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Abstract

This study investigated why some Finnish students receive part-time special education in Grade 1, duration of that support, and its relation to student reading fluency, reading comprehension, and arithmetic fluency development. The participants included two groups from Grade 1 receiving part-time special education (1–2 years vs. 3–4 years) and a control group comprising the remaining participants from the study. Teachers identified reading and expressive language difficulties as the main reasons for part-time special education in Grade 1. By Grade 4, students who received support until Grade 1 or 2 caught up the level of the control group especially in reading fluency. Students who had received support until Grade 3 or 4 exhibited more persistent and overlapping difficulties with attention, receptive language, memory, and motivation. Additionally, by Grade 4, differences from the control group remained statistically significant for all three skills. Implications for enhancing special education interventions for students with persistent and overlapping learning difficulties are discussed.

Keywords: part-time special education, reading fluency, reading comprehension, arithmetic fluency, overlapping difficulties

Development of reading and arithmetic skills across Grades 1 to 4 in two groups
of children receiving part-time special education

1. Introduction

Children face many learning challenges on commencing school, and difficulties in one academic domain have been found to increase the risk of difficulties in another (Koponen et al., 2018; Cirino et al., 2018; Landerl & Moll, 2010). For instance, comorbid difficulties in reading and mathematics are more common than might be expected statistically from the prevalence of deficits in single domains (e.g., Koponen et al., 2018; Landerl & Moll, 2010). To prevent more severe or prolonged learning difficulties, students should receive appropriate support as soon as any such difficulties are identified. In the Finnish educational context, primary school classroom teachers are the first to provide general support for learning reading and mathematics. If classroom teachers' support proves insufficient for students with reading, spelling, and arithmetic difficulties, part-time special education is provided individually or in small groups by special educational needs (SEN) teachers or special educators as a pull-out service, usually in their resource room (Holopainen et al., 2018; Lemons et al., 2018; Soodla et al., 2019; Takala & Ahl, 2014). In international comparisons, part-time special education for students with learning difficulties is quite extensive in Finland; in 2017, 22% of all students in Grades 1 to 9 participated in part-time special education at some point in the school year (Official Statistics of Finland, 2018). However, municipalities differ in terms of the share of students who receive special education and how such support is organized (Pulkkinen et al., 2019). The present study explores the reasons for providing part-time special education at the beginning of the school path, as well as the duration of the support period and how it affects subsequent skills development. To that end, the study compared two groups of students receiving part-time special education for differing lengths of time and followed the development of their academic skills until Grade 4.

1.1. Developing Academic Skills and Overlapping Difficulties

In Finland, pre-literacy skills are supported during compulsory pre-primary education for 6-year-old children. Although pre-primary education does not include formal instruction in literacy or math, children are introduced to letter names (Lerkkanen et al., 2004), mathematical concepts, and numbers (Aunola et al., 2004). Formal instruction in reading, spelling, and arithmetic starts at age seven, when children enter the first grade. The orthographic regularity of the Finnish language enables word reading and spelling to be taught simultaneously to first graders in the knowledge that one will complement the development of the other (Lerkkanen, 2007). As one of the most transparent alphabetic orthographies (Aro, 2017), Finnish supports rapid mastery of decoding accuracy. About 30% of first grade students can decode before school entry, and the rest acquire good decoding skills within months of beginning reading instruction at school (Lerkkanen et al., 2004). For that reason, reading difficulties (RD) in Finnish relate mainly to problems of reading fluency after learning to decode (Torppa et al., 2015), and these difficulties have been shown to persist (Eklund et al., 2015).

Fluent readers are able to read texts accurately at a conversational rate with appropriate prosody (Torgesen & Hudson, 2006). To comprehend texts effectively, one must also be able to understand the meanings of the words (Hudson et al., 2008; Mancilla-Martinez & Lesaux, 2010). In addition to difficulties with word recognition, reading comprehension issues relate to the nature of the text, insufficient vocabulary skills, and the objectives of reading (Mancilla-Martinez & Lesaux, 2010; van der Lely & Marshall, 2010). For some students, poor word reading and comprehension skills can present obstacles to learning throughout compulsory education and into adulthood (Holopainen & Hakkarainen, 2019; Landerl & Wimmer, 2008). In a recent German follow-up study (N = 4,123) across Grades 3 to 5, Moll et al. (2020) noted the prevalence of stability of fluency difficulties, which are hard to remediate.

The development of basic mathematical skills is a hierarchical process comprising basic number knowledge, verbal counting skills, memorizing arithmetic facts, understanding and using basic arithmetic operations (addition, subtraction, multiplication and division), understanding concepts, and being able to follow relevant procedures (Zhang et al., 2020; Butterworth, 2005; Geary et al., 2012; Jordan et al., 2009). Rapid retrieval of arithmetic facts and the ability to calculate by deploying such facts is the basis of math fluency. When a student must consistently rely on counting-based strategies (e.g., solving $4 + 3$ by counting “four, five, six, seven”), arithmetic skills remain dysfluent (Koponen et al., 2018). Morgan et al. (2009; see also Nelson & Powell, 2018) reported that the stability of math difficulty from kindergarten to Grade 5 was 28%–65%, where the higher rate related principally to the lowest achieving students ($\leq 10^{\text{th}}$ percentile).

