

LINKS BETWEEN BEHAVIOURAL SELF-REGULATION, GROSS MOTOR COORDINATION AND SOCIAL- EMOTIONAL SKILLS IN PRESCHOOLERS

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Abstract: *Recent studies have emphasized the importance of children's ability to control their behaviours, thoughts, and emotions. The present study aimed to investigate the relationship between behavioural self-regulation, motor coordination and social-emotional competencies in Romanian preschool children. We assessed 120 preschoolers using measures of behavioural self-regulation, gross motor coordination, and social-emotional competencies. Results revealed that there are no significant relations between behavioural self-regulation and gross motor coordination, nor between behavioural self-regulation and social-emotional skills. Interestingly, no gender differences emerged in terms of behavioural self-regulation, gross motor coordination, and social competencies. The only gender-related difference was found concerning emotional competencies, with girls outperforming boys. Further studies should investigate longitudinally the relations among these constructs, and also in relations with other factors, such as the preschool setting, the socio-economic status, and children's academic achievement.*

Key words: *behavioural self-regulation, gross motor coordination, social competence, emotional competence, preschoolers*

1. Introduction

Behavioural self-regulation is increasingly recognized as a hallmark of adaptive development with implications for academic achievement and school success (McClelland, 2014; Blair & Razza, 2015; Matthews, Cameron Ponitz, & Morrison, 2009; Wanless et al., 2011; von Suchodoletz et al., 2013; Guimard et al., 2012; Gestsdottir et al., 2014; Hubert et al., 2015). On the one hand, children with high levels of behavioural self-regulation can manage their reactions in everyday contexts by paying attention, following instructions, and by working independently without being distracted by their surroundings (McClelland et al., 2007). On the other hand, poor levels of self-regulation

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have been linked to high rates of expulsion, most dramatically in preschool classrooms (Gilliam & Shahar, 2006). During the preschool years, behavioural self-regulation is found to be one of the most important competencies, since it equips children for an effective learning engagement (Blair, 2002). The conceptualization of behavioural self-regulation relies on components such as executive functions (attention, cognitive flexibility, inhibition, and working memory) (Blair & Ursache, 2011; McClelland & Cameron Ponitz, 2012; Wanless et al., 2011), although the role each plays in regulating behaviour is still debatable. In light of this, the literature seems to indicate that the processes involved in self-regulation show dramatic development in three- to five-year-old children (Jones, Rothbart, & Posner, 2003; Welsh et al., 2010).

1.1. Measuring behavioural self-regulation in children

Most studies have used the *Head-Toes-Knees-and-Shoulder Task* (HTKS) to directly measure behavioural self-regulation. During this task, children are required to act based on a provided command such as “*Touch your head*” or “*Touch your toes*”. Then, the rules are reversed and children have to respond in the opposite manner (e.g., the child has to touch their head when the command is to touch their toes and vice versa). The task captures children’s behavioural regulation by asking young children to use a set of executive skills: (a) to pay attention to the experimenter’s instructions, (b) to use their cognitive flexibility skills to alternate successfully between the old rule and the new rule, (c) to use working memory to keep in mind the new rule, and (d) to inhibit their natural response to a test command while responding in the correct, unnatural way. Using this task, researchers have shown that there are gender differences in terms of behavioural self-regulation. For example, in Norway, Germany, Iceland, and U.S.A. girls outperform boys while in Asian countries no gender differences were reported (Størksen et al., 2015; von Suchodoletz & Grunzenhauser, 2013; Matthews, Cameron Ponitz, & Morrison, 2009). Although these studies have been carried out to investigate gender-related differences in behavioural self-regulation, there is still little scientific understanding of this issue in Romania. Hence, one of the aims of this study was to provide a clearer picture of behavioural self-regulation during early development. This is the first study, to our knowledge, that aimed to employ the HTKS for the first time in Romania.

