Three Year Old Children’s Executive Functions and Social Behaviours: Differences in Teachers’ and Parents’ Ratings of Child Behaviours

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Abstract：This study addresses the link between children's executive function and their social behaviours as rated by their parents and their teachers at the age of three. Executive functions were examined using direct testing of the children on three tasks: Digit span, Stroop and Dimensional Change Card Sorting. For social behaviours, both the parents and the teachers rated the child using the Strength and Difficulties Questionnaire. The parental rating was significantly higher than the teachers' rating. The teachers' ratings were significantly related with the direct testing of executive function tasks. The Implications for the difference in the relationship between the executive functions and social behaviours in real life setting are discussed.

Keywords：Executive functions, SDQ, Parental report, Teacher report, Language

Introduction

The development of executive functions has been recognised as an important predictor for the individuals' success and well-being from a life-span perspective（Moffitt et al., 2011）. This view has become increasingly prevalent in early years education and related areas, and There is consensus that investments into early development of self-control will benefit not only the individuals but also the nation's economic success（Heckman, Stixrud, & Urzua, 2006）. Despite such strong evidence, what exactly is meant by self-control and how it is measured has raised other issues. For example, when the term 'self-control' is used in research, the fine-grained definition might differ. A large scale longitudinal study, called the Dunedin Study was analysed by Moffitt et al.（2011）. The self-control scores obtained from 3 to 11 year olds used ratings by parents, teachers and trained observers. On the other hand, a well-recognised experimental task, called the "marshmallow test" has been used to assess self-control by measuring how long a child was able to delay his/her gratifications（Mischel, Shoda, & Rodriguez, 1989）. This issue needs to be addressed when we observe and measure an individual child's behaviours in detail in real social settings.

In psychological research, self-control, also an executive function has both emotional and cognitive aspects. The use of a delayed gratification task, like the marshmallow test, measures the emotional aspect of self-control. In light of the marshmallow test, recent debates have raised the issue of the conceptualisation of self-control（Barragan-Jason, Atance, Hopfensitz, Stieglitz, & Cauchoix, 2019; Watts, Duncan, & Quan, 2018）. Thus, even the measure of self-control raises multifaceted issues. One of the remaining issues in self-control research is how the rating of a child's behaviours is related to direct experimental tasks. Within the direct experimental tasks for cognitive functions, there is multifaceted testing based on the conceptualisation of executive functions, such as working memory, inhibitory control and shifting of attention（Miyake et al., 2000）. Understanding how these tasks are related to the observation data obtained in different social contexts contributes to a further consideration of the ways in which social support can best be provided.

For this reason, the present study is concerned with the cognitive aspect of executive functions and compares the assessments of different informants, namely parents and teachers. In the area of language development, parents are described as the best informant to assess the child's production and comprehension of vocabulary. Parental reports such as the internationally used MacArthur-Bates Communicative Development Inventories (MB-CDIs), is recognised as one of the reliable measures (Heilmann, Ellis Weismer, Evans, & Hollar, 2005; Styles & Plunkett, 2009).

In a previous study, parental reports and teacher reports were compared to assess a child's language ability, The parents' reports were found to more closely relate to the direct tests of the children's language abilities (Tsuji, 2018). It is likely that as the parents interact with their child in depth in wider social contexts, they would have a better understanding of their child's language abilities. Given the reliability of parental reports on language, it is possible that parents also know their child's social behaviours better than the teachers. To understand whether different informants observe the child's social behaviours differently, the present study compares the parents' and teachers' ratings of a child's social behaviours, and investigates which rating is more closely aligned with direct tests of a child's self-control.

Method

Participants

119 three-year old children (63 girls, M = 44.4 months, SD=3.8) participated in this study. They were also participating in a longitudinal project for measuring the development of self-control. Informed consent was obtained from their parents. Two children were not cooperative with the executive function tasks and one child could not complete the executive function tasks, thus these data sets were not included in the analyses of executive functions.

