



Comparison of Mobility Behavior of Children from a Physical Education Kindergarten with Children from a Regular Kindergarten

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ABSTRACT: Mobility in the sense of the International Classification of Functioning, Disability and Health ICF-CY is an important prerequisite for participation in everyday life. The present study aims to show to what extent a movement promotion program in kindergarten has an effect on mobility behavior. Methods: The sample consists of 46 boys and 34 girls (age $4.51 \pm .98$ years) from one regular and one physical education kindergarten. The MobiScreen 4-6 was performed. Group differences were examined using a t-test, and multiple linear regression analysis was used to examine the effects of the predictors kindergarten affiliation, age, sex, born premature, sports club membership, and number of sports hours in the club. Results: Total time shows a strong multiple coefficient of $R = .75$ with an explained variance of $R^2 = .57$; total score also shows strong values of $R = .59$ and $R^2 = .35$. Age and sports club membership are the strongest predictors for both variables. Conclusions: Since raw values are analyzed for total time and score, the high influence of age is obvious. The effect of sports club membership indicates that the children may be better supported in their free time than in the concept of physical education kindergarten. Therefore, the concept of the physical education kindergarten should be reviewed and standardized.

KEYWORDS: Mobility, Movement diagnostics, Movement promotion, Physical education kindergarten, Screening.

I. INTRODUCTION

A. Meaning of mobility

Mobility describes one's own movement or the movement and handling of objects, moving around in various ways, and the use of transportation. Thus, without mobility, participation does not take place. Since children's life situations change constantly during their development, participation plays an overriding role, even if the opportunity for participation is primarily given to them by their parents. Mobility is embedded as a domain in the model of the *International Classification of Functioning, Disability and Health for Children and Youth (ICF-CY)*. The *ICF-CY* belongs to the "family" of classifications applied to various aspects of health and was developed by the *World Health Organization (WHO)*. Through the *ICF-CY*, functioning and disability that exist due to a health problem are classified. Through a common language, it enables data comparisons across countries, disciplines, and over time, and provides a scientific basis for understanding health status and health-related conditions, outcomes, and determinants. The *ICF-CY* consists of two parts, each with two components. Part 1: Functioning and Disability (a. Body Functions and Structures and b. Activities and Participation/Participation) and Part 2: Contextual Factors (c. Environmental Factors and d. Person-Related Factors). The activities and participation component is superordinate to the mobility domain. The third and fourth levels list the individual categories of mobility, which describe a problem using a code. Each of these components can be expressed in positive or negative terms. The components of the *ICF-CY* interact with each other (1).

B. Importance of physical activity

Movement is a basic need of our children (2). A positive body and self-concept is the basis for the development of the overall personality, which is why measures to promote movement should help children to experience the possibilities and limits of their abilities (3). It is possible, however, that many children today do not move enough. Such a lack of physical activity means that preschool children do not reach the daily physical activity time of 180 minutes as recommended (4). The results of the KiGGS study show that, on average, even more than 50% of children of kindergarten age do not achieve this recommended amount of physical activity time (5). Therefore, it is of great importance that exercise, play, and sports are offered in kindergarten to make up for this difference. The children's urge to move must be followed up during the kindergarten day and sufficient opportunities must be



provided, both in terms of offering movement equipment such as scooters or tricycles, but also enough free space to play ball, climb or run (6). The concept of the physical education kindergarten is characterized by exactly this: In a physical education kindergarten, exercise, play, and sports are firmly anchored in the kindergarten concept. The children can move freely in the groups (open concept) and can use an open gymnasium or other open spaces to move at any time. Many materials and equipment encourage movement. In addition, guided exercise or sports sessions take place at least once a week. These are carried out by exercise instructors from a local cooperation sports club, and appropriately trained pedagogical staff from the kindergarten (7).

Whether children from a physical education kindergarten have a better motor performance than children from a regular kindergarten has been investigated so far with different, often very time-consuming motor tests. Here it has been shown that the choice of test procedure could play a role and that some tests are not suitable for such projects (8;9). Furthermore, sports club affiliation may have an influence on the results, which was verified in Seyda et al. (10), but not in Dincher (11). It is also problematic if there is an age difference between the groups to be compared and raw scores are taken into account (11). However, these studies also suggest that the programs in the physical education kindergartens are not stringently followed through, so that no differences in motor performance are apparent between these and regular kindergartens (8;9). Conclusions at this point are that such an investigation can only be carried out with a suitable diagnostic procedure, that the concepts of the physical education kindergartens should be reviewed and standardized, and that various predictors such as sports club membership must be taken into account (8;9;11).

