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ICELAND

Early Behavioral Self-Regulation, Academic Achievement, and Gender: Longitudinal Findings

from France, Germany, and Iceland

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Abstract

A growing body of research suggests that behavioral self-regulation skills are critical for early school success. However, few studies have explored the links between self-regulation and academic achievement among young children in Europe. This study examined the contribution of behavioral self-regulation to academic achievement gains among young children in France, Germany, and Iceland. Gender differences in behavioral self-regulation skills were also explored. A total of 260 children were followed longitudinally over one to two years (average age at Wave 1 was 74.5 months). Behavioral self-regulation was assessed using a structured direct observation (Head-Toes-Knees-Shoulders task) and teachers assessed how well children could apply behavioral self-regulation in the classroom. Multilevel analyses revealed that higher levels of directly assessed and teacher ratings of behavioral self-regulation predicted higher academic skills after controlling for gender, age, maternal education, and previous achievement, but the relations depended on the cultural context. Also, teacher ratings of behavioral self-regulation were more consistently related to achievement gains than directly assessed behavioral self-regulation. Girls outperformed boys only in the Icelandic sample, which may explain the noticeably large gender differences in later academic achievement in this country. We discuss universal and culture-specific findings as well as implications for educational practices.

Keywords: behavioral self-regulation; academic achievement; Head-Toes-Knees-Shoulders task (HTKS); school readiness; Europe

Early Behavioral Self-Regulation, Academic Achievement, and Gender: Longitudinal Findings from France, Germany, and Iceland

A growing body of research, most of which has been conducted with U.S. samples, suggests that early behavioral self-regulation skills are critical for a successful transition to formal schooling and academic success (see e.g., Blair & Razza, 2007; Bull & Scerif, 2001; McClelland, Cameron Ponitz, Messersmith, & Tominey, 2010; Rimm-Kaufman & Wanless, 2012; Sektnan, McClelland, Acock, & Morrison, 2010; Wanless, McClelland et al., 2011). Recently, researchers from Asia, Australia, and Europe have reported similar results, although the findings have mostly been based on concurrent data (see e.g., Guimard, Hubert, Crusson-Pondeville, & Nocus, 2012; Suchodoletz et al., 2013; Wanless, McClelland et al., 2011; Wanless et al., 2013).

In Europe, there have been increasing concerns that many children are not prepared to adjust successfully to the school context when they start formal schooling (see e.g., Britain Department for Children, Family, and Schools, 2007; Leseman, 2009). Similarly, the poor performance of many students, especially boys, on the Programme for International Student Assessment (PISA) has resulted in a call for increased emphasis on the promotion of self-regulation skills in early childhood in Europe (see, e.g., Hansel, 2005; Kultusportal Baden-Württemberg, 2011; Leseman, 2009). Evidence that boys may be at greater risk for academic achievement difficulties has led to the investigation of gender differences in behavioral self-regulation as a potential explanation. However, results have been inconsistent, varying depending on the child's age, the type of measure used, and the context in which self-regulation was measured.

The major goal of this paper is to contribute to an understanding about the role and nature of behavioral self-regulation among young European children. The present investigation focuses

on the longitudinal role of behavioral self-regulation in academic achievement gains among children in France, Germany, and Iceland by using two types of measures of self-regulation. In addition, we explored possible gender differences in self-regulation skills in the three countries.

Behavioral Self-Regulation, School Adjustment, and Early Academic Achievement

Around the world, as young children become better at controlling and integrating their own emotions, thinking, and behaviors, partly as a result of growth in the prefrontal cortex, they are faced with a more structured school environment (Bossaert, Doumen, Buyse, & Verschueren, 2011; Center on the Developing Child at Harvard University, 2011; Garon, Bryson, & Smith, 2008). At this time, usually when children are five or six years old, they enter kindergarten or first grade, where they are increasingly expected to control their attention (such as listening to a story without being distracted by peers or directing attention to teachers' instructions and away from irrelevant information), regulate their working memory (such as following multi-step instructions), and inhibit responses in favor of more adaptive behaviors (such as raising a hand before answering the teacher's question or waiting for their turn instead of taking a toy from a peer), all of which are components of behavioral self-regulation (Blair & Ursache, 2011; McClelland & Cameron Ponitz, 2012; Wanless, McClelland et al., 2011). Accordingly, behavioral self-regulation increases school engagement and helps children to develop adaptive learning strategies that allow them to fully utilize the learning environment, which in turn shapes their future educational trajectories (Blair & Razza, 2007; Center on the Developing Child at Harvard University, 2011; Garon et al., 2008; Matthews, Cameron Ponitz, & Morrison, 2009; Vaszonyi & Huang, 2010). Studies from various countries have confirmed the link between self-regulation and academic outcomes among young samples, including measures of language and math, the outcome measures in the current investigation. Although not evident from all studies, some have reported especially strong links to math (Blair, Gamson, Thorne, & Baker, 2005;

Brock, Rimm-Kaufman, Nathanson, & Grimm, 2009; Espy, McDiarmid, Cwik, Stalets, Hamby, & Senn, 2004).

In a typical school environment, a child is faced with self-regulatory tasks with varying levels of structure, which call for different types of measurements of self-regulatory behaviors (Toplak, West, & Stanovich, 2013). Direct observational measures provide a non-biased assessment of children's skills in regulating their behavior in highly structured one-on-one situations, whereas teacher ratings capture children's ability to independently apply their self-regulatory abilities across context and time (Toplak et al., 2013; Wanless et al., 2013). In studies with young typically developing children, moderate correlations are consistently observed between direct observational measures and assessments conducted by others (see, e.g., Matthews et al., 2009; Suchodoletz et al., 2013; Wanless et al., 2013). In the present study, we used two types of widely used measures of early behavioral self-regulation: a structured observational measure that directly assesses self-regulatory behaviors (the Head-Toes-Knees-Shoulder task; HTKS) and teachers' reports of behavioral self-regulation in the classroom (the Child Behavior Ratings Scale, CBRS, in Germany and Iceland, and the Questionnaire pour l'École Maternelle, Q-EM, in France).

Behavioral Self-Regulation and Culture

Studies from multiple cultures have demonstrated that good behavioral self-regulatory skills are linked to children's successful school adjustment (Blair & Razza, 2007; Cameron Ponitz, McClelland, Matthews, & Morrison, 2009; McClelland et al., 2007; Wanless et al., 2013). However, self-regulatory behaviors are informed and shaped by the cultural context in which they are embedded. For instance, self-regulatory behaviors reflect people's abilities to conform to the customs and values of what constitutes acceptable or non-acceptable behaviors and models of behavioral self-regulation are transmitted through culturally informed socialization processes,

such as parenting practices and educational traditions (Bindman, Hindman, Bowles, & Morrison, 2013; Friedlmeier, Corapci, & Cole, 2011; Lemétayer, 2005; Rimm-Kaufman & Wanless, 2012; Trommsdorff, 2009). Thus, it is necessary to cultivate an understanding about both universal and culture-specific functioning of self-regulation, but researchers have largely neglected the role of culture in the development and functioning of self-regulation (Trommsdorff, 2009).

Suchodoletz et al. (2013) argued that cross-cultural studies have historically treated culture as an independent variable that interacts with psychological processes, but there is an increased emphasis on examining behavioral self-regulation *within* each cultural context to fully understand its meaning (Raver, 2004; Shweder et al., 1998; Wanless et al., 2013). The advantage of this approach is that it may limit ethnocentrism and highlight unique patterns between covariates and outcomes across cultures, which can inform culture-specific interventions and policies (Cole & Packer, 2011; Keith, 2011; Raver, 2004; Wanless, Larsen, & Son, 2011).

In this study, we refer to the participants' shared national identity as their culture, although we acknowledge that culture and country are not synonymous (Goodnow, 2010). The three countries under investigation, France, Germany, and Iceland, are embedded in a Western sociocultural orientation where autonomy is highly valued, which involves, for example, support for independent problem solving, choice, and participation of the child in decisions (Grolnick & Ryan, 1989; Hofstede, 2001; Inglehart, 1997; Rimm-Kaufman & Wanless, 2012; Trommsdorff, 2009). Teachers and parents typically encourage children's autonomy and separateness, which are considered adaptive in Western cultures, especially in urban, middle-class environments (Kagitcibasi, 1996). As such, the three cultures adhere to the model of independent agency and share an orientation towards independence (Trommsdorff, 2009). Nevertheless, and as explained above, culture-specific aspects, such as different focuses of the early childhood education systems, make a generalization of research findings from one culture to another potentially

problematic. The current investigation is comprised of three complementary studies that were all developed with the aim of understanding the role of behavioral self-regulation in academic achievement gains within a specific cultural context.