Materials and procedures

Rating of child behaviours

Parents and classroom teachers were asked to rate independently the child's behaviours using the Strengths and Difficulties Questionnaire: SDQ (Goodman, 1997). This questionnaire comprises of five subsets: Emotional problems scale; Conduct problems scale; Hyperactivity scale; Peer problems scale; and Prosocial scale. The ratings use a 3 Likert scale of not true, somewhat true, and certainly true. The scoring was made following the manual (https://www.sdqinfo.org/a0.html).

Executive function tasks

Three tasks were used for measuring the children's executive functions. The Digit span task was used for measuring working memory; the Stroop task was used for measuring inhibitory control; and the Dimension Change Card Sorting (DCCS) task was used for measuring the shifting of attention. The order of administering the tasks was counterbalanced.

Digit span task

A series of number digits were orally presented to the child. The child was then asked to repeat the numbers back to the experimenter. Forward digit span stimuli in the K-ABC was used and all the scoring was made following the manual (Kaufman & Kaufman, 2004).

Stoop task

This task was devised based on Berger, Jones, Rothbart, and Posner (2000) and presented on a computer with a touch screen. The tasks involved two phases in which a pre-switch was followed by a post-switch trial. The child was asked to point at (touch the screen) the image that matches the sound of either a dog or a cat. In the post-switch trials, they were asked to point at the image that did not match the animal sound presented. This task was included because it has been used and shown to have a good reliability for Japanese children (for a detail of this task, see Tsuji & Mitchell, 2019). The number of correct responses made during the second phase trials were counted and yielded scores from 0 to 8.

Dimension Change Card Sorting task.

This task was devised based on Zelazo (2006), and

presented on a computer with a touch screen. Two dimensions: colour and shape were used in this task. The child was asked to select one of the colour categories (e.g. blue or red colour) by touching the matching category location. After the colour matching task, the child was asked to sort the target by shape categories (e.g. bag or hat), regardless of the colour (blue or red) of the shape. The number of correct responses made on the second task was used, yielding scores from 0 to 6.

Results

Ratings obtained from the parents and the teachers were computed to derive the mean scores for the sub-scales. The descriptive statistics are presented in Table 1. Parents' and teachers' rating scores were compared and it was found that the children's behaviours were rated significantly higher by the parents than by the teachers except for the emotional problem subscale: t (118) = 1.13, p = 0.26 for the emotional problem; t (118) = 7.28, p< 0.001 for the conduct problem; t (118) = 3.08, p = 0.003 for the hyperactivity; t (118) = 3.15, p = 0.002 for the peer problem; and t (118) = 2.37, p= 0.019 for the prosocial.

Children's executive function performance was analysed based on the three tasks, using a principal component analysis to reduce the dimensions. Three scores were loaded on to a single factor explaining for 48.67% of variances. The factor scores derived from this extraction method were used in the subsequent analyses. The descriptive statistics for these scores are presented in Table 2.

To examine the relationship between the children's executive functions and the ratings of child behaviours using the SDQ by their parents and teachers, the correlations were examined controlling for the child's age. The partial correlation coefficients are summarised in Table 3.

The parents' ratings using the SDQ correlated with the digit span scores. The direction of relationship is that those children who were rated to show more emotional problems tended to score higher on the executive function tasks, particularly the digit span

Table 1. The descriptive statistics for the parents' and teachers' ratings using the Strengths and Difficulties Questionnaire.

	Parents		Teachers	
	M	SD	M	SD
Emotional problem	0.41	0.39	0.35	0.46
Conduct problem	0.57	0.35	0.27	0.41
Hyperactivity	0.57	0.43	0.27	0.54
Peer problem	0.44	0.30	0.32	0.39
Prosocial	1.19	0.46	1.05	0.59

Table 2. Descriptive statistics for the executive function tasks.

	N	Min.	Max.	M	SD
Digit span	117	0	12	6.03	2.42
Stroop	117	0	8	3.10	3.11
DCCS	116	0	6	2.14	2.33
EF scores (standardised)	116	-2.24	2.60	0.00	1.00

Note: One child missed the DCCS task

Table 3. Partial correlation coefficients between the children's executive functions and the rating of behaviours using the SDQ by parents and teachers.