As noted above, learning difficulties exhibit strong comorbidity; for example, students with RD also tend to have difficulties with spelling (Holopainen et al., 2018; Landerl & Moll, 2010; Landerl & Wimmer, 2008), mathematics (Child et al., 2019; Cirino et al., 2015; Koponen et al., 2018; Moll et al., 2019), or language (Baird, 2008; Isoaho et al., 2016; Spanoudis et al., 2019) more frequently than expected. Many studies have also identified comorbidity of reading and attention difficulties (Grills-Taquechel et al., 2013; Prochnow et al., 2013; Peterson et al., 2017) and co-occurrence of reading and math difficulties with attention difficulties (Child et al., 2019). There is also some evidence that overlapping difficulties are especially persistent; for example, Koponen et al. (2018) showed that comorbid difficulties in reading and arithmetic are relatively stable after Grade 2 and are more persistent than single-domain difficulties throughout the individual’s school years. Korpipää et al. (2017) reported time-general intercorrelations between reading and arithmetic skills in Grades 1 and 7, and there is evidence that overlapping difficulties of this kind can impair students’ academic careers beyond Grade 9 (Holopainen & Hakkarainen, 2019).

1.2. Support for Learning Difficulties and Its Effect on Students’ Skills Development

It has been reported that classroom teachers tend to provide more instructional support and more active instruction to lower-performing students (Griffiths & Stuart, 2013; Kikas et al., 2015). However, some students with early learning difficulties subsequently require more support than classroom teachers can provide. As Finland's comprehensive part-time special education system is needs-based and free of charge, "low-threshold" learning support can be provided to any student as soon as there is an observed need. For students with milder learning or behavioral difficulties, no formal diagnosis is required (Björn et al., 2016; Jahnukainen & Itkonen, 2016). In some cases, a student with persistent wide-ranging difficulties in reading, spelling, and arithmetic (or more severe learning difficulties in one skill) will receive regular or irregular support from an SEN teacher during their early school years (see Holopainen et al., 2018).

Expressive or receptive language disorders (see Snowling & Melby-Lervåg, 2016; Spanoudis et al., 2019) and difficulties in reading, spelling, and arithmetic are the most typical reasons for providing special education support at the beginning of school (Holopainen et al., 2018; Lappalainen & Hotulainen, 2012; Morgan et al., 2011). To prevent severe difficulties, students should receive support as early as possible; in Finland, the decision to provide support is not based on national assessments, which do not exist. Instead, teacher evaluations determine which students are in need of support and which support practices are selected. These decisions are based on multi-professional evaluation and take account of the views of SEN teachers, regular teachers, and parents (Björn et al., 2016; Takala et al., 2009). Support may be implemented through co-teaching in regular classrooms (push-in)—for example, by the classroom teacher and SEN teacher—or in a separate class, individually or in small groups (3–4 students) with the SEN teacher (pull-out), for as long as the student needs it (Holopainen et al., 2018; Takala et al., 2009).

Part-time special education is most extensively provided at the beginning of school as a preventive measure to ensure that students learn to read and spell (Takala et al., 2009; Takala & Ahl, 2014). In the case of reading, support is usually provided in the form of extra lessons (usually

1–2 hours per week), including training in reading, spelling, and phonological awareness (Holopainen et al., 2018; Ise et al., 2011). While some students seem to benefit from a short period of support, others may have deeper and wider learning difficulties that cannot be remediated by short-term or temporary support (Holopainen et al., 2018). Previous studies have shown that pull-out instruction in a resource-type room often proves beneficial for students with learning difficulties (Bottge et al., 2018; Lemons et al., 2018), especially if the group is small (five or fewer students) (Vaughn & Wanzek, 2014).

However, regardless of the intensity or quality of the intervention, it is widely reported that some students fail to make adequate progress, and they lag behind the expected grade-level performance (Holopainen et al., 2018; Vaughn & Wanzek, 2014). Several studies have noted the issue of low responsiveness or non-responsiveness to interventions, highlighting the need for more individualized interventions and practices and for more precise definition of the duration of support (e.g., Denton et al., 2006; Denton, 2012; Miciak et al., 2017; Vaughn & Wanzek, 2014). With regard to overlapping difficulties, there is also evidence that students with co-occurring learning difficulties and attention deficit hyperactivity disorder (ADHD) exhibit a lack of responsiveness to instruction or support (DuPaul et al., 2013; Vaughn & Fuchs, 2003).

1.3. Study Aims and Context

The aim of the present study was to investigate SEN teachers' evaluations of Grade 1 students' special education needs, and how duration of support related to progress in reading fluency, reading comprehension, and arithmetic fluency in Grades 1 to 4. One of the two participating groups had received early-stage support (ESS) for 1–2 years while the other had received long-lasting support (LLS) for 3–4 years. A large population sample was used as the control group. The study sought to identify any differences between the two support groups in terms of reported reasons for part-time special education and additional difficulties in Grade 1. We also

compared all three groups' reading and arithmetic skills at the beginning and end of the follow-up period (in Grades 1 and 4) and examined how these skills developed.

The study augments the earlier findings of Holopainen et al. (2018) and Soodla et al. (2019) regarding the role of part-time special education support for students with reading difficulties (RD) across Grades 1 and 2. In a follow-up study, Holopainen et al. (2018) compared the development of reading and spelling skills of students with RD, who received part-time special education, and students without RD, who did not. In Grade 1, students with RD lagged behind their age level, but the gap between the groups had decreased by Grade 2. Comparison of students with RD alone and students with overlapping difficulties showed that the latter group was slower to develop. The preceding study also investigated the frequency and form (individual, small group, or both) of part-time special education provision and how these related to the development of reading and spelling skills in students with RD alone and students with RD and overlapping difficulties. The results indicated that frequent individual provision was associated with slower skill development while skills developed faster with moderate frequency of provision in small groups (3–4 students). In another follow-up study, Soodla et al. (2019) found that one year of part-time special education (two lessons per week) may not be the most effective form of support for students with RD, especially when that support is provided without prior diagnostic assessment, targeted intervention, or frequent progress monitoring.