Early Academic Environment in France, Germany, and Iceland

The approach to early childhood education in France, Germany, and Iceland is similar to that in the U.S. in many ways, where child-focused, center-based programs are usually delivered by professional early educators (Leseman, 2009; Tietze, Cryer, Bairrao, Palacios, & Wetzel, 1996). In all three countries, a vast majority of children over the age of three attend preschool; in France, 12% of all two-year olds and 100% of all three-year-olds (French Ministry of National Education, 2012). Similarly, in Germany, around 20% of children under the age of three and almost 92% of all three- to six-years-old children attend preschool (BMBF, 2010). Finally, over 95% of two-year-old and 97% of three-year-old children in Iceland attend preschool (Statistics Iceland, 2011). Children in all three countries enter the first grade of elementary school when they are about six years old (Blöndal, Jónasson, & Tannhäuser, 2011; Florin & Crammer, 2009; French H.C.E, 2007). At the same time, differences in the early education environment of the three countries can be expected. Within Europe, the early learning environment is arranged in accordance with two general models; a unitary settings, such as in Iceland, where the care and education of all children under the age of six are organized in a single phase, and more diverse settings, such as in France and Germany, where preschool programs are highly structured according to the ages of the children (Leseman, 2009).

In France, the preschool level is a public utility under the aegis of the Ministry of Education and has specific programs similar to elementary and secondary schools. The preschool programs aim to prepare children for first grade by supporting their school-related skills, including language, writing, and control of behaviors (Florin & Crammer, 2009; French Ministry of

National Education, 2008; 2011). In Germany, individual states regulate all programs, resulting in a more decentralized system. The curricula where the German sample was recruited encourages children to take an active role in investigating their own physical and social environment, thus supporting an autonomous, independent self (Kultusportal Baden-Württemberg, 2011). There is limited formal instruction in reading, writing, and math, although efforts have been made to improve the early childhood education to support children's academic success in Germany's highly selective education system (Perels, Merget-Kullmann, Wende, Schmitz, & Buchbinder, 2009). Finally, in Iceland, according to the National Curriculum Guidelines, preschool education aims to foster children's language development, support a care-free childhood, and encourage moral development, autonomy and creativity, thereby emphasizing free play and independence (Einarsdóttir, 2010; Icelandic Ministry of Education, Science, and Culture, 2011). There is limited emphasis on specific preparations for formal schooling, such as instructions in reading and math.

Overall, according to the national curricula there is less emphasis on formal preparation for academic learning (such as self-regulation support) in the Icelandic preschool system than in the other two countries, especially the French system, where considerable emphasis is placed on preparing young children for formal schooling and academic curricula. It is important to note, however, that research has not compared how the content of the preschool curricula in these three countries may or may not be reflected in actual educational practices.

Evidence for the importance of early self-regulation skills for school adjustment in various cultures has accumulated in recent years (see e.g., Wanless et al., 2011). Accordingly, we expect self-regulatory skills to predict achievement gains in all of our samples. Possible differences of the schooling systems, such as with regard to educational goals or the extent to which the curriculum is designed with the age of the children in mind, may provide varying support for self-

regulation skills and require different levels of self-regulatory behaviors, which may impact the pattern of relations observed across cultures. For example, studies have found that early math skills draw heavily on the underlying executive function processes involved in behavioral self-regulation (Blair et al., 2005; Cameron Ponitz et al., 2009; McClelland, Geldhof, Cameron Ponitz, & Wanless, in press). With regard to the current study, the French national curriculum places more explicit focus on self-regulation skills and early academics, including math, as compared to Germany and Iceland, which may result in stronger relations between behavioral self-regulation and math skills. However, in the absence of research comparing actual education practices and other cultural features relevant to the development of self-regulation across these three cultures, such ideas are speculative. As such, our investigation of culture-specific patterns is exploratory in nature and this paper is more in the mode of hypothesis seeking than hypothesis testing (Cattell, 1966).

Gender, Behavioral Self-Regulation, and Academic Achievement

There has been mounting evidence based on U.S. samples that girls have higher levels of self-regulatory processes than boys in kindergarten and elementary school (DiPrete & Jennings, 2012; Matthews et al., 2009; Wanless et al., 2013). The extent of gender differences in self-regulation may be influenced by the cultural context. For example, if expectations for the self-regulatory behaviors of boys and girls differ, or if each gender is socialized through different processes, the development of self-regulatory processes may not be the same for boys and girls. Recently, studies from cultures outside of the U.S. have confirmed findings of girls' consistent outperformance of boys on measures of self-regulation (Guimard, et al., 2012; Suchodoletz et al., 2013). However, there have also been studies that have reported equal levels of behavioral self-regulation among the genders (Köckeritz, Klinkhammer, & Salisch, 2010; Wanless et al., 2013).

Although the relation between self-regulation and gender may depend on the cultural context, studies from multiple cultures suggest that boys and girls benefit equally from having good self-regulatory strategies in relation to academic achievement (DiPrete & Jennings, 2012; Wanless et al., 2013). Accordingly, gender differences in self-regulatory skills may explain in part why girls frequently outperform boys on measures of school achievement (DiPrete & Jennings, 2012; Matthews et al., 2009; Rimm-Kaufman, Curby, Grimm, Nathanson, & Brock, 2009; Wanless et al., 2013). Not all studies have established the same pattern, but many suggest that the gender gap in achievement tends to grow throughout childhood and adolescence (Else-Quest, Hyde, Goldsmith, & Hulle, 2006; Matthews et al., 2009).

To our knowledge, no studies have examined the predictive role of early behavioral self-regulation skills in later academic achievement of boys and girls in France, Germany, and Iceland. However, evidence suggests that boys may be at greater risk for difficulties as they move through school in all three countries, which may be partly explained by differences in self-regulatory skills. In France, girls typically enter Grade 1 with better academic preparedness than boys, are less likely to repeat a grade level, achieve higher grades throughout secondary school, and are more likely to earn a degree in higher education (French Ministry of National Education, 2009; Lemaire, 2006; Rosenwald, 2006). In Germany, fewer girls than boys are enrolled in special education programs, and they are more likely to achieve higher grades in elementary school, complete compulsory school, and graduate from high school with superior diplomas (BMBF, 2010; Bos et al., 2007; Quenzel & Hurrelmann, 2010; Steinmayr & Spinath, 2008). Finally, in Iceland, girls outperform boys on measures of reading as early as in second grade, girls in Grades 4 and 7 outperform boys on national tests, and boys are more likely to drop out of school before completing compulsory education (Blöndal et al., 2011; City of Reykjavik, Department of Education, 2011). In fact, in 2003, the gender difference among the Icelandic

participants on the PISA was the greatest among the 41 countries that participated (Halldórsson & Ólafsson, 2009).

With the aim of informing the discussion about gender differences in academic achievement in Europe, one of the goals of the present study is to explore possible gender differences in early behavioral self-regulatory skills among children from the three participating European countries.

The Present Study

The goal of the current investigation is to examine the contribution of early behavioral self-regulation to academic achievement gains in three European countries and to clarify whether gender differences in behavioral self-regulation skills can be detected in these three countries using two types of self-regulatory measures.

Specifically, the study aims to (a) clarify whether children's early behavioral self-regulation, in both structured and everyday contexts, predicts academic achievement gains in longitudinal samples of children in France, Germany, and Iceland, and to (b) examine the extent of early gender differences on directly measured and teacher-assessed behavioral self-regulation in France, Germany, and Iceland. We expect children with better behavioral self-regulation, according to a direct measure and teacher assessment at the beginning of formal schooling, to show more gains on measures of academic achievement one to two years later than children with lower levels of self-regulation, after controlling for several theoretically important variables, namely age, gender, maternal education, and previous achievement scores. In addition, we explore culture-specific variation in the relation between self-regulation and different academic outcomes. However, in the absence of studies that have compared the academic practices or the relation between self-regulation and early academic achievement in France, Germany, and

Iceland, we do not make specific predictions regarding the similarities or differences we may observe in these relations across cultures.

Second, consistent with previous findings based on many U.S. and European samples, we expect girls to outperform boys on the two measures of behavioral self-regulation, which capture self-regulation in contexts with varying demands and support for self-regulation. Evidence of early gender differences in self-regulation suggests that boys and girls enter formal schooling with varying levels of self-regulation, which may be linked to achievement gaps that have been observed among older children in all three countries. As only few studies of early behavioral self-regulation in Europe have been conducted, the findings of this study will add to a mounting literature from multiple cultures on universal and culture-specific findings concerning the role of behavioral self-regulation and gender in early school success.