1.2. Cultural context: Behavioural self-regulation in Romanian preschoolers

Over the last 30 years, the Romanian early educational system underwent several major changes, intending to constantly develop and improve children’s general knowledge and skills. Even though a large number of studies have investigated the impact of different factors – cognitive, social-emotional, and motor – in the transition from kindergarten to primary school, little is known about these factors in the Romanian context. Such international studies have shown that some factors contribute to an effective school adjustment and school success: executive functions, information processing, attention-related skills, social and emotional skills, and fine motor skills (Blair & Raver, 2015; Denham et al., 2012; St Clair-Thompson & Gathercole, 2006; Duncan et

al., 2007; Roebbers et al., 2013). In Romania, all children have free access to early education programs and educational institutions; still, children with low socio-economic status and belonging to the Roma population are at risk of starting school without attending kindergarten and are thus less equipped for school requirements. At a national level, 77% of all children attend kindergarten programs, compared to only 37% of Roma children (World Bank Report, 2012). Therefore, a deeper understanding of individual differences in cognitive, motor and social as well as emotional factors that contribute to later school success and academic achievement may help the educational system to design and develop appropriate early educational programs.

Little is known about behavioural self-regulation in Romanian children and it is not clear what factors contribute to this broad construct. The present paper aims to shine a new light on this topic. Moreover, the study explores individual differences among the variables, since recent findings show gender differences in academic achievement, in preschoolers. Moreover, the gender gap persisted over the years, reflecting significant gender differences in different countries, when knowledge and competencies in mathematics, reading, and sciences were evaluated, OECD (2014), as the PISA results point out.

Specifically, in Romania, there is a complete lack of screening tools and most decisions about children's school readiness are made by parents relying on common sense rather than on a rigorous assessment of their child's abilities. The same lack of systematic assessment can be encountered in the case of referrals for mental health problems. Many children are deprived of early intervention because most of these problems remain undiagnosed, and sometimes, they become of concern only when children are unable to adapt to school requirements and teachers complain about their behavior. In the case of the Romanian education system, there are no evaluation methods that guide later enrolment. Usually, parents make a decision when their children are 6, whether they should spend another year in preschool or go to school. In either case, children are expected to perform well based on their attendance of preschool activities. In both cases, screening instruments should be taken into consideration foremost as a means of detecting early signs of problems and as a basis for proceeding in preventive interventions (Barry & Lochman, 2003).

1.3. Behavioural self-regulation and motor skills

During the preschool years, the development of self-regulation is a result of increased inhibitory control over motor skills (Fox et al., 2001; Kochanska, Coy, & Murray, 2001). New evidence brings up links between self-regulation and motor development, with the body and neural substrates underlying the motor system, being involved in self-regulatory processes (Balcetis & Cole, 2009; Becker et al., 2014; MacDonald et al., 2016).

Concerning gender-related differences, a review from Tucker (2008) suggests that male preschoolers are more motor active than female preschoolers (Montgomery et al., 2004; Pate et al., 2004), while Haapala (2013) found that the overall motor performance was significantly related to reading fluency among boys and girls, in the first, second and third grade, later, in primary school. Interestingly, the association between overall

motor performance and reading fluency was much bigger for boys than for the entire sample, over the three grades. A similar pattern can be found for reading comprehension and arithmetic skills. In contrast to boys, among girls there are only two significant relations between overall motor performance and academic achievement: in the second grade, between overall motor performance and arithmetic, and in the third grade, between overall motor performance and reading fluency.

Taken together, these studies show that motor skills are important in the transition from kindergarten to school, and later on for academic achievement. However, the evidence for the relationship between motor coordination and other processes during preschool years is inconclusive, and there is a lack of evidence for the Romanian population.

1.4. Behavioural self-regulation and social and emotional competencies

Social-emotional competencies are found to be important milestones in children's development across the preschool years. Together with cognitive development, the development of social and emotional competencies during the preschool years is paramount for later success. At the kindergarten entry, a child needs strong social skills to successfully manage the ever-changing demands coming from the kindergarten teacher, the group of peers, or everyday life events. Not only social, but emotional skills are relevant for further competencies, abilities, and learning outcomes of children. Emotional competencies are essential for the development of social competencies and strongly related to them, by the fact that the ability to manage emotions is central for social interaction (Halberstadt, Denham, & Dunsmore, 2001).