Based on previous research (Lappalainen & Hotulainen, 2012; Morgan et al., 2011), we anticipated that difficulties in reading, arithmetic, and expressive language were likely to be the most common reasons for support, and that the reasons would be quite similar in the two groups. On that basis, we formulated the following research question.

RQ1. What reasons did SEN teachers report for providing part-time special education in Grade 1, and to what extent did the reasons for support differ between the ESS and LLS groups?

We further expected that RD would overlap with arithmetic difficulty (Cirino et al., 2015; Moll et al., 2019), expressive language difficulty (Isoaho et al., 2016; Snowling & Melby-Lervåg, 2016), and attention difficulty (Grills-Taquechel et al., 2013; Prochnow et al., 2013), and that students in the LLS group would have more additional difficulties. On that basis, we formulated the following research question.

RQ1a. What kinds of additional learning-related difficulties did SEN teachers report in Grade 1, and to what extent did the ESS and LLS groups differ in terms of the extent and characteristics of those difficulties?

We also anticipated that the ESS and the LLS groups would perform less well in reading than the control group, and that the ESS group would outperform the LLS group (Holopainen et al., 2018). On that basis, we formulated the following research question.

RQ2. Did the two support groups (ESS and LLS) differ in reading fluency, reading comprehension, and arithmetic fluency at the beginning of part-time special education in Grade 1 compared to their peers in the large follow-up sample?

Again based on prior research (Holopainen et al., 2018), we anticipated that skills development among the LLS group would be slower than among the ESS and control groups, and that the ESS group would outperform the LLS group on every skill at the end of the follow-up period. We also expected that the ESS group would catch up with the control group. On that basis, we formulated the following research question.

RQ3. Did the development of reading fluency, reading comprehension, and arithmetic fluency skills in the ESS and LLS groups across Grades 1 to 4 (as compared to their peers in the large follow-up sample) reflect the duration of part-time special education, and to what extent did the ESS group, the LLS group, and the control group differ in terms of those skills at the end of the follow-up?

2. Method

2.1. Participants and Procedure

The study data were drawn from an extensive follow-up study (Lerkkanen et al., 2006–2016) in four municipalities in different parts of Finland, involving five data collection time points: fall 2007 and spring 2008 (Grade 1), spring 2009 (Grade 2), spring 2010 (Grade 3), and spring 2011 (Grade 4). The participants included one whole age cohort of children in three of the participating municipalities and half of the age cohort in the fourth municipality. Parental education levels were similar to the Finnish national average (Eurostat Regional Yearbook, 2013). Informed consent for participation was collected from the students' teachers and caretakers. Within the sample ($N = 2,157$), risk for RD was determined at the end of the kindergarten year on the basis of four criteria: initial phoneme identification (indicating phonological awareness), letter knowledge, rapid automatized naming, and self-reported parental RD (see Lerkkanen et al., 2011). RD risk was defined as joint occurrence of at least two of three criteria: low phonological awareness (clearly below age level score for initial phoneme identification, $\leq 15^{\text{th}}$ percentile); poor letter knowledge ($\leq 15^{\text{th}}$ percentile); and poor rapid automatized naming ($\leq 15^{\text{th}}$ percentile) (Lerkkanen et al., 2011). If parents themselves reported having reading difficulties, a score below the 15^{th} percentile in any one of the three tests (phonological awareness, letter knowledge, or rapid automatized naming) was considered a sufficient indicator of RD risk. Control group members were randomly selected from the same classrooms as those identified as at risk for RD.

Of the 2,157 children in the sample, a sub-study followed 598 (53% boys, 47% girls; 277 at risk for RD, 321 not at risk for RD) individually from Grade 1. In Grade 1, 35 SEN teachers (94% female; mean age = 45.6 years; $SD = 9.60$) from four municipalities participated in the special education sub-study; issues investigated included pedagogical practices for children with learning difficulties. The SEN teachers received a list of children who were followed more intensively, but they did not know which children were at risk for RD and which were not. The teachers were asked

to rate those who had received special education in Grade 1; there were typically two or three such students, but if the number exceeded six, the teachers were allowed to select students to be rated. Each year, the SEN teachers were asked to complete individual student reports and questionnaires regarding special education content and implementation. For present purposes, we used the questionnaires and reports collected during Grade 1 (fall and spring terms).

The support groups comprised 130 children who had received part-time special education during the fall and/or spring term in Grade 1. We assigned the students to two groups: the ESS group ($n = 55$, 64% boys), who had received support in Grade 1, Grade 2, or both, and the LLS group ($n = 75$, 69% boys), who had received support from Grade 1 until Grade 3 or 4. The control group ($n = 2,027$, 52% boys) comprised peers who participated in the follow-up but were not included in the two support samples. Control group performance was used as an indicator of age-appropriate skills development. The research follows the principles that are endorsed by the research community, that is, integrity, meticulousness, and accuracy in conducting research, and in recording, presenting, and evaluating the research results. In the treatment of our samples research ethical standards and in reporting publishing ethics have been complied. The study has been reviewed and approved by the Ethical Board of the University of Jyväskylä in 2006.

2.2. Measures

2.2.1. Teacher Ratings of Students' Learning Difficulties

Learning difficulties were identified on the basis of SEN teachers' reports in Grade 1. The questionnaires (sent in the fall and spring terms) asked teachers to specify the reasons for part-time special education provision by responding to the following open-ended question: "*What is the main reason for support?*" Responses were assigned to four main categories (*Reading difficulty*, *Expressive language difficulty*, *Arithmetic difficulty*, *Other difficulty*) and 11 sub-categories (see Table 1). Sometimes the teachers reported a student having several reasons for providing support, and categories were formed accordingly. In addition to the main reason(s) for receiving part-time

special education the teachers were asked to identify each individual student's other learning related difficulties as follows: "*Does the student receiving part-time special education have other difficulties?*" Based on a list of 10 options (1 = *Receptive language difficulty*, 2 = *Expressive language difficulty*, 3 = *Perception difficulty*, 4 = *Memory difficulty*, 5 = *Attention difficulty*, 6 = *Motor difficulty*, 7 = *Motivation difficulty*, 8 = *Socio-emotional difficulty*, 9 = *Behavior difficulty*, and 10 = *Other: what?*), the teachers were asked to rate each student on a three-point scale (0 = *not at all*, 1 = *mild problems/sometimes*, 2 = *clear problems/often*). In the analysis, mild problems (or sometimes) and clear problems (or often) were pooled, and scores were summed to determine the total number of observed difficulties.