Method

The current investigation is based on three complementary longitudinal studies that were designed to examine the relation between behavioral self-regulation skills and early academic success. All of the studies used similar measures to assess behavioral self-regulation and academic achievement, as well as measures that reflect the age of the sample and the school level involved in each study.

Participants

Data were collected from children, parents, and teachers in France, Germany, and Iceland. As a whole, the sample consisted of 260 children (43% girls at Wave 1), who were enrolled in 34 classrooms at Wave 1. The children were followed longitudinally in each sample. French and German children were in the last year of preschool at Wave 1 and in the first grade of elementary school at Wave 2. The Icelandic sample was in the first grade at Wave 1 and in third grade at Wave 2. At Wave 1, when behavioral self-regulatory skills were assessed, all children were

around the age of five or six years (average age 74.52 months) and had received some preparation for school participation. At Wave 2, all children had started formal schooling and faced a more structured learning environment.

Participants in France. The French sample ($N=79$) was recruited in public preschools near the city of Nantes. Only children whose parents had given written informed consent participated. At Wave 1, the average age was 68.0 months ($SD=3.6$), 47% ($n=37$) of whom were girls. At Wave 2, the children ($N=79$) were aged 78.3 months ($SD=3.6$). All children participated in both waves of data collection. Parents of 94% ($n=74$) of the children provided background information. The majority of the children came from an upper middle-class background. Thirty-one percent ($n=23$) of the mothers had an undergraduate university degree and 36% ($n=27$) had a graduate degree. French was the mother tongue of all children who participated, none of the parents had immigrated to France, and no child had repeated a grade. In spite of growing immigration to France, the sample is quite representative of the population where the study was conducted. All of the children's teachers participated in the study.

Participants in Germany. The German sample ($N=70$) was recruited in public preschools in the cities of Freiburg and Konstanz. Preschools distributed information about the study to parents of children who were enrolled in the last year of preschool. Only children whose parents had given their written informed consent participated. At Wave 1, the average age was 66.2 months ($SD=3.2$), 40% ($n=28$) of whom were girls. At Wave 2, the children ($N=56$) were aged 85.4 months ($SD=2.5$). Eighty percent of the children who participated at Wave 1 participated again at Wave 2. Parents of 79% ($n=55$) of the children provided background information. The majority of the children came from an upper middle-class background, and the mothers' level of education was moderate to high; 38% had a graduate university degree. The majority of the children (93%) were of German origin. Other national origins were Swiss,

American, Belarusian, and British (1 child each). Most of the children were monolingual German speakers (72%), 25% were bilingual (German and one other language), and 3% were not native German but had learned German as a second language. Overall, the sample largely reflected the regional demographic characteristics of the population in terms of nationality and socioeconomic status. Seventy-nine percent ($n=55$) of the children's teachers participated.

Participants in Iceland. The Icelandic sample ($N=111$) was recruited in the capital Reykjavik. Four schools with high, medium, and low average scores on an annual assessment of reading (City of Reykjavik, Department of Education, 2011) were asked to participate and all agreed. At Wave 1, the average age of the children was 79.3 months ($SD=3.3$), 41% ($n=46$) of whom were girls. At Wave 2, the children ($N=101$) were aged 102.6 months ($SD=3.4$). Ninety-one percent of the children who participated at Wave 1 participated again at Wave 2. Parents of 74% of the children provided background information. The majority of the children came from an upper middle-class background, and two-thirds of their mothers (67%) had completed an undergraduate or a graduate degree. All children who participated were monolingual Icelandic speakers. Although the number of immigrants in Iceland is growing, the population in the areas where the study was conducted is relatively homogenous as compared to many other Western countries, and the sample thus largely reflects the regional demographic characteristics of the population. All of the children's teachers participated in the study.

Procedure

In France, Germany, and Iceland, the measures of background variables (parents), behavioral self-regulation (children and teachers), and academic achievement (children) were delivered in French, German, and Icelandic, respectively. In all countries, parents responded to background questions at Wave 1. In France, the measures were administered to the children in three sessions at each wave, each lasting about 20 minutes. In Germany, the measures were

administered to the children in two sessions during Wave 1 (each lasting 20–30 minutes) and in one session (50–60 minutes) at Wave 2. In Iceland, the measures were administered to the children in two sessions at each wave, each lasting between 15 and 30 minutes. All children were tested individually in a quiet area in their preschool, elementary school, or after-school program (Germany at Wave 2). The data collection points at Waves 1 and 2 were approximately 12, 19, and 24 months apart in France, Germany, and Iceland, respectively. In France and Iceland, measures were administered in the same order, but the order was randomly varied within the German study. See Table 1 for an overview of measures across samples and to contact the authors for a more detailed description of the procedure in each country.

Measures

Background questions.

In the three samples, parents completed questionnaires asking about various background characteristics, including family structure, parental occupation, and socioeconomic status (SES). Maternal education was used as a proxy to assess family SES, as it is believed to be typically reported more accurately than parental occupation. For consistency across samples, maternal education was recoded into four levels in each country, ranging from (1) “Has not completed compulsory education” to (4) “A graduate university degree.”

Direct observational assessment of behavioral self-regulation.

The HTKS task was used as a direct observational measure of each child’s behavioral self-regulation in all samples (Cameron Ponitz et al., 2008; 2009; McClelland et al., 2007). The measure was developed to capture children’s attentional control, working memory, and inhibitory control using a simple “opposite Simon Says”-type game (see, e.g., Cameron Ponitz et al., 2008, 2009; McClelland & Cameron Ponitz, 2012). In this task, the child is instructed to make movements that are the opposite of the directions given by the researcher. For example, when

told to touch his or her head, the child is supposed to touch his or her toes. In this task, children need to focus on the instructions (attention), remember multiple rules (working memory), and stop a dominant response and replace it with the opposite response (inhibitory control). The first 10 items included two types of paired commands (e.g., “touch your head” and “touch your toes”). In the second part, two new paired commands were added (e.g., “touch your shoulders” and “touch your knees”). Thus, the HTKS includes two parts with 10 commands each. Each part of the task was introduced with practice items. The items were scored with 0 for an incorrect response, 1 for a self-correct (initially incorrect response, but then corrected), or a 2 for a correct response. Total scores on the HTKS (total of 20 items) ranged from 0 to 40 points. Higher scores indicated higher levels of behavioral self-regulation. In recent research, scores on the HTKS have shown reliability and validity with preschoolers and early elementary students (e.g., Cameron Ponitz et al., 2008; 2009; McClelland et al., 2007; Suchodoletz et al., 2013; Wanless, McClelland, et al., 2011). In the present sample, inter-rater reliability was assessed for the Icelandic sample, where two raters assessed 10 children simultaneously during a pretest session. When using percentage agreement, the two raters agreed on 93% of the 400 responses, indicating a high inter-rater reliability. Similar information did not exist for the French or German sample. However, there were no significant differences between the examiners in children’s HTKS scores after child age had been controlled for (France; $F(4,74) = 1.48, p > .05$; Germany; $F(4,75) = 1.44, p > .05$; Iceland; $F(4,99) = .23, p > .05$), which matches previous research on other samples (McClelland et al., 2007; Cameron Ponitz et al., 2009; Wanless, McClelland et al., 2011).

Teachers’ assessment of behavioral self-regulation.

In France, teachers used the Q-EM questionnaire (Florin, Guimard, & Nocus, 2002), which includes 20 questions that estimate academic skills (language, reasoning, and math) and behavioral self-regulation skills (e.g., attention, memorization). For each item, the teachers

answered on a 3-point scale indicating the frequency of the skills: often observed, sometimes observed, or never observed. The questionnaire has been validated in several longitudinal studies conducted in preschools and elementary schools in France (Boussicault et al., 2013; Florin et al., 2002; Guimard & Florin, 2007). Categorical confirmatory factor analysis conducted for this study indicated that eight of the nine items that refer to self-regulatory behaviors comprise a factor that evaluates behavioral self-regulation (CFI = 1.00) with loadings ranging from .78–.94, with the exception of one item at .55. Despite this item having a mediocre factor loading, we decided to keep it in the composite due to its face validity and use in previous studies. Sample items include “He/she finds it difficult to focus attention on activities involving memory (such as songs and stories).” Higher scores demonstrate higher levels of behavioral self-regulation. Internal consistency of the eight items of behavioral self-regulation was good in the current French sample (Cronbach’s alpha = .90).