However, one should always try to limit the burden of testing for both the children and the tester, as each test is a burden for both parties (12). A screening is an economical form of testing with a kind of filtering function in the diagnostic process (13). It only differentiates between "inconspicuous" and "conspicuous" and does not allow for a specific diagnosis (14). Only children with a conspicuous test result are referred to a more specific developmental diagnostic examination (15).

Therefore, an attempt is being made to replicate these studies with the *MobiScreen 4-6*, a mobility screening for four- to six-year-old children based on the *ICF-CY* domain of mobility. The aim is to determine whether children from a physical education kindergarten have better mobility behavior than children from a kindergarten without physical education program ("regular kindergarten").

C. Hypothesis

Children from a physical education kindergarten have better mobility behavior than children from a regular kindergarten.

II. METHODS

A. Sample of Persons

The study was conducted in May 2022. For this purpose, one regular and one physical education kindergarten in Saarland (Germany) were randomly selected. The management of the kindergartens and the parents of the children gave their consent for participation. The total sample consists of 80 boys and girls aged three to six years. The following table gives an overview of the characteristics of the total sample.

Table 1: Characteristics of the Sample of Persons, shown for Physical Education (PE) and Regular Kindergarten, as well as Total Sample (m = male, f = female, M ± SD = mean ± standard deviation)

	<i>m/f</i>	<i>Height (M ± SD)</i>	<i>Weight (M ± SD)</i>	<i>Age (M ± SD)</i>	<i>Pre-mature</i>	<i>Sports Club member</i>	<i>Sports hours (M ± SD)</i>
<i>PE kindergarten</i>	23/16	1.10 ± .10 m	18.14 ± 3.64 kg	4.49 ± 1.02 years	2	23	1.21 ± 1.29
<i>Regular kindergarten</i>	23/18	1.10 ± .08 m	17.97 ± 3.18 kg	4.53 ± .96 years	5	28	1.20 ± 1.11
<i>Total sample</i>	46/34	1.10 ± .09 m	18.06 ± 3.40 kg	4.51 ± .98 years	7	51	1.20 ± 1.20

No significant differences between the two groups can be found in any of the parameters.



B. Variable Sample

MobiScreen 4-6: The mobility screening for four- to six-year-old children is based on the mobility domain of the *ICF-CY*. The screening can reliably determine whether or not a child's mobility behavior is conspicuous. It includes the tasks "standing up from lying", "running a slalom" (further abbreviated as "slalom"), "climbing over an obstacle" (abbrev. "climbing"), "crawling through an obstacle" (abbrev. "crawling"), "maneuvering a medicine ball with the lower extremities" (abbrev. "maneuvering") and "transporting a medicine ball with the upper extremities" (abbrev. "transporting"). The tasks are set up as a course that the child is expected to run through as fast as he or she can. The primary criterion for judging is the total time the child needs to complete the course. For this purpose, a cutoff value of 39 seconds is set for four-year-olds, 29 seconds for five-year-olds, and 26 seconds for six-year-olds. In addition, the quality of movement can be recorded in a protocol sheet. The procedure has good to very good psychometric properties: Inter-Rater Reliability: $r = .96$ for total time and $r = .92$ for total score, Retest Reliability $r = .93$, Paralleltest Reliability $r = .76$ for total time and $r = .68$ for total score, Cronbach's $\alpha = .60$, Construct Validity via exploratory factor analysis (one component with an eigenvalue of 2.31 confirms the one-factor model of mobility), Criterion Validity ranging from $r = -.46$ to $r = -.71$ for total time, $r = .30$ and $r = .72$ for total score, Sensitivity SN = .80 (4-year-olds), SN = 1.00 (5-year-olds) and SN = .88 (6-year-olds), Specificity SP = .75 (4-year-olds), SP = .68 (5-year-olds), and SP = .76 (6-year-olds), Area Under the Curve AUC = .82 (4-year-olds), AUC = .86 (5-year-olds), and AUC = .91 (6-year-olds) (16). For the present study, total time and total score are evaluated.

C. Statistics

To test for differences between physical education and regular kindergarten, t-tests are calculated in addition to means and standard deviations for each variable. To analyze the effects of the predictors of age, sex, born premature, kindergarten affiliation, sports club membership and number of sports hours per week, a multiple linear regression is calculated. To assume independence of the residuals, the Durbin-Watson value should be between 1.5 and 2.5 (17). For the multiple correlation coefficient and the explained variance/ model fit, the evaluation according to Cohen (18) is done as follows: low ($R > .10$ or $R^2 > .02$), medium ($R > .30$ or $R^2 > .13$) and strong ($R > .50$ or $R^2 > .26$) For this purpose, the program SPSS version 26 was used. The significance level was set at $p < .05$. The significance level is labeled as $p < .05^*$, $p < .01^{**}$, and $p < .001^{***}$.