Students' reading fluency, reading comprehension, and arithmetic fluency in Grades 1 to 4 were assessed annually during the spring term using identical tests, which were group-administered in the classroom by trained research assistants.

2.2.2. Reading Fluency

Two tasks were used to test reading fluency: ALLU TL2 (Lindeman, 1998) and Test of Silent Reading Efficiency and Comprehension (TOSREC; Wagner et al., 2009; Finnish adaptation by Lerkkanen & Poikkeus, 2009). A group-administered word reading fluency task, ALLU is a subtest of a standardized Finnish reading test battery for primary schools (ALLU; Lindeman, 1998). Each of the 80 items comprises one picture and four phonologically similar words that are familiar and frequently used by children. Students were instructed to read the four words silently before matching the correct word to the picture by drawing a line. Scores were calculated as the number of correct responses within a two-minute time limit (maximum = 80). TOSREC (Wagner et al., 2009) is a sentence verification task comprising 60 sentences. The students were instructed to decide whether the content of each silently read sentence was true or false by circling the appropriate option (true/false). Scores were calculated as the number of correct responses within a three-minute time limit (maximum = 60). A composite score for reading fluency was derived separately for each

grade by calculating the mean of the two standardized scores (ALLU TL2 and TOSREC). In Grades 1, 2, 3, and 4, Cronbach's alpha values were .86, .82, .82, and .83, respectively.

2.2.3. Reading Comprehension

A standardized subtest of ALLU (Lindeman, 1998) was used to assess reading comprehension, with texts and questions customized for each grade level. The students were instructed to read a short story silently before either answering 12 multiple-choice questions (4 alternative responses) about the text or arranging statements by their order of appearance in the text. One point was awarded for each correct response (maximum = 12); students were allowed to complete the task at their own pace, up to a maximum of 45 minutes. Cronbach's alpha values were .98 in Grade 1, .94 in Grade 2, .96 in Grade 3, and .85 in Grade 4. Task scores were standardized separately for the four grade levels to enable assessment of progress in the ESS and LLS groups as compared to the control group.

2.2.4. Arithmetic Fluency

Arithmetic fluency was tested using the Basic Arithmetic Test in Grades 1, 2, and 3 and the Basic Arithmetic II Test (Aunola & Räsänen, 2007) in Grade 4; the latter included more demanding items than in Grades 1 to 3. Both versions comprised 28 items, including addition and subtraction items in Grades 1, 2 and 3, and addition, subtraction, division, and multiplication items in Grade 4. Scores were calculated as the number of correct responses within a three-minute time limit (maximum = 28). Cronbach's alpha values in Grades 1, 2, 3, and 4 were .98, .86, .68, and .85, respectively. Scores were standardized within grade levels to enable assessment of progress in the ESS and LLS groups as compared to the control group.

2.2.5. Data Analyses

IBM's SPSS Statistics 26 program was used to perform the statistical analyses. Descriptive statistics (frequencies, percentages, means, and standard deviations) were used to specify learning difficulties in Grade 1, using cross-tabulation with χ^2 tests to identify any differences between ESS

and LLS group skills in Grade 1. Independent samples t-testing was used to assess any differences between the two groups in terms of additional difficulties in Grade 1. Analysis of variance was performed in Grade 4 to identify any differences between the two support groups and the control group in terms of initial skills (reading fluency, reading comprehension, and arithmetic fluency) in Grade 1, as well as final skill levels at the last time point. Using Cohen's *d* (Cohen, 1992), effect sizes were calculated to estimate the magnitude of any differences between the three groups (.20 = small, .50 = medium, .80 = large). Mixed-design ANOVAs were used to investigate differences in development of these skills among the three groups. Grade level (1, 2, 3, 4) was used as the within-subjects factor, and group (ESS, LLS, control) served as the between-subjects factor. In all analyses of academic skills, standardized scores were used to demonstrate relative differences between the two support groups (ESS and LLS) as compared to the control group. The use of standardized scores also enabled group comparisons of skills (reading fluency, reading comprehension, and arithmetic fluency). As standardization was performed separately for each grade and measure, the main effect of grade is not reported in the mixed-design ANOVAs.

3. Results

3.1. Reasons for Part-Time Special Education Provision and Students' Additional Difficulties

To begin, we investigated SEN teachers' reported reasons for part-time special education provision in Grade 1, and the extent to which those reasons differed for the ESS and LLS groups. Reasons were assigned to four main categories and 11 sub-categories (see Table 1). The teachers' reports showed, first, that there were various reasons for part-time special education provision in Grade 1, and that some students required support for several reasons. The two most frequently mentioned reasons were reading difficulty (RD; 69%) and expressive language difficulty (30%); the least frequent was arithmetic difficulty (6%). For both ESS and LLS groups, the most frequent reason for part-time special education was RD, followed by expressive language difficulty.

