GEORG-AUGUST-UNIVERSITÄT
GÖTTINGEN

11th Joint Conference on Motor Control & Learning, Biomechanics & Training
Darmstadt, 28th - 30th September 2016

Influence of motor coordination-level on motor learning

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Introduction:

Why do children learn new motor tasks not equally well? Already during the 80s Hirtz (1985) described the importance of coordinative performance as an essential requirement for the learning of sport motor skills. Years later Hirtz (1994) expanded his statement and added that a good coordinative performance qualifies “as a decisive influencing variable on the motor learning” (p. 125). Moreover, Willimczik and colleagues (1999) pointed out that “the ability of motor learning is dependent on the level of coordinative performance” (p. 57). Meinel and Schnabel (2015, p. 160) have the same opinion. This means that one can use coordinative tests to learn about the indivual’s ability of motor learning. Children with a high level of motor coordination generally showed also high physical activity (Lopes et al., 2012). Therefore, it can be supposed that due to a lack of movement repertoire, children learn new movements with different quality. Until now this topic has hardly been explored empirically. The aim of the study was to examine whether the motor coordination-level of children has an influence on the learning process of a gross motor task.

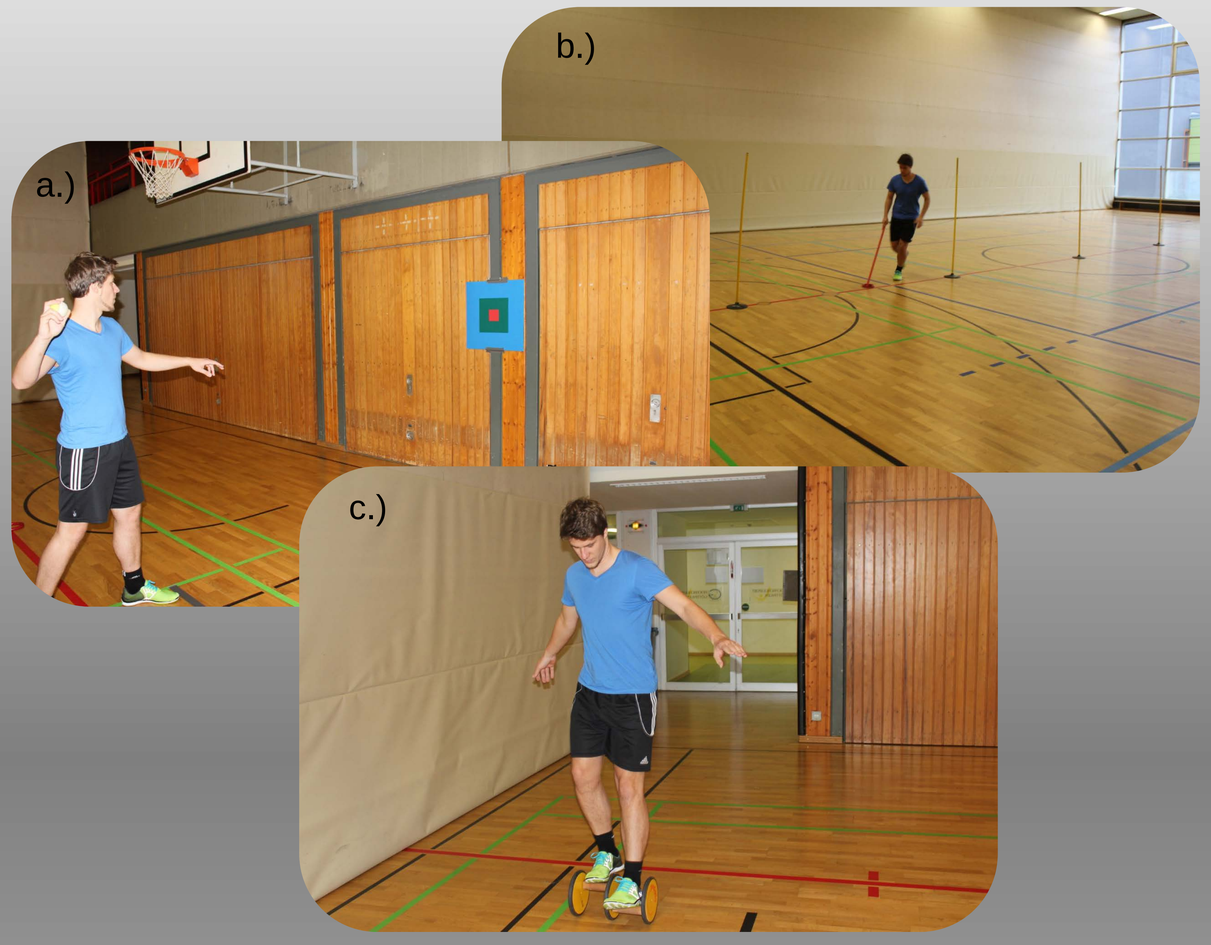

Fig. 1: a.) target throwing , b.) ring lead with gymnastic rod und c.) driving a Pedalo

Methods:

The study consisted of 22 children (7 boys and 15 girls) at the age of ten to twelve (10,45 +/- 0,74 years). The investigation took place on one day during four regular physical education lessons. The children’s individual basic coordination level was determined by four coordination tests (toggle lateral, balance backward, target throwing (see fig. 1a) and ring lead with gymnastic rod (see fig. 1b)). The balance backward and target throwing tests were summarized to precision pressure and the tests to toggle lateral and ring lead with gymnastic rod to time pressure. The average of the Z-value of the precision and the time pressure formed the Z-value of the total coordination. The children were divided for the total coordination-level, precision-level and time-level by the median of their respective Z-value in two equal groups („low-level“ [lL; n=11] and „high-level“ [hL; n=11]). The learning task (following Willimczik et al., 1999) consisted of driving a Pedalo (see fig. 1c) in 30 seconds and try to make a maximum distance (ten total trials). The distance and descents were measured and from that a quotient was determined. The learning criterion was the improvement of the average of the first two trials (first measurement point) in relation to the average of the last two trials (second measurement point) (Willimczik et al., 1999).

Results:

No significant interaction effect (p=.192, η2=.08) was found between the level-groups and both measurement points. Regardless of their coordination-level, all children showed a significant improvement of their learning efficiency (n=22, p<.001, d=1.08). Furthermore, all level-groups (see fig. 2) showed a significant learning efficiency, whereas the hL groups demonstrated greater learning efficiency compared to the lL groups (e.g. hL-total coordination-level: p=.004, d=1.10 and lL-total coordination-level: p=.008, d=1.25). There are no significant group differences (see fig. 3), but small to medium effects size (total coordination-level: p=.192, d=.58; precision-level: p=.377, d=.39 and time-level: p=.558, d=.25). Furthermore no correlation was found between level-groups and their respective learning efficiency.

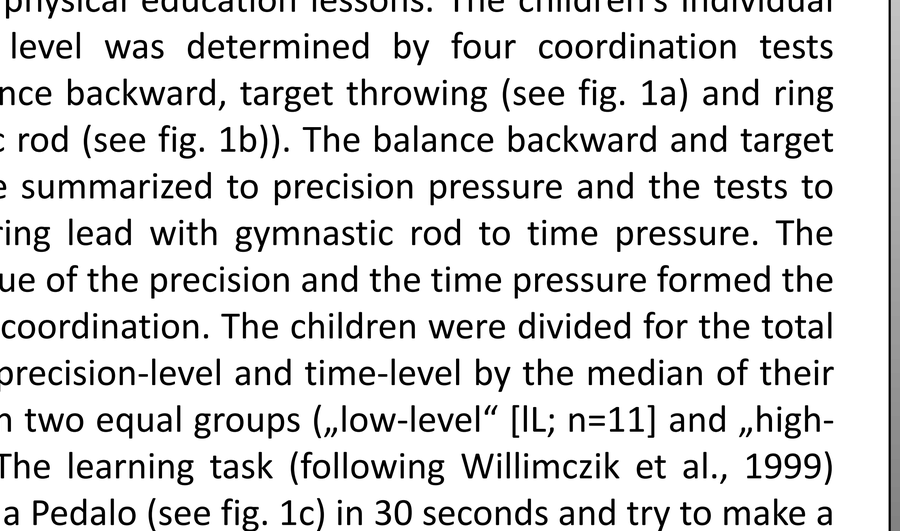

Fig. 2: Learning efficiency of total coordination-level

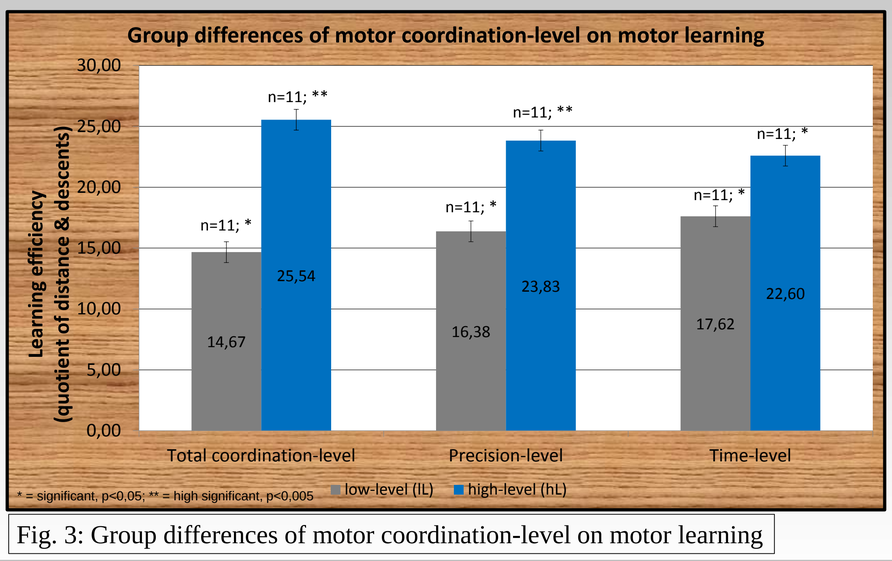

Fig. 3: Group differences of motor coordination-level on motor learning

Discussion:

The hL groups learn to drive a Pedalo better than the lL groups. These differences are clearly shown by the small to medium effect size. However, no favoured level of coordination for the hL and/ or lL group could be shown based on the learned movements. The reason for this is probably the low number of participants and the difficulty of the motor learning task for children at the age of ten to twelve. In a future study a greater number of participants must be included, other age groups and other motor learning tasks must be used.

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