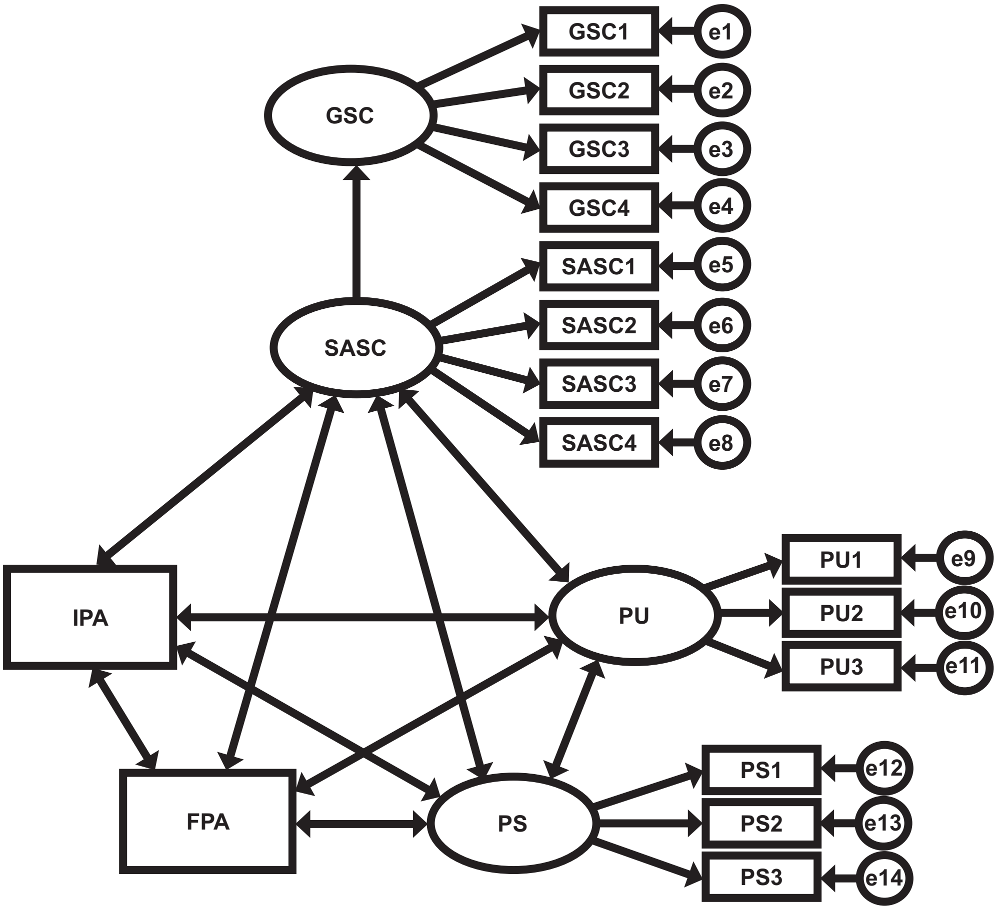

FIGURE 2 Structural equation model based on the Reciprocal Effect Model. General self-concept (GSC), sport-related ability self-concept (SASC), informal physical activity (IPA), formal physical activity (FPA), psychomotor uninhibitedness (PU), psychomotor skill (PS).

disabilities: $r_s = .72$, $p = <.001$, $n = 1694$. It can therefore be assumed that the statements made by the children are valid. The second item, formal physical activity is associated with the extent of sporting activities in organised sports (e.g., soccer or volleyball training). On a 5-point Likert scale, the children indicated their engagement in organised sports per week. The validity of these statements was checked by relating them to statements by the children about the sports club they attended. The children were asked to state the name of the sports club or, if unknown, the type of sport. In total, only four children without intellectual disabilities could not give any information about the sports club they attended. This allows for the assumption that the statements about the extent of physical activity in organised sports are valid.

3.4 | Analysis methods

In our model, as illustrated in Figure 2, different relationships were computed simultaneously. Based on the Reciprocal Effects Model, we assumed that there are reciprocal relationships between motor competencies, physical activities and sport-related ability self-concept. Further drawing on this model, we assumed that the sport-related ability self-concept explains part of the general self-concept.