Table 1

Main Reasons for Part-Time Special Education Provision for Grade 1 Students (n = 130) as Reported by SEN Teachers

Main reason for support	Student sample (n = 130) %	ESS group N = 55 % (n)	LLS group N = 75 % (n)
Reading difficulty (RD): total	69		
RD alone		44 (24)	39 (29)
RD with expressive language difficulty		5 (3)	7 (5)
RD with arithmetic difficulty		2 (1)	7 (5)
RD with attention difficulty		4 (2)	7 (5)
RD with some other difficulty ^a		7 (4)	16 (12)
Expressive language difficulty ^a : total	30		
Expressive language difficulty alone		31 (17)	17 (13)
Expressive language difficulty with RD		5 (3)	7 (5)
Expressive language difficulty with attention difficulty		2 (1)	0 (0)
Arithmetic difficulty: total	6		
Arithmetic difficulty alone		0 (0)	1 (1)
Arithmetic difficulty with RD		2 (1)	7 (5)
Arithmetic difficulty with some other difficulty ^b		2 (1)	0 (0)
Other difficulty ^a , total	5	4 (2)	7 (5)

Note. ^aExpressive language difficulty = e.g., distortions of /s/ or /r/ sounds; ^bOther difficulty = behavior difficulty, motor difficulty, memory difficulty, socioemotional difficulty, perception difficulty, slowness in learning.

The sum exceeds 100% because teachers reported that most students had several difficulties.

We then examined students' additional learning-related difficulties in Grade 1 as reported by SEN teachers, and any differences between ESS and LLS groups in the reported extent of those difficulties (see Table 2). The most frequently reported additional difficulty was attention difficulty

(64% in the ESS group versus 85% in the LLS group). Memory difficulty was the second most common additional difficulty in both support groups (62% in the ESS group versus 79% in the LLS group).

Table 2

Students' Additional Learning-Related Difficulties in Grade 1 as Reported by SEN Teachers

	ESS group <i>N</i> = 55 % (<i>n</i>)	LLS group <i>N</i> = 75 % (<i>n</i>)
Learning difficulty		
Attention difficulty ^a	64 (35)	85 (64)
Memory difficulty ^b	62 (34)	79 (59)
Receptive language difficulty ^c	58 (32)	77 (58)
Motivation difficulty ^d	55 (30)	72 (54)
Perception difficulty ^e	53 (29)	65 (49)
Expressive language difficulty ^f	51 (28)	51 (38)
Motor difficulty ^g	44 (24)	55 (41)
Socio-emotional difficulty ^h	53 (29)	44 (33)
Behavior difficulty ⁱ	29 (16)	27 (20)

Note. ^aConcentration, impulsivity, executive functioning; ^bauditory memory, forgetfulness; ^cnaming, vocabulary, comprehension of speech; ^dwork orientation, self-esteem, persistence; ^edirections, left-right; ^farticulation, stuttering, voice difficulty; ^gfine motor skills, gross motor skills; ^htimidity, anxiety, exhaustion, friendships; ⁱaggressiveness, defiance, harassment.

We were also interested in how the ESS and LLS groups differed in terms of additional difficulties. While the vast majority of students in both groups had several additional difficulties, the percentage of students with each difficulty was systematically higher in the LLS group (with the exception of socio-emotional difficulty). The χ^2 test revealed that the two groups differed in terms of the frequency of teacher-reported difficulties in four categories: attention difficulty ($\chi^2(1) = 8.2$, adjusted standardized residual = 2.9, $p = .004$), receptive language difficulty ($\chi^2(1) = 5.4$, adjusted standardized residual = 2.3, $p = .02$), memory difficulty ($\chi^2(1) = 4.4$, adjusted standardized residual = 2.1, $p = .04$), and motivation difficulty ($\chi^2(1) = 4.2$, adjusted standardized residual = 2.1, $p = .04$).

Based on the teachers' reports, students in the ESS group had an average of 4.67 difficulties ($SD = 2.69$) while the LLS group averaged 5.55 difficulties ($SD = 2.39$). Independent samples t-testing indicated that the difference between the two groups in terms of total difficulties was barely non-significant ($t(128) = -1.954, p = .053$).

3.2 Differences in Skill Levels in Grade 1

We then investigated the extent to which the ESS and LLS groups differed in reading fluency, reading comprehension, and arithmetic fluency skills in Grade 1 when compared to the control group. The ANOVA results revealed significant differences between the groups in all tested skills (see Table 3). Post hoc tests with Bonferroni corrections showed that the LLS group differed from the control group in reading fluency ($p < .001$), reading comprehension ($p < .001$), and arithmetic fluency ($p < .01$). The difference between the ESS group and the control group was statistically significant for reading fluency ($p = .001$) and reading comprehension ($p = .05$) but not arithmetic fluency ($p = .175$). Finally, differences between the LLS and ESS groups were not significant for reading fluency ($p = .114$), reading comprehension ($p = .161$), or arithmetic fluency ($p = 1.000$).

Table 3

Standardized Scores and Significant Group Differences in Reading Fluency, Reading Comprehension, and Arithmetic Fluency (Grade 1)

Skill	ESS group n = 52–53		LLS group n = 74–75		Control group n = 1909–1924		$F(2, 2035–2049)^a$
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Reading fluency	-.44 ^y	1.00	-.81 ^y	.78	.04 ^z	.99	32.28***
Reading comprehension	-.37 ^y	.99	-.71 ^y	.84	.04 ^z	.99	24.09***
Arithmetic fluency	-.24 ^{y,z}	1.01	-.36 ^y	.91	.02 ^z	1.00	6.78***

Note. *** $p < 0.001$. ^a Degrees of freedom vary between 2035–2049 due to missing values in dependent measures (reading fluency, reading comprehension, and arithmetic fluency).

^{y,z} Groups with different superscripts differed significantly ($p < .05$).

Table 4 shows pairwise comparisons of group means and effect sizes (see Cohen, 1992) in Grade 1. The effect sizes of group differences between LLS and the control group were large for reading fluency and reading comprehension and small for arithmetic fluency. The effect sizes of differences between ESS and the control group were small for all three skills, as were the differences between the LLS and ESS groups.