In Germany and Iceland, teachers used the Child Behavior Rating Scale (CBRS) to assess behavioral self-regulation in the classroom, which requires the demonstration of working memory, attention, and inhibitory control (Bronson, Tivnan, & Seppanen, 1995). The original version of the CBRS also includes items that measure children’s social relations with peers or adults, but previous studies have identified a 10-item factor that describes the child’s behavioral self-regulation in the classroom (see, e.g., Cameron Ponitz et al., 2009; Matthews et al., 2009; Wanless, McClelland, et al., 2011). In a previous study including a subsample of the German and Icelandic children that participated in the current investigation, the CBRS demonstrated good internal consistency and validity (blinded for review). Sample items include “Sees own errors on tasks and corrects them” and “Observes rules and follows directions without requiring repeated reminders.” Items were rated on a 5-point Likert scale from 1 (*never*) to 5 (*always*), where higher scores demonstrate higher levels of behavioral self-regulation. Internal consistency of the 10-item

behavioral self-regulation scale was high among German (Cronbach's alpha = .92) and Icelandic (Cronbach's alpha = .94) participants in the current study.

None of the studies included the CBRS and the Q-EM, so it was not possible to compare the scores on these two measures. However, when comparing items of the CBRS and the Q-EM, the two measures capture similar behaviors. For example, the CBRS asks the teacher to rate whether the child can concentrate on activities without being distracted and the Q-EM asks whether the child can generally fix his or her attention. Similarly, the CBRS asks whether a child can work independently on a task without help from someone else and the Q-EM asks whether a child shows autonomy in completing a task on his or her own. Similarly, other items on the two measures assess children's ability to remember rules, work efficiently, work in an organized way, and cope with demands without frustration. Finally, the two measures have almost equal correlations to the HTKS (see Table 2).

Academic skills.

France. Math, phonological awareness, word reading, and vocabulary were measured as outcomes at Wave 2. All of these variables were also measured at Wave 1, serving as control variables in our analyses. At Wave 1, emerging math skills were assessed with the measure Tedi-Math (Van Nieuwenhoven, Noël, & Gregoire, 2001), which assesses children's ability to count and enumerate. At Wave 2, two additional subtests of this measure were added: arithmetic problems and transcoding (Cronbach's alpha = .71 and .82 at Wave 1 and Wave 2, respectively).

Literacy skills were assessed with tests of phonological awareness, word reading, and vocabulary. The test of phonological awareness is derived from the Battery for Rapid Evaluation of Cognitive Functions (Batterie Rapide d'Évaluation des Fonctions Cognitives, BREV; Billard, Livet, et al., 2002) and was used at Wave 1. The test consists of sections of syllabic segmentation and subtraction, containing five words each. At Wave 2, a subtest of phonemic subtraction (five

words) was added. The BREV has demonstrated reliability and validity (Billard, Vol, et al., 2002). Letter knowledge was assessed with 26 items corresponding to the 26 letters of the French alphabet, which the experimenter named and asked the child to point to on a board (Foulin, 2007). One point was given for each correct response (in the current study, Cronbach's alpha = .94). Word reading was assessed at Wave 2 by means of the test *Timé 2*, which includes three subtests (Ecalte, 2002). Each subtest consists of twelve items that require the child to recognize written words and words provided orally, choose among five words to match to a picture and categorize semantically, and choose a word semantically or pragmatically close to another. One point was given for each correct response. Internal consistency was high in the current sample (Cronbach's alpha = .88).

Vocabulary was measured with the subtest "Lexicon in production" of the Evaluation du Langage Oral battery (ELO; Khomsi, 2001). In this task, children were asked to name 20 pictures by answering the question "What is this?" when presented with each picture. The task consisted of 20 pictures of increasingly difficult words. Correct answers to the 20 items were summarized to provide a score for vocabulary. The vocabulary scale showed good internal consistency in the current study (Cronbach's alpha = .85).

Germany. Math, letter knowledge, word reading, and vocabulary were measured as outcomes at Wave 2. All of these variables were also measured at Wave 1, serving as control variables in our analyses. At Wave 1, math skills were assessed with the arithmetic subtest of the Kaufman Assessment Battery for Children – German Version (K-ABC – II, Kaufman, Kaufman, Melchers, & Preuß, 2006). The subtest measures children's emerging ability to count, compare quantities, and solve calculation problems. In the task, children were presented a set of pictures and asked, for example, to count the number of objects on a page. The task consisted of 21 items presented in blocks of five, four, and three items each. The internal consistency was good in the

present sample (Cronbach's alpha = .71). At Wave 2, the German Test of Mathematics for the First Grade (DEMAT 1+; Krajewski, Küspert, & Schneider, 2002), a standardized school achievement test, was used. The subtests *Number Sets*, *Number Rays*, and *Addition and Subtraction* were administered. In the present study, the internal consistency was acceptable (Cronbach's alpha = .65). To create a total score, we averaged the sum scores within each subtest.

Children's literacy skills were assessed through measurements of letter knowledge, word reading, and vocabulary. The first two were assessed with the reading subtest of the K-ABC-II at Waves 1 and 2, which has two parts, first a letter knowledge part with 10 items and second a word reading part with 28 items (Kaufman et al., 2006). In the task, the children were presented with upper and lower case letters which they were asked to identify. Children who were able to identify at least one of those letters on each page were subsequently shown pages with words they were asked to read aloud. The subtest consisted of blocks of five, three, and two words each with increasing word length and complexity. Internal consistency was acceptable in the present data (Cronbach's alpha = .61).

At Wave 1, the children's vocabulary was assessed with the vocabulary subtest of the K-ABC-II (Kaufman et al., 2006). In this task, children were asked to name pictures (for example, a window, a letter box). The task consisted of 24 increasing difficult items. In the present sample, internal consistency of the test was acceptable (Cronbach's alpha = .62). At Wave 2, the expressive vocabulary subtest (short version) of the Vocabulary and Word Finding Test for 6- to 10-year-old Children (WWT 6-10; Glück, 2007) was administered. Children were presented with a set of colored pictures (total of 44 items) and asked either to (a) supply the word for a picture, (b) name what a person was doing, (c) name the opposite of a word, or (d) find a category for a series of four pictures. The total score represented the total number of correct answers. The test had high internal consistency in the present study (Cronbach's alpha = .93).

Iceland. Math, word reading, reading fluency, and reading comprehension were measured as outcomes at Wave 2. All of these variables, except for math, were also measured at Wave 1, and used as control variables in our analyses (see section on analytic strategy in the results for details). Mathematical skills were assessed with a test that was based on three national tests designed to capture children's understanding of the main areas of math curricula in the first three grades of formal schooling. It includes 15 items that two professors of mathematical instructions created to assess children's understanding of numbers (such as quantity and the decimal notation system) and mathematical procedures (addition, subtraction, multiplication, and division). The internal consistency was high in the current sample (Cronbach's alpha = .89).

Word reading was assessed with a list containing 48 words of varying length, frequency, and orthographic complexity. The children were asked to read each word out loud, and if they made more than six consecutive wrong responses they were asked to stop reading. The total score represented the total number of words read correctly. In the present study, the internal consistency was high (Cronbach's alpha = .98).

The teachers assessed reading fluency by asking the children to read continuous text aloud for two minutes. The final score represented the number of words they were able to read within that time limit, minus any words that were read incorrectly. Thus, higher scores indicate more fluency.

Reading comprehension was assessed with a test consisting of five passages of varying length and difficulty. The participants were asked to read each passage aloud and then answer questions about its content. If the children were able to answer a certain number of questions correctly, they were asked to move on to the next passage. The children received one point for each correct response. Thus, the total score represented the number of questions answered

correctly. The internal consistency of this test was high in the present sample (Cronbach's alpha = .92).

Results

The present study examines two research aims within longitudinal samples of young children from France, Germany, and Iceland. First, we examine relations between early behavioral self-regulation and growth on children's academic achievement. Second, we investigate the extent of early gender differences according to two measures of behavioral self-regulation.

Analytic Strategy and Descriptive Statistics

We analyzed data separately within each country, rather than as one large sample, to allow country-specific patterns of relations to emerge. Within each sample, children were nested in classrooms, so we calculated intra-class correlation coefficients (ICCs) for each of the dependent variables in each country, including behavioral self-regulation and academic achievement. ICCs reflected Wave 2 scores and ranged from 5.42% to 18.87% in France, from 7.29% to 22.95% in Germany, and from 5.53% to 29.08% in Iceland. These coefficients suggested that children could not be considered as independent cases, and multilevel modeling (MLM) was needed to obtain unbiased standard errors (Peugh, 2010; Raudenbush & Bryk, 2002). Therefore, we used MLM to address both research questions. For the level 2 analyses, we used data from 79 children in 9 classrooms in France, 70 children in 21 classrooms in Germany, and 105 children in 8 classrooms in Iceland. There was significant variation in the random intercept in all our models, suggesting that different classrooms had significantly different average outcomes from each other on both measures of self-regulation within each culture. This is consistent with previous research on academic and self-regulatory outcomes in young children

(see e.g., Merritt, Wanless, Rimm-Kaufman, Cameron, & Peugh, 2012; Skibbe, McDonald Connor, Morrison, & Jewkes, 2011).