The MGSEM modelled to answer the questions was calculated using the *weighted least square mean and variance adjusted* (WLSMV) estimator. This estimator is recommended for ordinally scaled indicator variables (Wang & Wang, 2020) and is suitable for a moderate violation of the normality assumption (Suh, 2015). Therefore, it is ideal for the analysed data since the indicator variables in the MGSEM have an ordinal scale level, and the normal distribution is only moderately violated, as demonstrated by the Shapiro–Wilk tests and the consideration of the skewness and kurtosis.

3.4.1 | Analysis method for research question 1

The first research question was answered by demonstrating measurement invariance. This implies that the theoretical model calculated in the MGSEM measures the same in both groups (Wang & Wang, 2020). Thus, the assumed relationships are also valid for children with intellectual disabilities. To support measurement invariance, the step-up approach, according to Brown (2015), was followed. Thereby, different levels of measurement invariance (configural, metric, scalar invariance) were tested stepwise by the comparison of differently restricted model variants (unrestricted, constant factor loadings, constant factor loadings and thresholds) using the Satorra–Bentler chi-square (x^2) difference test

TABLE 3 Model fit values of different model variants to prove measurement invariance.

Model variants	x^2 Value	df	p	RMSEA[a] Value	RMSEA[a] 90% CI[d]	CFI[b]	SRMR[c]
Baseline model for children with intellectual disabilities[e]	154.719	95	<.001	0.072	[0.051, 0.092]	0.956	0.081
Baseline model for children without intellectual disabilities[f]	714.490	95	<.001	0.062	[0.057, 0.066]	0.979	0.041
Configural model	819.839	192	<.001	0.060	[0.055, 0.064]	0.979	0.045
Constant factor loadings	794.780	202	<.001	0.056	[0.052, 0.061]	0.980	0.045
Constant factor loadings and thresholds	858.263	230	<.001	0.054	[0.051, 0.058]	0.979	0.045
Partial scalar measurement invariance	853.214	229	<.001	0.054	[0.051, 0.058]	0.979	0.045

[a]Root-mean-square-error of approximation (RMSEA), threshold: RMSEA < 0.08.
[b]Comparative fit index (CFI), threshold: CFI ≥ .90.
[c]Standardised root mean square residual (SRMR), threshold: SRMR ≤ 0.10.
[d]Confidence interval.
[e]Children with intellectual disabilities ($n = 121$).
[f]Children without intellectual disabilities ($n = 1721$).

(Kleinke et al., 2017). The model fit values of the different model variants are illustrated in Table 3.

3.4.2 | Analysis method for research question 2

To answer research question 2, structural parameters (means, correlation and regression coefficients) of the two groups were compared. The means in the reference group (children without intellectual disabilities) were restricted to zero, and the means for children with intellectual disabilities were estimated. The values of the item's informal physical activity and formal physical activity were compared using a Mann–Whitney *U* test with the software SPSS due to non-normally distributed and ordinally scaled variables and a lack of variance homogeneity in the formal physical activity variable. Two model variants were compared to explore the differences in the assumed relationships. All relationships were equivalent in both groups in one model variant while freely estimated in the second model variant. The two model variants were compared using the x^2-difference test.

4 | RESULTS

4.1 | Validity of the reciprocal effects model for children with intellectual disabilities (research question 1)

The structural equation model was calculated separately for children with intellectual disabilities and children without intellectual disabilities the first step. The model fit values of these *baseline models* were good for both groups. The structural equation model was estimated simultaneously for both groups in a second step. In this *configural model*, the model structure was the same for both groups, and all parameters were freely estimated. The fit of the configural model was good, and configural measurement invariance could thus be confirmed. In a third step, the model variant *constant factor loadings* were calculated. The factor loadings were equal in both groups in this model variant, which also had satisfactory model fit values compared to the configural model using the x^2-difference test. The result of this x^2-difference test was statistically not significant (x^2 difference = 17,875 (10), $p = .0571$). Metric measurement invariance could thereby be demonstrated, and the model variant constant factor loadings and thresholds were calculated in a fourth step. In this model variant, the factor loadings and the thresholds were set to be equal in both groups. This model variant, which has satisfactory model fit values, was compared with the model variant constant factor loadings using the x^2-difference test. The x^2-difference was statistically significant [x^2-difference = 45,097 (28), $p = .0216$]. Scalar measurement invariance could not be confirmed; the participants of one group responded systematically higher or lower to the items of scales. An attempt was made to establish partial scalar measurement invariance to compare the relationships and means despite the lack of scalar measurement invariance. For this purpose, thresholds that differ significantly between the two groups were identified. To achieve *partial scalar measurement invariance*, it was sufficient to release the threshold four in the variable psychomotor uninhibitedness psychomotor uninhibitedness 1. The x^2-difference test of the model variants' constant factor loadings and intercepts and partial scalar measurement invariance was statistically insignificant (x^2-difference = 37,878 (27), $p = .0798$), whereby partial scalar measurement invariance could be demonstrated.