III. RESULTS

Table 2 provides an overview of the test performance of the children in both groups on the *MobiScreen 4-6* and their comparison using a t-test.

Table 2: Comparison of Test Performance on *MobiScreen 4-6* of Physical Education (PE) and Regular Kindergarten ($M \pm SD =$ mean \pm standard deviation, $n =$ sample size, $T =$ T-value of t-test, $p =$ level of significance, n.s. = not significant)

Variable	PE kindergarten (n = 39)	Regular kindergarten (n = 41)	T (p)
Total time (M \pm SD)	29.02 \pm 12.29 s	26.96 \pm 9.03 s	.86 (n.s.)
Total score (M \pm SD)	22.21 \pm 2.31	23.17 \pm 2.21	-1.91 (n.s.)

The children of the physical education kindergarten need on average about two seconds longer to complete the course and score on average one point less in the total score than the children of the regular kindergarten. However, the kindergartens do not differ significantly in their mobility behaviors.

As follows in table 3 are presented the results of the multiple linear regression for the total time of *MobiScreen 4-6*. The conditions for this are all met (linear relationship between the variables, no outliers, no multicollinearity, homoscedasticity, normal distribution and independence of the residuals), two outliers (> 3 SD) were removed. Predictors analyzed are age, sex, kindergarten affiliation, sports club membership, sports hours per week, and born premature. This shows a multiple regression coefficient of $R = .75$ with a variance explanation of $R^2 = .57$. The ANOVA shows a value of $F(6,72) = 15.62^{***}$. Table 3 shows the influence of the predictors using standardized regression coefficient beta, and T-value with its significance.

**Table 3:** Results of the Regression Analysis: Standardized Regression Coefficient Beta, T-value and its Significance (p) for the MobiScreen 4-6 Total Time

<i>Predictor</i>	<i>Beta</i>	<i>T</i>	<i>p</i>
<i>Constant</i>		11.10	.000***
<i>Age</i>	-.68	-7.45	.000***
<i>Born premature</i>	.22	2.73	.008**
<i>Sex</i>	.16	1.97	.053
<i>Kindergarten affiliation</i>	.05	.61	.542
<i>Sports Club membership</i>	-.29	-2.60	.011*
<i>Sports hours per week</i>	.23	1.96	.053

The coefficient beta is highest for the predictor age and lowest for the predictor kindergarten affiliation. Only the predictors age, born premature and sports club membership are significant. With increasing age the time decreases significantly, premature children take significantly longer and children who are a sports club member are significantly faster.

Following are the results of the multiple linear regression of the total score. The predictors are carried over from the previous analysis. Again, all conditions are met. One outlier has been removed. Thus, a multiple regression coefficient of $R = .59$ with a variance explanation of $R^2 = .35$ is shown. The ANOVA yields a value of $F(6,73) = 6.59***$. Table 4 shows the influence of the predictors using standardized regression coefficient beta, and T-value with its significance.

Table 4: Results of the Regression Analysis: Standardized Regression Coefficient Beta, T-value and its Significance (p) for the MobiScreen 4-6 Total Score

<i>Predictor</i>	<i>Beta</i>	<i>T</i>	<i>p</i>
<i>Constant</i>		12.38	.000***
<i>Age</i>	.39	3.45	.001**
<i>Born premature</i>	.03	.33	.741
<i>Sex</i>	-.03	-.27	.790
<i>Kindergarten affiliation</i>	-.16	-1.66	.102
<i>Sports Club membership</i>	.40	2.92	.005**
<i>Sports hours per week</i>	-.12	-.82	.414

The predictors age and sports club membership show the highest beta coefficients. Only these two predictors are significant. Increasing age shows an increasing total score, likewise the children who are sports club members achieve higher total scores.

IV. DISCUSSION

In the present study, the mobility behavior of children from a regular kindergarten was to be compared with children from a physical education kindergarten.



Neither in the characteristics of the two groups nor in their test performances in *MobiScreen 4-6* (total time and score) a significant difference is found.