In France, all variables had complete data except mother's education (5.1% missing). In Germany, 20.0% of the children were missing on the academic outcomes at Wave 2 due to dropout. Mother's education and teacher-rated behavioral self-regulation had 21.4% missing. In Iceland, a few variables were missing less than 1.0%, reading fluency was missing 18.9% at Wave 1 and 9.9% at Wave 2, and mother's education was missing 26.1% (see Table 1 for information about missingness across variables and samples). Due to the fairly small sample sizes and the presence of missing data, we used Bayesian estimation to produce the most trustworthy results (Lee & Song, 2004; Muthén, 2010). Since there was limited research in each of these countries to inform prior probability distributions, which are sometimes used in Bayesian estimation models, we estimated our models more conservatively using non-informative priors. Bayesian estimation uses all available data to estimate the model.

We used direct assessments as well as teacher ratings of behavioral self-regulation as an independent variable in analyses for our first research question. In models using the teacher ratings, we group-mean centered the teacher ratings to adjust for differences in teachers' use of the rating scale (Enders & Tofighi, 2007). For example, some teachers may rate all children higher or lower than other teachers, and group-mean centering adjusts for this difference.

To account for initial child academic achievement, we included measures of achievement at Wave 1 as predictors in the models. For the French sample, we used equivalent measures of math achievement, vocabulary, and phonological awareness. A pre-reading measure of letter knowledge was given to children at Wave 1 and served to predict word reading scores at Wave 2. For the German sample, we used similar measures of vocabulary, letter knowledge, and word reading. For math achievement, raw math scores at Wave 1 served to predict Wave 2 math total

scores. For the Icelandic sample, we used equivalent measures of reading comprehension, reading fluency, and word reading at both waves. Math skills were not assessed at Wave 1 in the Icelandic sample. There are no prior studies with Icelandic children who have established the correlation between math in Grade 1 and Grade 3, but Wave 2 math skills were correlated with Wave 1 reading comprehension at $.26$ ($p = .01$), similar to the strength of associations between Wave 2 math and other Wave 1 academic skills. In the absence of an initial level measure for math, we used reading comprehension to account for initial skill levels in predicting Wave 2 math skills.

In relation to our second research question, we ran multilevel models within each country using both a direct measure and teacher ratings of behavioral self-regulation as dependent variables. Children's age was correlated with children's behavioral self-regulation in the Icelandic sample, while mother's education was correlated with this variable in the French sample (Table 2). Therefore, we controlled for the children's age and mothers' education in these analyses to ensure that gender differences were not a function of children's age or mothers' education.

Table 1 presents descriptive statistics for the background variables, the two types of measures of behavioral self-regulation, and all academic achievement measures in each country. Most measures showed good variability. However, the HTKS in the Icelandic sample had a high mean score, or 33.27 out of 40 points ($SD = 5.52$). Although only two Icelandic children (1.8%) scored at ceiling, 81 (73.6%) of the children scored correctly on 80% of the items or more (i.e., they had a score of 32 points or more), and the measure showed limited variability in this sample (skewness = -1.8; kurtosis 4.4). An ANOVA showed significant main effects of country after controlling for age, gender, and mothers' education ($F(2, 217) = 7.33, p < .001$). Post-hoc analyses showed that the French children scored lower than the other two samples, but that the

German and the Icelandic samples did not differ statistically. The most likely explanation for the high scores and limited variability among the Icelandic children is that they were the oldest sample and may have been slightly older than the ideal age for the version of the HTKS used in the current study (see Table 1). The German children, the second oldest sample, also had a high mean at 29.21 ($SD = 9.35$), with one (1.4%) child scoring at ceiling, and 36 (51.4%) scoring 32 points or higher. However, in the German sample, the HTKS scores had reasonable variability (skewness = -1.8; kurtosis = 2.9). The variability of the French children, who were slightly younger than those in the German sample, on the HTKS was good: No children scored at ceiling and 31 (39.2%) scored 32 points or higher; skewness was -1.02 and kurtosis 0.07.

Table 2 presents correlations between the predictors (directly assessed and teacher-rated behavioral self-regulation and background characteristics) and the outcome, measured for each sample. With regard to the background variables, age had few significant correlations to the academic outcomes, which is probably due to the limited variability in age within each sample. Gender was only related to academic outcomes in Iceland, where the correlations were in the expected direction. Mothers' education was related to one academic outcome in the Icelandic sample, none in the German sample, and had clearer relations to the academic outcomes, in the expected direction, in the French sample. The main analyses, presented below, control for the effect of age, gender, and mothers' education. As expected, the two behavioral self-regulation measures (the HTKS and the teacher ratings) had positive and similar correlations in the French, German, and Icelandic samples ($r = .39, p < 0.001$; $r = .38, p < .01$; $r = .40, p < 0.001$, respectively).

Research Question 1: Early Behavioral Self-Regulation and Later Academic Achievement

Within each country, we examined the patterns of relations between directly assessed (HTKS) and teacher-rated (CBRS and Q-EM) behavioral self-regulation and academic achievement. First we ran multilevel models to test the relation of HTKS and academic

achievement, and then we ran the same models again using the CBRS or Q-EM instead of the direct measure. The relation between behavioral self-regulation and academic achievement differed depending on the type of self-regulation in question. When we used the HTKS, higher behavioral self-regulation was significantly related to greater growth in math in France and greater growth in word reading in Germany (see Table 3). The relation with word reading in Germany was particularly strong, with a standardized coefficient of .54. In other words, German children with HTKS scores that were about 39 out of 40 (1 standard deviation above the mean) had word reading scores one year later that were over 8 points higher than average. Behavioral self-regulation was not significantly related to any other academic outcomes when we used this measure. When we used the teacher rating, however, higher behavioral self-regulation was significantly related to greater growth in all academic outcomes in France and Iceland and to vocabulary in Germany (see Table 4). Across all models, gender and mother's education were generally not related to academic achievement, but Wave 1 academic skills and age were often related.

Research Question 2: Gender Differences in Behavioral Self-Regulation

To answer our second research question, we ran multilevel models within each country using direct measures and teacher ratings of behavioral self-regulation. In France and Germany, gender was not related to either measure of behavioral self-regulation (see Table 5). In Iceland, however, boys had lower scores on both measures of behavioral self-regulation. More specifically, Icelandic boys had HTKS self-regulation scores that were about 1/4 SD (about 1.40 points) lower than Icelandic girls. They also had teacher-rated behavioral self-regulation scores that were over 1/3 SD (about .27 points) lower than Icelandic girls.

In terms of relations with control variables, children with high mother's education levels were rated significantly higher on behavioral self-regulation as assessed by their teachers in

France. In Germany and Iceland, teachers were significantly more likely to rate older children higher than younger children on behavioral self-regulation. This pattern was also evident in Iceland for HTKS scores of behavioral self-regulation, but was reversed in Germany when the HTKS measure was used. Overall, the background variables seemed more strongly related to teacher-rated behavioral self-regulation than to directly observed behavioral self-regulation.

Discussion

The present study investigated the role of behavioral self-regulation in early academic performance as well as possible gender differences in behavioral self-regulation in France, Germany, and Iceland at the beginning of formal schooling.

Does Early Behavioral Self-Regulation Predict Gains in Academic Achievement?

The first research question examined whether the children's behavioral self-regulation, both when measured directly and according to teacher assessment, was related to gains in academic achievement in the three countries. In support of this hypothesis, we found that early behavioral self-regulation predicted growth in academic performance one to two years later in all three samples. In other words, behavioral self-regulation uniquely accounted for children's academic outcomes, independent of background variables and previous academic skills that are likely to explain much of the variation in academic achievement. Although our results are consistent with recent findings from other cultures, the patterns of relations differed depending on the type of self-regulation measure, the cultural context, and the academic outcome in question.