Through a demonstration of the partial scalar measurement invariance, it was observed that the assumed relationships modelled in the MGSEM are equally valid for both groups. Thus, the reciprocal relationships between motor competencies, physical activity and sport-related ability self-concept, which have been empirically confirmed for children without intellectual disabilities, also exist for children with intellectual disabilities. It is also evident that the sport-related ability self-concept explains part of the general self-concept in children with intellectual disabilities. Thus, the relationships assumed in the reciprocal effects model are also valid for children with intellectual disabilities.

TABLE 4 Comparison of the physical activity of children with and without intellectual disabilities.

Physical activities	Children with ID[a] Mdn	Children without ID[b] Mdn	Mann–Whitney *U* test *U*	*p*	Cohen's *d*
Informal physical activities	662.01	939.22	72,722	<.001	0.26
Formal physical activities	707.66	936.53	80,103	<.001	0.21

[a]Children with intellectual disabilities ($N = 121$).
[b]Children without intellectual disabilities ($N = 1721$).

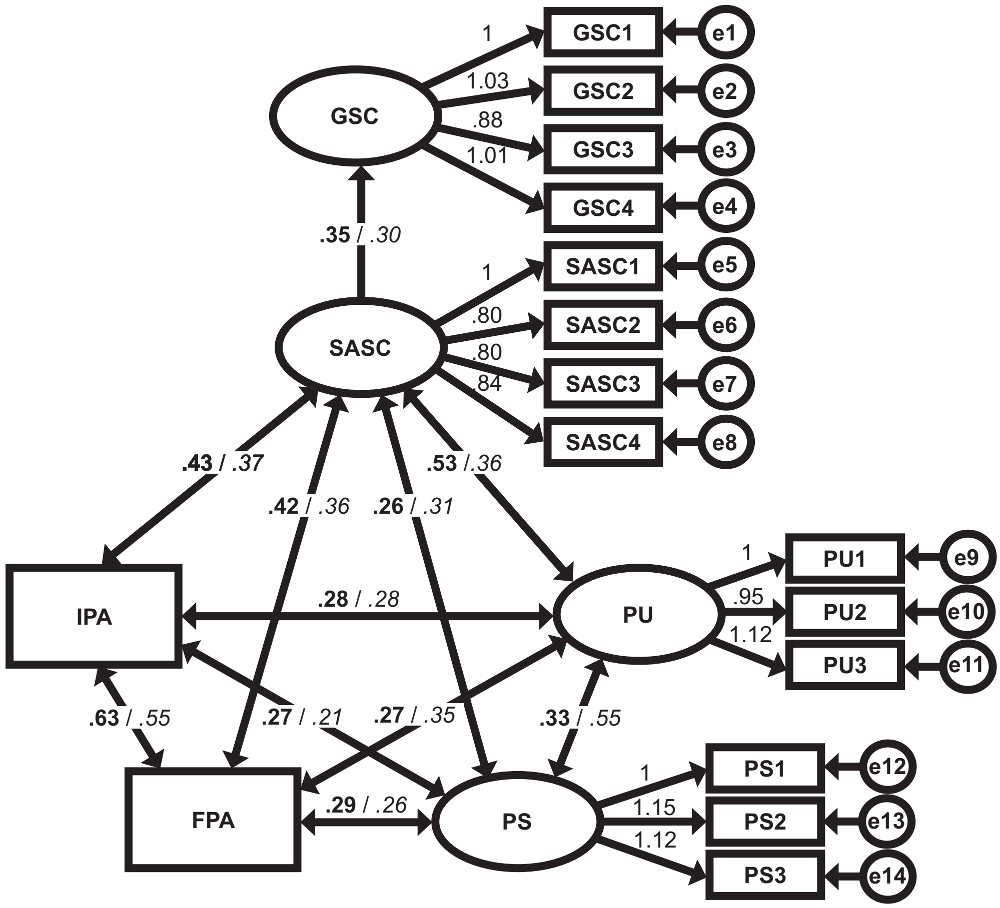

FIGURE 3 Correlations and regression coefficients for children with and without intellectual disabilities. General self-concept (GSC), sport-related ability self-concept (SASC), informal physical activity (IPA), formal physical activity (FPA), psychomotor uninhibitedness (PU), psychomotor skill (PS). The unstandardized path coefficients for children with intellectual disabilities are noted to the left of the hyphen and highlighted in bold. Values for children without intellectual disabilities are indicated in italics to the right of the hyphen. Factor loadings were restricted and are the same in both groups. All modelled correlations and regression coefficients are significant ($p < .05$).

4.2 | Differences between children with intellectual disabilities and without intellectual disabilities in terms of relationships, motor competencies, physical activity and self-concept (research question 2)

The comparison of the unstandardized mean values illustrates that children with intellectual disabilities have a higher general self-concept (0.90), a lower sport-related ability self-concept (−0.17), lower psychomotor skills (−0.39) and have lower values in relation to their psychomotor uninhibitedness (−0.76) in comparison with children without intellectual disabilities. These differences are statistically significant, except for the sport-related ability self-concept.