	Parents				Teachers			
SDQ	EF scores	Digit span	Stroop	DCCS	EF scores	Digit span	Stroop	DCCS
Emotional problem	0.204 *	0.231 *	0.128	0.023	-0.025	0.020	-0.159	0.108
Conduct problem	-0.043	0.062	-0.054	-0.133	0.023	0.001	-0.033	0.097
Hyperactivity	-0.123	-0.085	-0.156	0.004	-0.188 *	-0.163	-0.311 **	0.150
Peer problem	-0.120	-0.178	-0.004	-0.042	-0.243 **	-0.141	-0.320 **	-0.012
Prosocial	0.167	0.132	0.116	0.087	0.310 **	0.203	0.314 **	0.098

Note: *$p < 0.05$; **$p < .0$

task, whereas no such relationship was found for the teachers' ratings. In contrast, the ratings for hyperactivity and peer problems made by the teachers but not made by the parents were related to the children's executive functions. The directions of the relationships indicate that those children who showed more hyperactivity and/or more peer problems tended to have lower scores on executive function tasks, particularly with the Stroop task.

Discussion

The present study examined how the social behaviours rated by the parents and the teachers were associated with the children's self-control by measuring the executive functions using the experimental tasks. The parents and the teachers play different roles in providing support for the children, thus it was expected that there would be differences in their ratings on the SDQ. As expected, the parents' ratings were higher than the teachers' on the whole, except for the emotional problems. These findings indicate that the classroom teachers might not have been able to observe an individual child as well as the parents. The trend of the higher ratings by the parents than by the teachers was also found in language development for 3-year-olds (Tsuji, 2018), suggesting that lengths of contact hours and varieties of social contexts give the parents more insight into their own child. However, when it came to the link with the child executive functions, a different picture has emerged. The parents' ratings on all the subscales, with the exception of emotional problems, showed no significant relationship with child executive functions. This finding is very intriguing in that in the previous study of the parents' ratings of language (Tsuji, 2018) was more closely related than the teachers' with the child's language as tested by the Picture Vocabulary Test (Ueno, Nakoshi, & Onuki, 2008).

This trend has not been the case in the area of the relationship between of executive functions and social behaviours. The reason for finding significant links between executive functions and teachers' ratings but not for the parents' ratings may be related to the areas of social behaviours addressed in the SDQ. The teachers' ratings that related to the children's executive functions were social behaviours for hyperactivity, peer problem and prosocial areas. The negative or positive aspects of these social behaviours are likely to be more prevalent in wider social group settings, such as preschool rather than at home. In this respect, the teachers are in a better position to observe individual differences in a social group. On the other hand, the parents are less likely to view their own child mixing with other children in the same-age group. The lack of such situations may create difficulties in judging the child social behaviours.

This finding also indicates that self-control is closely related to social behaviours in a social setting. Although the present study is limited to the concurrent relationship, it may be possible to assume that for long term development, the early development of executive functions may influence the subsequent social development during formal schooling. Given the existing evidence of the impact of self-control on life-course well-being (Mischel et al., 2010; Moffitt et al., 2011), the teachers' ratings are likely to be one of the better predictors for such development. To understand children, parents are seen to be the best informant in general. However, in wider social settings such as formal schooling, teacher observations and ratings of a child in relation to group norms may provide very important information about each child.

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３歳児の実行機能と社会性の主観的評価の関連性
―親と教師の視点の違い―

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要　旨

本研究は、集団保育を受け始めた3歳児を対象に、実行機能の発達と社会行動との関係について検討した。実験課題による測定には、3課題：ワーキングメモリを測定する数唱、抑制を測定するストループ課題、注意のシフトを測定する次元変化カード分類課題：DCCSを用いた。社会行動の測定には、保護者と学級担任による主観的評定として、子どもの強さと困難さアンケート（Strengths and Difficulties Questionnaires）への回答をもとにデータを収集した。社会的行動の主観的評定は、親の評定が学級担任より有意に高かった。実行機能の発達と社会行動との関係については、実行機能課題から得られた直接的なスコアは、学級担任の評定と有意な相関が見られた。一方で、親の評定とは有意な相関はみられなかった。これらより、実行機能と観察された社会行動の評定との関係について、誰が評定するかによって、関係性が異なることが示唆された。

キーワード：実行機能、SDQ、親の評定、教師評定、言語