With regard to the relations between the two types of behavioral self-regulation to the various academic outcomes, teacher ratings (CBRS and Q-EM) had clearer relations to the outcomes than the observational measure (HTKS). Among both the French and Icelandic children, teacher-rated behavioral self-regulation predicted greater growth in all academic areas

under investigation. In the German sample, only vocabulary performance was significantly predicted by teacher-rated behavioral self-regulation.

When looking at the predictions of the directly observed behavioral self-regulation (the HTKS), we found significant relations for math growth in the French sample and significant relations for word reading gains in the German sample but no significant relations for growth in academic outcomes in the Icelandic sample. The clear contribution of both behavioral self-regulation measures to math among the French sample corresponds to our previous discussion about relations between self-regulation and math. Due to more structured and explicit academic instruction, the early academic context in France may call for a greater use of behavioral self-regulation than in Germany and Iceland, especially in math, as instructional strategies used in math lessons require strong behavioral self-regulation skills (Blair et al., 2005). The results found in France are consistent with other recent studies, such as Ivrendi (2011), who found that behavioral self-regulation was an especially strong predictor of math in a sample of Turkish kindergarten children (see also Cameron Ponitz et al., 2009; McClelland et al., 2007). It is possible that the strong link to math, as compared to other academic outcomes, may emerge among the German and Icelandic children as they grow older and face increased academic demands. Although the HTKS scores of the children in France were lower than those in the other countries, they did not show evidence of ceiling effects, in contrast to the Germany or Iceland samples. Thus, it is possible that the HTKS had stronger relations to math in France than in Germany or Iceland because the measure heavily taxes cognitive processes that are especially important for early math (Blair et al., 2005; Cameron Ponitz et al., 2009; McClelland et al., in press).

The different patterns between the two types of measures of behavioral self-regulation across samples and outcomes may also be due to the fact that the two measures assessed different

aspects of behavioral self-regulation. As previously explained, the direct measure assesses the application of self-regulatory skills in a highly structured environment, whereas teacher ratings are based on observations of how these skills are used independently in situations with limited support from others (Toplak et al., 2013). It is also important to note that other studies have found that direct measures of self-regulation are stronger predictors of academic outcomes for children compared to teacher reports (e.g., Cameron Pontiz et al., 2009; Wanless et al., 2011; Suchodoletz et al., 2013). The relatively strong relations of the teacher reports of behavioral self-regulation to growth in academic outcomes compared to the directly observed behavioral self-regulation in the current study may suggest that being able to demonstrate self-regulation in highly structured situations as well as in classroom settings are both important for academic success. To make efficient use of the school environment, children must be able to control their attention and working memory and inhibit behaviors, but they also must develop competencies to apply these skills independently in complex, demanding environments such as the classroom. Thus, it is importance that future studies employ both types of assessment.

In addition, methodological issues may have influenced the pattern of results. In particular, the children in Iceland may have been older than would be ideal for this version of the HTKS when they were first observed, which may explain why the teacher assessments had such strong relations to academic growth in this sample compared to the direct measure. Other research using the HTKS has found that the task performs best with children aged 4–6 years (Cameron Ponitz et al., 2009; McClelland & Cameron Ponitz, 2012; Wanless et al., 2013). Although only 1.8% of the Icelandic children scored at ceiling, their scores are high (mean of 33 out of 40 points) and have limited variability, which suggests that the direct measure may have been somewhat easy and not have fully captured individual variability in behavioral self-regulation (see Table 1). Recently, a more complex version of the HTKS was developed for older

children, but it was not available for use at Wave 1 of the current studies (see McClelland, Cameron Ponitz, Acock, & Bowles, 2013).

Furthermore, the small sample size in the three countries may have resulted in meaningful differences not reaching statistical significance. The standardized effects (SE) for the HTKS in predicting growth in academic outcomes were often in the range of .13–.17 (see Table 3) without reaching statistical significance, especially among the German sample, which was our smallest sample. In previous studies that have used the HTKS measure with young children to predict growth in achievement, similar ES sizes have reached significance with larger samples (see, e.g., Cameron Ponitz et al, 2009; Matthews et al., 2009). Furthermore, in relation to methodological issues, in Germany some formal preparations for school are offered in the last weeks of kindergarten, but such programs take place outside of normal classroom routines, are conducted in small age-homogeneous groups for a limited time, and are not implemented in all kindergarten classes. As a result, the teachers of the German children may have had limited opportunities to observe how consistently children applied their behavioral self-regulation skills in an academic setting, which may have resulted in a less accurate assessment of children's self-regulation in the classroom.

Do Boys and Girls Have Different Levels of Behavioral Self-Regulation?

In search of an explanation for a gender gap in academic achievement favoring girls in the three countries under investigation, we examined in the second research question whether girls outperformed boys on both behavioral self-regulation measures. Our observations indicate that there may be cross-cultural variation in the relations between gender and behavioral self-regulatory skills, as we only found gender differences in Iceland, where girls outperformed boys on both self-regulation measures.

Differences in the academic contexts of these three countries may be related to the culture-specific gender differences. According to the preschool curricula, French children should be introduced earlier to systematic support of self-regulation and a structured, academic environment that places high demands on children's behavioral self-regulatory skills as compared to the other two samples. If the self-regulatory skills of all children, boys and girls, are systematically supported from an early age, it seems likely that children of both genders will develop such competencies, especially those who would otherwise struggle with self-regulation skills, a group in which boys are likely to be overrepresented. In a context that places less emphasis on the development of self-regulatory skills, other socializing factors may play a larger part in the development of behavioral self-regulation. During the preschool period, peer influences increase and children tend to play more often with same-sex peers. Previous research has found that boys' play is generally less regulated, while games more frequently played by girls, such as socio-dramatic role-playing, have been found to support behavioral self-regulation (Fabes, Hanish, & Martin, 2003). In the context of the current study, the influence of peers on the development of self-regulatory skills may be particularly pertinent to the Icelandic preschool context, where children are likely to spend much time in free play with older children and be exposed to gender-specific same-sex peer interactions at an earlier age than their French and German counterparts, especially as a children in Iceland enter preschool at an earlier age than children in the other two countries. As a result, gender differences in behavioral self-regulation may become greater among this sample. These findings correspond to recent findings of Wanless et al. (2013), who, when comparing gender differences across cultures, found no gender differences in behavioral self-regulation as measured by the HTKS in Asian cultures that placed more emphasis on academic achievement, whereas they did observe differences in an U.S. context that placed less emphasis on achievement.

Although there is limited emphasis on preparations for formal schooling in the German preschool system, gender differences did not emerge among this sample as they did in Iceland. Why this is the case is unclear. As an initial explanation, as we have noted, it is not clear how differences in curricula between the three countries are reflected in actual educational practice. Accordingly, there may be more support for self-regulatory strategies in the German preschool system than in Iceland, although this is not clearly reflected in the curricula. In addition, other non-school related socializing factors, such as high standards for self-regulation for boys and girls or parenting practices, may support equal self-regulation skills of German boys and girls, which would reduce the probability of gender differences. We should note that although only few studies on early gender differences have been conducted with German samples, the ones that have been published have been inconsistent in their findings, reporting both gender differences and equal levels of self-regulation among girls and boys (Köckeritz et al., 2010; Neubauer, Gawrilow, & Hasselhorn, 2012; Suchodoletz & Gunzenhauser, 2013).

In addition, in the current study, differences in the ages of the three samples may have had an impact on gender differences. The one sample where a gender difference was observed, the Icelandic sample, was the oldest (at Wave 1, the Icelandic sample was approximately 11–13 months older than the French and German samples; see Table 1). This finding may indicate that gender differences become more profound with age and gender differences may emerge among the other two samples as they get older, particularly in the German children, who may not be exposed to the same systematic support of behavioral self-regulation skills as the French children at the preschool level. However, it is important to note that any inferences concerning age-related development must be supported by additional longitudinal data.

A number of studies have demonstrated the importance of behavioral self-regulation for the academic achievement of both boys and girls (see, e.g., DiPrete & Jennings, 2012; Wanless et

al., 2013). This means that gender differences in early behavioral self-regulation may account for later gender differences in academic achievement that have been observed in different societies (e.g., Duckworth & Seligman, 2006). Previous research indicates that the gender gap in academic achievement is particularly large in Iceland (Halldórsson & Ólafsson, 2009). The clear and consistent differences in early behavioral self-regulation among Icelandic boys and girls in the current study suggest that Icelandic girls may typically enter formal schooling better equipped to manage and benefit from the school context, which may account for the academic advantage older girls have over boys in recent PISA studies.