Table 4

Effect Sizes of Group Differences in Reading Fluency, Reading Comprehension, and Arithmetic Fluency (Grade 1)

Skill	Control group vs. ESS group	Control group vs. LLS group	ESS group vs. LLS group
	Effect size ^a	Effect size ^a	Effect size ^a
Reading fluency	0.49	0.95	0.43
Reading comprehension	0.41	0.81	0.39
Arithmetic fluency	0.26	0.40	0.12

Note. ^a Cohen's *d* (Cohen, 1992)

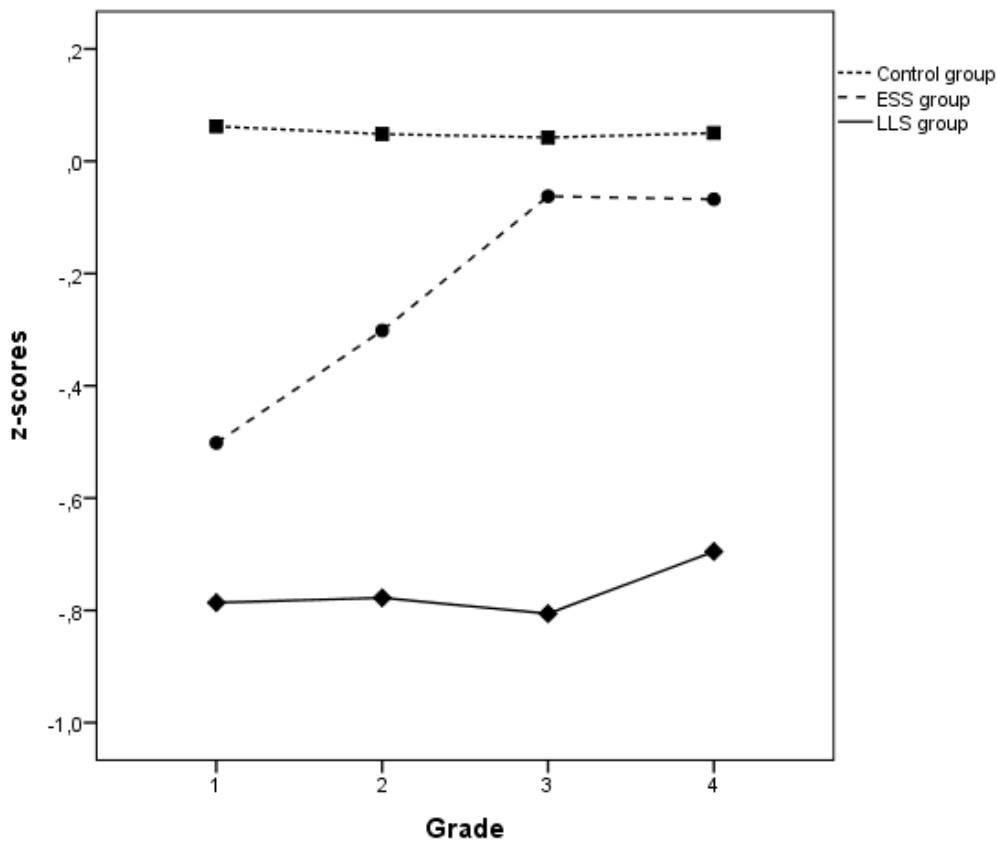
3.3. Differences in Skill Development (Grades 1 to 4)

The third research question investigated differences in the development of reading fluency, reading comprehension, and arithmetic fluency between the three groups in Grades 1 to 4. Using mixed-design ANOVA, separate analyses were performed for each academic skill. Grade (1, 2, 3, and 4) was used as the within-subjects factor, and group (ESS group, LLS group, and control group) served as the between-subjects factor.

The mixed-design ANOVA for reading fluency identified a significant Grade x Group interaction effect ($F(6, 3710) = 3.75, p < .01, \eta_p^2 = .006$). To further assess differences between the groups in reading fluency development between Grades 1 and 2, Grades 2 and 3, and Grades 3 and 4, we tested for within-subject contrasts in Grade x Group interaction. The effect was significant for development between Grades 2 and 3 ($F(2, 1857) = 3.70, p < .05, \eta_p^2 = .004$) but not for any other

period, indicating differences in reading fluency development between Grades 2 and 3. Post hoc pairwise comparisons (see Figure 1) of reading fluency improvement between Grades 2 and 3 showed that the ESS group had made greater gains in reading fluency than the control group ($F(1, 1873) = 6.89, p < .01, \eta_p^2 = .004$) or the LLS group ($F(1, 125) = 5.57, p < .05, \eta_p^2 = .04$), but there was no difference in reading fluency development between the LLS group and the control group ($F(1, 1896) = 0.91, p = .76, \eta_p^2 = .000$).