While children's ability to follow instructions, take turns during group activities, and stay focused on tasks have been identified as predictors for school success (McClelland, Morrison, & Holmes, 2000), social-emotional development fosters both learning engagement and positive social behaviour in the classroom (Ladd, Birch & Buhs, 1999). In addition, preschoolers who can better regulate their social and emotional experiences are more confident in their social and emotional outcomes (Cole, Teti, & Zahn-Waxler, 2003).

In the present study, we refer to social competencies, defined as compliance to rules – the ability of a child to understand and follow rules and instructions (Kotler, & McMahon, 2002), interpersonal skills – the ability of a child to initiate and preserve positive relations with peers and adults (Ştefan et al., 2009), prosocial behaviours – the ability of a child to help others and to ask for help, to share objects and toys (Warnes et al., 2005). We address the emotional competencies as consisting of several abilities: emotion understanding – the capacity of a child to identify and interpret emotions, based on their label (Denham, 2006), emotion expression – the ability of a child to transmit emotional messages in a socially accepted manner (Ştefan et al., 2009), and emotion regulation – the ability of a child to monitor, evaluate and modify emotional reaction, to display socially desirable behaviours (Ştefan & Kallay, 2010).

1.5. Present study

The evidence presented above suggests that social-emotional competencies are key indicators of later achievement success. However, little is known about the relationship between these competencies and behavioural self-regulation, with the present study aiming to offer new insight regarding this relation. Also, the current study aims to contribute to the further clarification of the concept of behavioural self-regulation by examining the relations between behavioural self-regulation, social and emotional skills, and gross motor coordination in preschool children from Romania. We expect a significant positive relation between behavioural self-regulation and social and emotional competencies (Blair, 2002, Calkins & Howse, 2004; McClelland et al., 2007), as well as a positive significant relationship between gross motor coordination and behavioural self-regulation (Fox et al., 2001; Kochanska, Coy, & Murray, 2001).

In addition, the study will focus on gender-related differences over the main study variables. Based upon the studies reviewed in the introduction, we expect girls to outperform boys in the behaviour self-regulation task and in terms of social and emotional skills, while we expect boys to outperform girls in the gross motor coordination task.

2. Method

2.1. Participants

Participants were 120 Caucasian children from three public kindergartens in Central Romania. Children's mean age was 67.9 months ($SD = 4.739$), with a comparable number of girls ($N = 61$) and boys ($N = 59$). All children had Romanian as their first language and had homogenous socioeconomic backgrounds.

2.2. Measures

To assess children's behavioural self-regulation we used *The Head-Toes-Knees-and-Shoulder-Task*, a well-established and age-appropriate instrument used in several countries (Cameron Ponitz et al., 2009; McClelland et al., 2014). The task consists of three parts and each part includes ten items. The child has to do the opposite of what the examiner says, for example, if the examiner says in the first part: *Touch your head*, the child has to touch its toes and vice versa. In the second part, knees and shoulders are added. In the third part, the rules are changed. Hence, when the examiner says: *Touch your head*, the child has to touch its knees, and vice versa, and, when the examiner says *Touch your shoulders*, the child has to touch his/her toes. Each part starts with instructions given by the experimenter and four practice trials. When a child does not understand the task, up to two more explanations are given. The task is interrupted when the child fails to complete the task after the additional instructions are provided or when at a certain part the child scores less than 4 points. The examiner rates the items with 2 points when the answer of the child is correct, with 1 point if the child self-

corrects the answer, and 0, if the child's answer is wrong. For each part, a child can receive a maximum of 20 points, and for the entire task, 60 points. All three parts showed good internal consistency, with α Cronbach's between .84 and .91. Also, this task has proven to be a reliable and valid measure of behavioral self-regulation in a wide range of children (e.g., McClelland et al., 2014; von Suchodoletz et al., 2013; Wanless et al., 2011).