Implications for Educational Practices

Behavioral self-regulation predicted growth in academic achievement in all three countries of this study, particularly teacher-rated behavioral self-regulation, where nine out of twelve relations were significant. Therefore, we suggest that our findings provide further evidence for a possibly universal pattern of relations between behavioral self-regulation and academic success. If this is the case, systematically encouraging behavioral self-regulation in preschool may help to ensure that all children enter first grade with the skills to pay attention, remember instructions, and inhibit behaviors that they need to utilize the learning environment and work independently. The results of recent intervention studies are promising, as they provide preliminary evidence that behavioral self-regulation is amenable to change (e.g., Raver et al., 2011; Tominey & McClelland, 2011). Some interventions are designed as structured preschool curricular programs that can easily be integrated into daily preschool routines (such as the “Tools of the Mind” program; Bodrova & Leong, 2006; Diamond, Barnett, Thomas, & Munro, 2007).

The relation between behavioral self-regulation and growth in academic achievement was inconsistent across cultures. The culture-specific patterns of relations between behavioral self-regulation and academic outcomes in our findings, such as the limited relation between self-

regulation and academic growth among the German sample or the limited relation between directly observed self-regulation and academic growth among the Icelandic sample, also highlight the importance of taking contextual differences into account when attempting to understand the role of self-regulation in academic success and developing and implementing interventions. As we have explained, it is possible that methodological issues contributed to the inconsistent findings across cultures. However, these differences may reflect a different functioning of self-regulation depending on cultural context. It is possible that self-regulation skills do not have the same significance in the German academic context as they do in many other cultures, or that self-regulation skills that are needed in highly structured environments do not have the same implications for academic achievement in the Icelandic school context as skills applied without support. There is little previous research on the links between early self-regulation and school adjustment and success in the three cultures, and more longitudinal research in France, Germany, and Iceland is needed to clarify these issues.

It is important to note that around the age of four or five, children cannot be expected to have developed advanced control over their emotions, cognition, and behaviors and therefore cannot be expected to sit still or pay attention for long periods of time. Nevertheless, systematic support of self-regulatory skills seems relevant for all children in adjusting to formal schooling, particularly for children who are at risk for poor behavioral self-regulation skills. According to the findings of the current study, boys may be overrepresented in this group, at least in some cultural contexts. In this regard, it seems important to help preschool teachers to identify children who may be at risk and provide them with teaching methods that support self-regulatory skills. For example, teachers should be familiar with different tools (such as questionnaires and observational measures) for evaluating children's behaviors. Recently, systematic efforts have been made to improve preschool teachers' competencies in the three countries under

investigation. For example, in Germany, some states have introduced new advanced study programs. Similarly, in France and Iceland, programs for preschool and elementary school teachers now include five years of university-level training, up from three years. We encourage officials of higher education to include an emphasis on understanding and promoting children's behavioral self-regulation as part of the education of preschool and elementary school teachers.

Limitations

Although the results of the current study identified significant relations between early behavioral self-regulation and growth in academic performance across diverse cultural contexts and academic outcomes, a number of limitations should be noted. First, as we have pointed out, due to the small sample size in all three countries, significant relations may not have been detected in some models. Additionally, the small sample size did not allow for analyses examining the development of behavioral self-regulation and its relations to academic outcomes among boys and girls separately. However, it seems important to investigate the range of behavioral self-regulation skills within each gender to advance our understanding of the gender gap, not only in behavioral self-regulation but also in academic performance.

Second, the three studies were not completely comparable, for example in terms of ages of the samples, levels of schooling, and time between waves 1 and 2, which complicates the interpretation of the findings. The Icelandic children were the oldest and had the largest time difference between measurements (24 months as compared to 12 months in France and 19 months in Germany), but it should be noted that a strong relation was observed between behavioral self-regulation and academic outcomes among this sample. Finally in relation to differences across studies, we should point out that they were conducted in three different language contexts, which means that different outcome measures were used to assess the same constructs across studies. As such, the measures may not be completely comparable, which may

have influenced the pattern of results. Future studies would benefit from assessing the measurement invariance of the outcome measures across cultures when examining the contribution of early behavioral self-regulation to academic achievement. In spite of differences across samples and studies, behavioral self-regulation skills were related to growth in academic outcomes among all samples, lending support to our overall conclusion concerning the importance of early behavioral self-regulation skills among European samples.

Third, the study did not include other variables of the school environment (such as teacher education, teacher-child ratio, and teaching practices) that influence the development of behavioral self-regulation. Further studies are needed that examine relations between the school environment and the development of behavioral self-regulation across different academic contexts.

We should note the negative relation between age and some of the outcome variables. Surprisingly, age was negatively correlated to vocabulary in the German sample (see Table 1). In this sample, boys were somewhat older than the girls (66,6 and 65,7 months, respectively). As girls have been frequently shown to outperform boys on linguistic measures in preschool, including vocabulary (see e.g., Dodd, Holm, Hua, & Crosbie, 2003), the fact that girls were younger than boys may have contribute to this negative relation. In our multilevel analyses, age negatively predicted a number of the outcome measures at Wave 2 after controlling for student performance at Wave 1. In early childhood, many variables, such as word recognition, is expected to be strongly related to age. As such, by controlling for previous achievement, one also controls in part for the effect of age. Accordingly, these results do not mean that younger students have better performance than older at Wave 2, but that younger children showed more improvement in their performance between the two measuring times. This pattern of finding has

been found in several studies on the impact of season of birth on academic outcomes (Caille & Rosenwald, 2006; Florin, Cosnefroy & Guimard, 2004).

Finally, it should be noted that the areas in which the three studies were conducted had somewhat homogenous populations. Due to immigration, the populations of France, Germany, and Iceland are becoming increasingly diverse. Future studies in these countries should include more diverse samples that allow for the examination of possible subgroup similarities and differences. Currently, a study is underway in France that will include a larger, more diverse sample of French children.

Conclusions

The present study suggests that early behavioral self-regulation is related to growth in academic achievement among children in France, Germany, and Iceland. Consistent with findings from many other cultures, children in this study who had poor early behavioral self-regulation skills were more likely to show less growth in academic performance. The study also highlighted cross-cultural variations in the relation between behavioral self-regulation and academic outcomes and suggested that the implications of directly observed self-regulation are somewhat different than those of independently applied behavioral self-regulation for academic success. Gender differences in early behavioral self-regulation skills, favoring girls, were observed and may explain some of the later academic achievement disparities between boys and girls. However, the gender differences observed in the study were not consistent across cultures. The variation in findings across cultures and measures have also been observed in other studies. This highlights the importance of understanding both global and culture-specific aspects of behavioral self-regulation and using multiple measures of self-regulation skills to understand the full range of implications of these skills for school adjustment and academic success.

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Table 1

Descriptive Statistics of Behavioral Self-Regulation, Academic Achievement, and Covariates by Country

	Iceland			Germany			France		
	Mean	SD	% Missing	Mean	SD	% Missing	Mean	SD	% Missing
Self-Regulation (Wave 1)									
HTKS ^a	33.27	5.52	.90	29.21	9.35	0	26.18	10.82	0
Teacher Report	3.78	0.79	1.80	3.91	.71	21.43	2.55	0.48	0
Achievement (Wave 2)									
Math	8.44	4.33	6.31	12.71	2.56	20.00	44.91	5.58	0
Reading Comprehension	16.30	6.74	6.31	na	na	na	na	na	na
Vocabulary	na	na	na	32.61	8.09	20.00	23.66	3.84	0
Reading Fluency	199.67	73.60	9.91	na	na	na	na	na	na
Letter Knowledge	na	na	na	9.84	.85	20.00	na	na	na
Phonological Awareness	na	na	na	na	na	na	12.54	4.40	0
Word Reading	40.41	8.39	6.31	19.75	7.87	20.00	14.66	7.17	0
Covariates for Background (Wave 1)									
Age at W1 (in months)	79.32	3.31	0	66.23	3.18	0	68.02	3.66	0
Male	.59		0	.60		0	.53		0
Mother Education ^b	2.84	.69	26.13	2.82	.96	21.43	2.15	1.06	5.06
Covariates for Achievement (Wave 1)									
Math	na	na	na	14.11	3.19	0	15.84	3.59	0
Reading Comp.	6.41	6.51	.90	na	na	na	na	na	na
Vocabulary	na	na	na	18.84	3.09	0	16.53	2.36	0

Reading Fluency	12.60	12.04	18.92	na	na	na	na	na	na
Letter Knowledge	na	na	na	2.90	2.60	1.43	21.51	5.6	0
Phonological Awareness	na	na	na	na	na	na	15.99	4.06	0
Word Reading	17.94	14.72	0	.29	1.10	1.43	na	na	na

Note. A dash indicates that data was not collected on that measure for the relevant country.