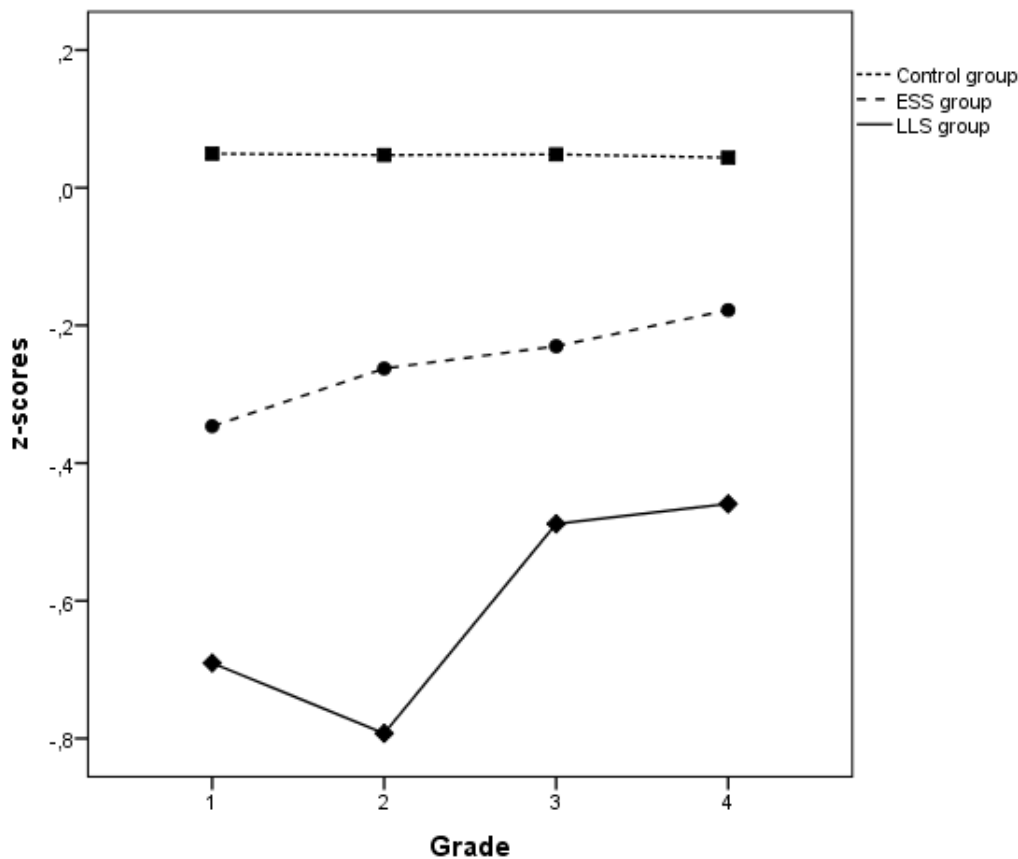
Figure 1. *Progress in Reading Fluency (Grades 1, 2, 3, and 4): Control Group, Early-Stage Support (ESS) Group, and Long-Lasting Support (LLS) Group*



In the mixed-design ANOVA for reading comprehension, the main effect of Group was significant ($F(2, 1817) = 28.16, p < .001, \eta_p^2 = .03$). The Grade x Group interaction effect was non-significant ($F(6, 3630) = 1.96, p = .07, \eta_p^2 = .003$), indicating similar development in all groups. In pairwise post-hoc analyses with Bonferroni correction (see Figure 2), the control group exhibited

better reading comprehension skills than the LLS ($p < .001$) and ESS ($p < .05$) groups. In addition, the ESS group outperformed the LLS group in reading comprehension ($p < .05$).

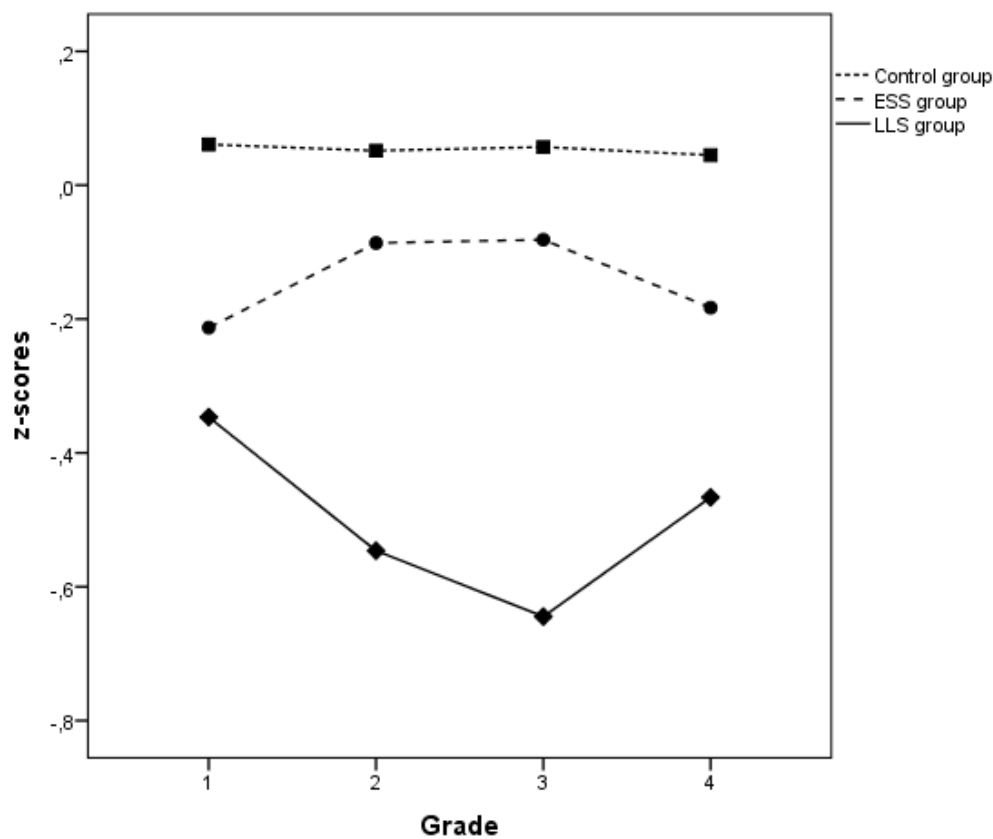
Figure 2. *Progress in Reading Comprehension (Grades 1, 2, 3, and 4): Control Group, Early-Stage Support (ESS) Group, and Long-Lasting Support (LLS) Group*