The comparison of the physical activities of the two groups, illustrated in Table 4, demonstrates that children with intellectual disabilities are less active in informal and formal physical activities compared to children without intellectual disabilities. The effect sizes calculated with Lenhard and Lenhard's (2016) effect size calculator corresponds to a small effect in both cases (Cohen, 1988).

A comparison of the relationships between motor competencies, physical activity and sport-related ability self-concept in the two groups shows that they do not differ significantly (x^2-difference = 19,345 (11), $p = .0550$). Nevertheless, the unstandardized correlation coefficients (r) and the unstandardized regression coefficient (β) illustrated in Figure 3 reveal some interesting differences. For example, the effect of the sport-related ability self-concept on the general self-concept is slightly more substantial for children with intellectual disabilities ($\beta = .35$) than for children without intellectual disabilities ($\beta = .30$). The effect size corresponds to a medium effect in both groups. The most considerable differences between the two groups are the correlations between sport-related ability self-concept and psychomotor uninhibitedness (children with intellectual disabilities: $r = .53$, large effect; children without intellectual disabilities: $r = .36$, medium effect) and the correlations between psychomotor uninhibitedness and psychomotor skill (children with intellectual disabilities: $r = .33$, medium effect; children without intellectual disabilities: $r = .55$, large effect). All other correlation coefficients are comparable in both groups. However, there are still differences in terms of the effect sizes in the correlations between sport-related ability self-concept and psychomotor skill (children with intellectual disabilities: $r = .26$; children without intellectual disabilities: $r = .31$) and between formal physical activity and psychomotor uninhibitedness (children with intellectual disabilities: $r = .27$; children without intellectual disabilities: $r = .35$). For both correlations, the effect is small for children with intellectual disabilities and medium for children without intellectual disabilities. The strongest correlations exist between informal and formal physical activity (children with intellectual disabilities: $r = .63$; children without intellectual disabilities: $r = .55$) for both groups. The effect size corresponds to a large effect in both groups; and weak correlations with small effect sizes exist for both groups between informal physical activity and psychomotor uninhibitedness, between informal physical activity and psychomotor skill, and between formal physical activity and psychomotor skill.