Gross motor coordination skills were assessed through the use of the *Körper Koordinationstest für Kinder* (KTK, Kiphard & Schilling, 1974), an instrument used for measuring general corporal coordination in children aged between 5 and 14 years. The general corporal coordination consists of four dimensions: backward balance, forward jumping, and lateral jumping, lateral place. Backward balance and forward jumping are subtests based on accuracy. The lateral jumping and lateral place are based on speed and register a score in a given time frame. In the *backward balance* task, the child has to go on three balance beams (with a length of 300 cm and a width of 6, 4.5, and 3 cm, respectively), backward. The practice trials consist in asking children to step on each beam forward, and backward. In three trials for each beam, the number of correct steps is added as a raw score. In the *forward jumping* task, each child has to jump first on the right leg, and after that, on the left leg, over foam boards (60 x 20 x 5 cm). The children have two practice trials on each leg. Five and six-year-old children had practice trials to jump five times on each leg. Then a foam board is placed 1.5 m away from the child and the child has to jump over the board and then two times more on the same leg. After each successful jump, another board is placed over the existing board(s). For each jump, the child gets 3 points (respectively for the right and the left leg). The points from each leg are summed up in a total raw score. In the *lateral jumping* task, the child has to jump laterally as quickly as it can, over a wood strip, placed on a carpet, within 15 seconds. The practice trials consist of five lateral jumps. The task includes two trials, the total jumps are computed in a total raw score. The lateral place task implies the lateral placement of two wood boards (25 x 25 x 2 cm), within 20 seconds. First, the child has to decide if she/he wants to move the boards to the left or the right side. Consequently, the child steps on one board, having the other placed laterally so that she/he can grab it and move it on the opposite side, left or right, depending on the chosen direction. The child steps on the moved board and repeats the action (lateral place). After five practice trials, the child is given two attempts (each within 20 seconds), and the number of lateral placements is summed. Finally, a total raw score of corporal coordination is computed by summing up the raw scores of each subtest.

The social and emotional skills were assessed using the *Preschool Screening for Social and Emotional Competencies - teachers form* (Ştefan et al., 2009). The teachers had to rate on a 5-point Likert scale (1 = almost never and 5 = almost always) the frequency of different child behaviours. All items are scored directly. The *social competencies scale* has 21 items included in three subscales: Compliance to Rules (e.g., "The child answers adequately to your demands", "The child interrupts an activity when asked"), Interpersonal Skills (e.g., "The child plays in bigger groups, with more than 3 children", "The child cooperate with other when playing"), and Prosocial Behaviour (e.g., "The child takes care of other children's toys", "The child listens to what other colleagues are

saying"). The scale for the assessment of *emotional competencies* has 18 items, grouped into three subscales: Emotion understanding (e.g., "The child is capable of naming complex emotions: surprise, disgust, shame", "The child said about him/her that he/she is happy, angry, sad, or afraid"), Emotion Expression: (e.g., "The child verbally encourages his/her colleagues", "The child adapts his/her facial expression, up to the emotional content of the message"), and Emotion Regulation (e.g., "The child stays calm, when he/she doesn't manage or is not getting along", "The child persists on a task even if it is challenging").

2.3. Procedure

Children were recruited from three public kindergartens via school administration and kindergarten teachers. Hence, parents received a written description of the study and were asked for their written consent so that their children could take part in this research. Data were collected from two sources: children and their teachers. Children were individually tested by two trained research assistants, during two testing sessions, in a quiet room located within their kindergarten. Each session lasted approximately 15 minutes. During the first session, the HTKS task was delivered. Following this, in the second session, children also completed the KTK motor coordination task. Lastly, teachers' ratings regarding children's social and emotional skills were collected.

2.4. Preliminary data analyses

The preliminary data analyses were carried out using standard SPSS 20 procedures. Data was analyzed by controlling for outliers and only children who completed all measures were included in the final sample. Hence, data from 108 children were further considered. Pearson correlations were computed to investigate associations of behaviour self-regulation with gross motor coordination, and social and emotional competencies. To test the presence of gender-related differences across variables, Multivariate analyses of covariance (MANCOVA) were computed, while controlling for age. Age was thus treated as a continuous variable since the age range in the group was between 60 and 78 months.