^aHTKS = Head-Toes-Knees-Shoulders task. ^bMother Education: 1=Has not completed compulsory education; 2=Has completed compulsory education; 3=University degree; 4=Has completed a graduate degree.

Table 2

Correlation between Background Characteristics and Outcome Measures by Country

France (<i>N</i> = 79)	Math	Vocab	Phono- logical awareness	Word reading	Q-EM	HTKS
Child Age	.07	-.08	-.09	.06	.04	.01
Gender	-.13	-.15	-.07	-.06	.03	-.04
Mother education	.25*	.25*	.25*	.16	.35**	.19
Q-EM	.57***	.44***	.53***	.46***	--	.39***
HTKS	.58***	.34**	.31**	.29*	.39***	--
Germany (<i>N</i> = 70)	Math	Vocab	Letter knowledge	Word reading	CBRS	HTKS
Child Age	-.06	-.35**	-.01	-.15	.00	-.13
Gender	.13	-.03	-.12	.04	-.05	.08
Mother education	-.01	.24	.13	.05	.15	.07
CBRS	.27	.35*	.26	.26	--	.38**
HTKS	.20	.28*	.00	.44***	.38**	--
Iceland (<i>N</i> = 110)	Math	Reading comp.	Reading fluency	Word reading	CBRS	HTKS
Child Age	.16	.11	.07	.03	.20*	.19 ^t
Gender	.10	.03	.00	.07	-.33**	-.20*
Mother education	.25*	.09	.06	.18	.01	.03
CBRS	.28**	.36***	.41***	.42***	--	.40***
HTKS	.15	.13	.25*	.03	.40***	--

Note. A dash indicates that data was not collected on that measure in the relevant country. HTKS

is the Head-Toes-Knees-Shoulders task. CBRS is the Child Behavior Rating Scale. Q-EM is the

École Maternelle. Gender is coded as a 1 for boys and 0 for girls. ^t $p < .10$; * $p < .05$; ** $p < .01$;

*** $p < .001$

Table 3

Multilevel Models for the Head-Toes-Knees-Shoulders task of Behavioral Self-Regulation and Academic Achievement by Country

	Iceland (N=105)				Germany (N=70)				France (N=79)			
	Math	Read Comp	Read Fluency	Word Read	Math	Vocab	Letter knowledge	Word Read	Math	Vocab	Phon. awareness	Word Read
HTKS ^a												
B	.14	.08	1.92	-.09	.03	.03	0	.45***	.23***	.03	.07	.09
PSD	(.09)	(.12)	(1.43)	(.14)	(.04)	(.10)	(.02)	(.11)	(.05)	(.03)	(.05)	(.07)
β	.17	.07	.14	-.05	.09	.03	-.05	.54	.47	.07	.17	.13
Wave												
Iscore												
B	.18**	.49***	3.04***	.32***	.23	1.70***	.08	.47	.39*	1.05***	.43***	.44***
PSD	(.07)	(.10)	(.65)	(.06)	(.12)	(.87)	(.05)	(.79)	(.16)	(.16)	(.12)	(.10)
β	.26	.45	.47	.54	.27	.69	.24	.06	.27	.63	.40	.47
Age												
B	-.07	.01	-.67	-.03	-.02	-.48***	.01	.04	-.14**	-.25***	-.18***	.10
PSD	(.06)	(.07)	(2.08)	(.09)	(.04)	(.15)	(.03)	(.08)	(.06)	(.04)	(.04)	(.15)
β	-.05	.01	-.03	-.01	-.02	-.20	.03	.02	-.10	-.23	-.15	.05
Male												
B	.46	.24	.98	.29	.24	-.38	-.15	-.78	-.21	-.80*	-.36	.30
PSD	(.54)	(.77)	(9.10)	(.91)	(.45)	(1.01)	(.19)	(1.32)	(.66)	(.45)	(.55)	(.98)
β	.11	.04	.01	.03	.09	-.05	-.16	-.10	-.04	-.20	-.08	.04
Mother												
education												
B	1.06	-.17	-2.65	.61	-.08	.55	.02	-.44	.28	.43	.65	.22
PSD	(.70)	(1.13)	(11.86)	(1.44)	(.41)	(.87)	(.25)	(1.24)	(.56)	(.36)	(.48)	(.81)
β	.17	-.02	-.02	.05	-.03	.07	.02	-.05	.05	.12	.16	.03
R ²	.18***	.25***	.28***	.32***	.16***	.56***	.25***	.37***	.36***	.53***	.28***	.29***

Note .^aHTKS = Head-Toes-Knees-Shoulders task. * $p < .05$. ** $p < .01$. *** $p < .001$.

Table 4

Multilevel Models for Teacher-Reported Behavioral Self-Regulation and Academic Achievement by Country

	Iceland (N=105)				Germany (N=70)				France (N=79)			
	Math	Read Comp	Read Fluency	Word Read	Math	Vocab	Letter Knowl.	Word Read	Math	Vocab	Phon. Awaren.	Word Reading
Teacher report												
B	2.55***	2.49**	38.37***	3.36***	1.34	3.86*	.20	1.13	4.65***	1.53*	3.88***	5.24***
<i>PSD</i>	(.63)	(1.05)	(10.81)	(1.24)	(.85)	(1.53)	(.36)	(2.68)	(1.24)	(.76)	(.98)	(1.68)
β	.42	.28	.38	.31	.25	.27	.12	.07	.40	.18	.42	.34
Wave 1 score												
B	.02	.34**	2.16**	.22***	.24*	1.69***	.07	.71	.49***	1.04***	.37***	.35***
<i>PSD</i>	(.08)	(.13)	(.70)	(.07)	(.11)	(.22)	(.05)	(.95)	(.16)	(.14)	.11	(.10)
β	.04	.32	.33	.37	.28	.70	.21	.10	.33	.64	.34	.39
Age												
B	-.04	.02	-3.17*	-.08	-.02	-.47***	.05	-.21	-.05	-.22***	-.12**	-.17*
<i>PSD</i>	(.05)	(.05)	(1.42)	(.06)	(.03)	(.07)	(.03)	(.29)	(.07)	(.04)	(.04)	(.08)
β	-.03	.01	-.14	-.03	-.03	-.20	.19	-.09	-.04	-.21	-.10	-.09
Male												
B	1.08*	.84	9.38	1.30	.37	-.15	-.16	.25	.03	-.68	.03	.48
<i>PSD</i>	(.52)	(.81)	(9.09)	(.94)	(.43)	(.86)	(.17)	(1.44)	(.72)	(.43)	(.56)	(.92)
β	.24	.12	.13	.16	.14	-.02	-.17	.03	.01	-.17	.01	.07
Mother education												
B	1.07*	.07	-3.00	1.16	-.10	.56	.21	-.45	-.17	.27	.19	-.33
<i>PSD</i>	(.67)	(1.10)	(11.56)	(1.36)	(.40)	(.87)	(.23)	(1.50)	(.63)	(.36)	(.48)	(.79)
β	.17	.01	-.03	.10	-.04	.08	.23	-.06	-.04	.08	.05	-.05
R ²	.30***	.24***	.33***	.31***	.23***	.65***	.33***	.14***	.32***	.55***	.36***	.32***

Note. * $p < .05$. ** $p < .01$. *** $p < .001$.

Table 5

Multilevel Models for Gender and Directly Assessed (HTKS) and Teacher Rated (CBRS/Q-EM) Behavioral Self-Regulation by Country

	Iceland (N=105)		Germany (N=70)		France (N=79)	
	HTKS	Teacher Rating	HTKS	Teacher Rating	HTKS	Teacher Rating
Age (months)						
B	.13*	.03**	-.75***	.05***	-.31	.01
PSD	(.08)	(.01)	(.21)	(.01)	(.28)	(.01)
β	.09	.14	-.30	.23	-.11	.08
Male						
B	-1.31*	-.29**	1.32	-.14	-.53	-.07
PSD	(.67)	(.09)	(1.24)	(.13)	(1.63)	(.07)
β	-.26	-.38	.16	-.19	-.05	-.15
Mother Education						
B	-.39	.02	-.87	.22	1.66	.18**
PSD	(.85)	(.14)	(1.20)	(.12)	(1.30)	(.06)
β	-.05	.02	-.11	.30	.16	.37
R ²	.10***	.18***	.16***	.21***	.07***	.19***

Note.^aHTKS = Head-Toes-Knees-Shoulders task. * $p < .05$. ** $p < .01$. *** $p < .001$. All p values are one-tailed. PSD= posterior standard deviation.

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