5 | DISCUSSION

This paper attempts to fill a literature gap by addressing the relationships between motor competencies, physical activity and self-concept in children with intellectual disabilities (Maïano et al., 2019a). Our analyses demonstrate that the reciprocal relationships assumed in the Reciprocal Effects Model (Sonstroem & Morgan, 1989) are also valid for children with intellectual disabilities, and that these relationships can be elucidated in children with intellectual disabilities if inverse items are omitted. With this methodical approach, important insights can be gained for this specific population. These relate initially to the reciprocal relationships between motor competencies and physical activity, which are of comparable strength for children with intellectual disabilities and those without. In accordance with existing research (Maïano et al., 2019b), the correlations correspond to small effects in both groups. Particularly noteworthy are, on the one hand, the lower levels of motor competencies reported by the physical education teachers and on the other hand, the lower physical activity levels indicated by the children with intellectual disabilities. Both results align with previous research findings (Hinckson & Curtis, 2012; Maïano et al., 2019b). They underline the particular vulnerability of children with intellectual disabilities in terms of health, well-being and development (Lodal & Bond, 2016). Future development approaches should target these areas. The results also correspond to the existing research results regarding reciprocal relationships between sport-related ability self-concept and motor competencies, as well as physical activity (Babic et al., 2014; Dreiskämper et al., 2020). The correlations correspond to small effects in both groups, except for the relationship between sport-related ability self-concept and psychomotor uninhibitedness, which corresponds to a medium effect in the group of children with intellectual disabilities. Based on these correlations, it can be concluded that these aspects are at least as important for the sport-related ability self-concept of children with intellectual disabilities as they are for children without intellectual disabilities. The results pertaining to the self-concept of children with intellectual disabilities partially contradict previous research findings (Maïano et al., 2018). This applies in particular to the expression of the general self-concept, which in our study is significantly higher in children with intellectual disabilities than in those without intellectual disabilities. Theoretically, this result can be explained by the delayed cognitive development of children with intellectual disabilities, which results in an overestimation of the general self-concept. Regarding the expression of the sport-related ability self-concept and its importance for the general self-concept, the results are in line with expectations (Maïano et al., 2018; Rubeli et al., 2020). However, the contradictory results and inconsistent research findings on the self-concept of children with intellectual disabilities suggests that further research is required.

6 | LIMITATIONS

This paper has several limitations. First, the analysed data originates from a cross-sectional research project; therefore, no statements about causal relationships can be made. To make causal inferences, further, and especially longitudinal, research projects are needed. These are necessary to understand these rarely investigated connections and gain insights into the self-concept development of children with intellectual disabilities. Second, the children questioned have mild intellectual disabilities. Generalisations to children with stronger intellectual disabilities or other disabilities are impossible. To explore the self-concept of children with moderate to severe intellectual disabilities, qualitative methods (e.g., interviews) would have to be used. This is necessary to avoid problems with regard to comprehension, which may arise in questionnaire surveys. Third, the interviewees attended inclusive school classes. A transference of the results to children who attend separative school settings is not possible, especially since context and its related social comparison process significantly influence children's self-concept (Douma et al., 2022). Fourth, the motor competencies of the children were assessed with motoscopic methods and not, as is usually the case, through standardised motor tests. The advantage of this approach is that the physical education teachers, which are familiar with the children's developmental stage and individual abilities, could assess the children's motor competencies. However, these are subjective assessments and incorrect assessments can occur (Valkanover, 2005). To gain deeper insight into the motor competencies of children with intellectual disabilities, further surveys that use motometric and motographic methods are needed.

7 | CONCLUSION

The significance of the present article is that empirically tested statements were made regarding the relationships between motor competencies, physical activity and self-concept of children with intellectual disabilities. These statements can be translated into practical implications and provide information on how children with intellectual disabilities can be supported. On the one hand, it is possible to focus on the promotion of physical activity to increase motor competencies. Such promotion can occur in everyday school life, especially in physical education and with targeted psychomotor support, in leisure time and organised forms. On the other hand, the focus can be on promoting motor competencies to improve physical activity, with physical education and organised sport also providing the appropriate framework. The importance of promoting motor competencies and physical activity is particularly emphasised by the fact that these are linked to the sport-related ability self-concept. Since there are reciprocal relationships, the promotion of the sport-related ability self-concept is also important. After all, a sense of achievement in sports can have a positive effect on motor competencies and physical activity. The fact that the sport-related ability self-concept also explains part of the general self-concept shows that motor competencies, physical activity and the sport-related ability self-concept should be promoted to support the general self-concept. This is important as it can improve the health and well-being, social participation and development of children with intellectual disabilities, who are particularly vulnerable in this respect. Future longitudinal research needs to investigate how motor competencies, physical activity and sport-related ability self-concept can be improved through interventions in children with intellectual disabilities.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

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DATA AVAILABILITY STATEMENT

The data of the research project are currently not freely accessible. They will be freely accessible in the Swiss National Science Foundation database from autumn 2023.

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