3. Results

The present study investigated the relations between behavioural self-regulation and gross motor coordination on one hand and between behavioural self-regulation and social and emotional competencies on the other hand. We also explored the presence of any gender differences in terms of behavioural self-regulation, gross motor coordination, and social-emotional competencies. Descriptive data were generated for all study variables, as it can be seen in Table 1.

Descriptives statistics

Table 1

	<i>M</i>	<i>SD</i>	Min	Max
Motor Coordination	92.15	26.42	28	152
HTKS Total	46.89	8.52	24	60
Social Competence Scale	88.13	14.74	50	111
Emotion Competence Scale	65.31	9.70	38	85

Note: HTKS = Head- Toes-Knees-and-Shoulder Task

The motor tasks showed sufficient variability, similar the HTKS task and social-emotional competencies inventory.

Table 2 shows intercorrelations among study variables. Contrary to our hypothesis, behavioural self-regulation showed no relation neither with social and emotional competencies, nor with gross motor coordination. The single positive significant correlation was revealed between social and emotional competencies (see Table.2).

Table 2

Correlations between behavioural self-regulation, motor coordination and social and emotional competencies

		1	2	3	4
1	Behavioral self-regulation	1	.01	.07	.06
2	Motor coordination		1	.14	.11
3	Social competencies			1	.72**
4	Emotional competencies				1

Note: * Correlation is significant at the .05 level (2-tailed).

3.1. Gender differences in behavioural self-regulation, gross motor coordination and social-emotional competencies

To address the next hypothesis, as to what extent gender influences performance in behavioural self-regulation, the motor task, and teachers' ratings regarding children's social and emotional skills, we conducted a MANCOVA. Again, we wanted to control for age and it has been thus treated as a continuous variable. The predicted main effect of gender on behavioural self-regulation, gross motor coordination and social competencies was not significant, with $F(1,105) = .03$, $p = .87$, $\eta^2 = .00$, respectively, $F(1,105) = .14$, $p = .71$, $\eta^2 = .00$, and $F(1,105) = 3.06$, $p = .08$, $\eta^2 = .03$. The only significant effect of gender, after controlling for age, was on emotional competencies, with girls outperforming boys, $F(1, 105) = 5.20$, $p = .02$, $\eta^2 = .05$. Figure 1 shows the significant differences between girls and boys in all measures, with girls outperforming boys only in emotional skills. For the comparison, we used standardized values +1 of the variables' means.

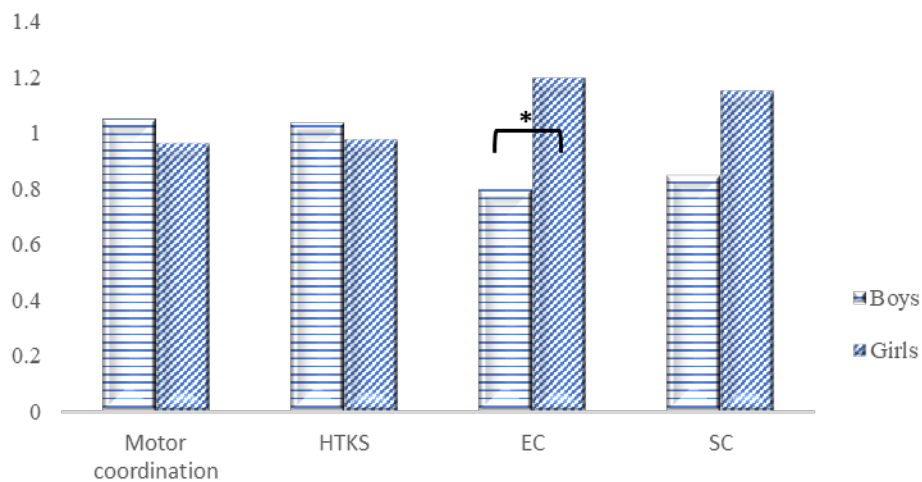


Fig. 1. *Gender differences in the tasks measuring motor coordination, (b) behavioral self-regulation (HTKS), and emotional (EC) and social (SC) competencies*