Multiple linear regression analysis of total time on the *MobiScreen 4-6* reveals a strong multiple regression coefficient of $R = .75$ with an equally strong variance explanation of $R^2 = .57$. The age of the children is the strongest predictor with a value of $\text{Beta} = -.68$, the strongest predictor, followed by identification as a preterm infant with $\text{Beta} = .22$. This implies that the total time for the course decreases with increasing age, which was to be expected when looking at the norm scores of the *MobiScreen 4-6* (16). The extent to which children born prematurely achieve deviant test results has not yet been evaluated with this screening. However, since it is assumed that children born prematurely usually show developmental delays or abnormalities (19), it is also obvious that these children complete the course more slowly. Girls take minimally longer than boys, but not significantly, which is consistent with the normative values of the procedure (16). Whether the procedure can differentiate between different kindergarten concepts has also not yet been tested. Kindergarten affiliation makes no difference in this case. It is possible that this should be considered an aftereffect of the Covid 19 pandemic. The kindergartens were temporarily closed, which meant that the children in the physical education kindergarten lacked these opportunities for movement. However, similar results were noted before the pandemic (8;9). This suggests that the concept of the physical education kindergarten may not be stringently implemented.

Sports club membership was found in 62% of the norming sample. In the current sample, the figure is around 63%. In contrast to the norming sample, it can be seen that the children who are in a sports club achieve significantly better times than children who do not belong to a club. This could also be related to the fact that due to the Covid 19 pandemic, kindergartens were temporarily closed and after reopening, sports activities were not allowed to take place even for a longer period of time. It is possible that the children who normally train in a sports club simply exercised more in their free time than the other children because their urge to move is stronger.

The number of hours of sports per week the children participate in has also not yet been examined for its effects on test performance in *MobiScreen 4-6*. It can be seen here that as the number of hours increases, the total time does not increase significantly. This raises the question of the extent to which this could be dependent on the type of sport. In the regular kindergarten, seven children participate in gymnastics and ten in ball sports, while in the physical education kindergarten, eleven children participate in gymnastics and one in ball sports. Each sport has its own requirement profile and correspondingly different training content. For example, soccer requires good endurance, but also good sprinting ability and, of course, handling the ball (20), while gymnastics is more about flexibility, strength and coordinative aspects (21). Thus, it can be surmised that the children who participate in a ball sport are faster in the two tasks with the medicine ball than the children who go to gymnastics, with the latter possibly performing better in the other tasks.

Multiple linear regression analysis of the *MobiScreen 4-6* total score yielded a multiple regression coefficient of $R = .59$ with a variance explanation of $R^2 = .35$. Although this model is slightly worse than that for total time, the values can still be considered strong. The predictors born premature, sex, kindergarten affiliation, and number of sports hours make no difference. That there are no sex differences is consistent with the norming sample (16). However, even for the total score, the other predictors mentioned have not been studied before. As age increases, the total score increases, which is also consistent with the norming sample (16). However, children who are in a sports club also achieve a higher total score, which is in contrast to the norming sample. Again, the circumstances of the Covid 19 pandemic or the inconsistent implementation of the concept of physical education kindergarten could provide an explanation.

If we look at the values for beta in comparison of total time and total score, we see that beta with $-.68$ for age has a significantly greater influence on total time than on total score with a beta of $.39$. The influence of the predictor born premature is also significantly greater for total time with a beta of $.22$ than for total score of $.03$. This could mean that the quantity of mobility develops first, i.e. that certain tasks can be mastered more quickly, before the development of quality plays a role and the tasks are completed with fewer errors.

Limitations are that only a cross-sectional study is available here. A pre-post experimental design could have better examined the effects of the program in the physical education kindergarten. Alternatively, the three-year-olds could have been excluded, since most of them had only been enrolled in kindergarten for a short time and thus the full program could not yet have had any effect. However, the sample was too small for this and at least two kindergartens would have had to be examined in each case. The samples were also randomized only on the basis of kindergarten choice, so the choice of children was not. It is possible that children with a



favorable socialization in terms of sports or a greater urge to exercise are more likely to be in a physical education kindergarten than other children anyway. Another problem may also be the analysis of raw scores, since these are neither age nor gender standardized. Percentile ranks or a motor quotient, for example, are more appropriate for such procedures. This would mean that the *MobiScreen 4-6* is rather unsuitable for such an investigation.

V. PROSPECTS

The present study was designed to examine the extent to which the mobility behavior of children from a physical education kindergarten differs from that of children from a regular kindergarten. For this purpose, the *MobiScreen 4-6* was used. No group differences were found, but age and sports club membership were found to be the strongest predictors. Further studies could follow, firstly a long-term study with a pre-post design for a better examination of the effects, secondly an analysis of the implementation of the concept of the physical education kindergarten and thirdly an attempt to standardize the *MobiScreen 4-6* using percentile ranks.

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