4. Discussion

The main goal of this study was to investigate the relationship between behavioural self-regulation (measured with the HTKS) and gross motor coordination ability (measured via a gross motor task) on the one hand and the other hand the relationship between behavioural self-regulation and social and emotional competencies (rated by teachers). Interestingly, we found no relation between behavioural self-regulation (HTKS) and general motor ability. The reason for this is not clear but it may have something to do with the fact that the HTKS is not assessing motor abilities, although the task requires ‘a motor response to a verbal command’ (Hubert, Guimard, Florin, & Tracy, 2015). Contrary to our expectations, we found no relation between behavioural self-regulation and social and emotional competencies. A possible explanation for these findings may be the fact that the HTKS is a behavioural task completed by children hence a direct measurement, while social and emotional competencies are rated by teachers and are thus considered indirect measurements. The results contrast with findings from other studies showing that both behavioural self-regulation and social and emotional competencies are interrelated (McClelland et al., 2007). It is possible, therefore, that behavioural self-regulation measured with the HTKS and social and emotional competence rated by teachers, tap into a different process, yet to be explored.

The only confirmed hypothesis of our study reflects the fact that girls show better emotional regulation, emotional understanding and emotional expression as compared to boys during this developmental window. The result should be analyzed in further studies, with different measurements for emotional competencies, and not only teacher rating scales.

Concerning gender differences in behavioural self-regulation, the results are consistent with those of other studies (Son, Lee, & Miyoung, 2013; Wanless et al., 2013), revealed in Asia, suggesting that there are no significant differences in preschool-age boys and girls regarding the performance in HTKS. Similar results were found in France (Hubert et al., 2015). In contrast, results from the U.S.A., Iceland, and Norway, show significant differences in favor of girls, in the HTKS task, in preschool or kindergarten (Hubert, 2014; Størksen et al., 2015; von Suchodoletz et al., 2013; Cameron Ponitz et al., 2008; Matthews, Cameron Ponitz, & Morrison, 2009; Wanless et al., 2013).

As the gender differences in gross motor coordination were regarded, no significant differences between boys and girls were found, albeit boys showed better performances than girls in the motor tasks. A possible explanation for that might be the educational setting in Romanian kindergartens, the structuring of the instructional design at this age. Regarding the social competencies, no significant gender differences were found. Girls obtained higher scores than boys, but the difference might be due to possible gender exaggerations in teachers' reports (Duckworth & Seligman, 2006). Another possible explanation might be that social competencies are developed in preschool years through play and boys play more solitary than girls at 6 years (Barbu, Cabanes, & Le Maner-Idrissi 2011), having fewer opportunities for social interactions.

Altogether, these findings suggest a differentiation between behavioural self-regulation and gross motor coordination ability, this topic still needs further investigation, to find indicators and factors that may contribute to this difference. Another important finding of the present study is the fact that, for our sample, no gender differences were found for behavioural self-regulation, supporting other findings in the field, and also being controversial to other studies investigating this issue. More cultural and educational factors have to be explored in further studies, in a longitudinal design, to capture the importance of individual differences in the case of behavioral self-regulation. This work provides new insights into behavioural self-regulation and explores relations between this concept and other constructs that were less examined by previous research.

Finally, several important limitations need to be considered. First, the study provides only cross-sectional evidence on behavioural self-regulation, socio-emotional competencies, and gross motor coordination and no causalities between them could be explored. Second, no background variables were recorded, to control for, when investigating the relationship between these variables. Third, the present study did not take into account children's cognitive prerequisites, to explore the existing literature about the relation between behavioural self-regulation and academic achievement, and social and emotional competencies and academic achievement during the preschool years. Furthermore, social and emotional competencies were assessed by teacher's reports only. Future research should include direct measurements of social and emotional competencies or also include parental reports.

The present findings can be considered as an important starting point for further research that sets out to explore the relations between the main variables considered, for preschool academic achievement, but also for later school success and school readiness. For the Romanian early educational system such research can support

prevention and intervention programs for each child to develop an optimum level of prerequisites required for a successful academic track.

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