Finally, in the mixed-design ANOVA for arithmetic fluency, the main effect of Group was significant ($F(2, 1848) = 15.56, p < .001, \eta_p^2 = .017$), and there was a significant Grade x Group interaction effect ($F(6, 3692) = 2.27, p < .05, \eta_p^2 = .004$). To further assess differences between the groups in the development of arithmetic fluency across grade levels, we analyzed within-subjects contrasts in Grade x Group interaction and found a significant group difference in development between Grades 3 and 4 ($F(2, 1848) = 3.27, p < .05, \eta_p^2 = .004$). Post hoc pairwise comparisons with Bonferroni corrections (see Figure 3) showed that arithmetic fluency had improved more in the

LLS group than in the control group ($F(1,1885) = 5.69, p < .05, \eta_p^2 = .003$). There were no significant differences between the ESS group and the control group ($F(1, 1859) = .54, p = .46, \eta_p^2 = .000$) or between the ESS and LLS groups ($F(1, 118) = 3.62, p = .06, \eta_p^2 = .03$).

Figure 3. *Progress in Arithmetic Fluency (Grades 1, 2, 3, and 4): Control Group, Early-Stage Support (ESS) Group, and Long-Lasting Support (LLS) Group*



3.4. Skills Differences in Grade 4

As well as investigating differences in the development of academic skills across the three groups, we also investigated differences in reading fluency, reading comprehension, and arithmetic fluency at the final assessment point at the end of Grade 4 (see Table 5). The ANOVA results indicated that the LLS group differed from the control group on all three skills. Post hoc tests with Bonferroni corrections showed that the LLS group differed from the control group in reading

fluency ($p < .001$), reading comprehension ($p < .001$), and arithmetic fluency ($p < .001$). No differences were found between the ESS group and the control group. The differences between the ESS and the LLS groups were statistically significant for reading fluency ($p < .01$) but non-significant for reading comprehension and arithmetic fluency.

Table 5

Standardized Scores and Significant Group Differences in Reading Fluency, Reading Comprehension, and Arithmetic Fluency in Grade 4

Skill	ESS group n = 47		LLS group n = 73		Control group n = 1829–1834		$F(2, 1949-1954)^a$
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
Reading fluency	-.09 ^{y,z}	.97	-.69 ^y	.96	.03 ^z	.99	19.04***
Reading comprehension	-.19 ^{y,z}	1.05	-.45 ^y	1.03	.02 ^z	.99	8.92***
Arithmetic fluency	-.17 ^{y,z}	1.13	-.47 ^{y,z}	.97	.02 ^z	.99	9.22***

Note. *** $p < 0.001$

^a Degrees of freedom vary between 1949–1954 due to missing values in dependent measures (reading fluency, reading comprehension, and arithmetic fluency).

^{y,z} Groups with different superscripts differed significantly from each other ($p < .05$).

ESS = early-stage support group, LLS = long-lasting support group.

Table 6 shows pairwise comparisons of group means and effect sizes (see Cohen, 1992) in Grade 4. The effect sizes of differences between the LLS group and the control group were large for reading fluency, medium for arithmetic fluency, and small for reading comprehension. The effect sizes of differences between the ESS group and the control group were small for all three skills. The effect sizes of differences between the LLS and ESS groups were medium for reading fluency and small for reading comprehension and arithmetic fluency.

Table 6

Effect Sizes of Group Differences in Reading Fluency, Reading Comprehension, and Arithmetic Fluency in Grade 4

Skill	Control group vs. ESS group	Control group vs. LLS group	ESS group vs. LLS group
	Effect size ^a	Effect size ^a	Effect size ^a
Reading fluency	0.13	0.75	0.63
Reading comprehension	0.26	0.47	0.25
Arithmetic fluency	0.19	0.50	0.29

Note. ^a Cohen's *d* (Cohen, 1992)

ESS = early-stage support group, LLS = long-lasting support group

4. Discussion

4.1. General Discussion

The study investigated the development of reading fluency, reading comprehension, and arithmetic fluency in two groups (ESS and LLS) that had received part-time special education support for 1–2 years and 3–4 years, respectively, as compared to a control group. The aim was to identify teacher-reported reasons for part-time special education provision, and how additional learning-related difficulties in Grade 1 pertained to duration of support. The study also examined the development across Grades 1 to 4 of reading fluency, reading comprehension, and arithmetic fluency and skill levels in the two support groups at two timepoints (Grade 1 and Grade 4).

The results indicate the differing developmental trajectories of the two support groups across Grades 1 to 4. By Grade 4, students in the ESS group had caught up with their control group peers, confirming the benefit of short support periods. These results align with earlier evidence that struggling students can usually improve their literacy skills with individual attention or small group intervention (Denton, 2006; Griffiths & Stuart, 2013; Kikas et al., 2015). While the need for support may decrease after Grade 1 or 2, our findings show that students with persistent and overlapping learning difficulties (the LLS group) generally received part-time special education support throughout their early school years. This suggests that some students may need more intensive and targeted intervention based on systematic assessment of core difficulties if they are to catch up with their typically achieving peers (see Denton et al., 2006; Denton, 2012). However, there is also

evidence that frequent individual support of this kind (> 48 h per year) may be associated with slower skills development (Holopainen et al., 2018).

4.2. Reported Reasons for Part-Time Special Education; Overlapping Difficulties

As we anticipated, RD was the most frequently reported reason for provision of part-time special education for both support groups in Grade 1. This is understandable in light of the selection criteria for individual follow-up (i.e., identified risk for RD). According to Official Statistics of Finland (2018), RD is the most common reason for part-time special education at the beginning of primary school in Finland. As we hypothesized, expressive language difficulty alone was the second most common reported reason for support in both groups. Unexpectedly, however, arithmetic difficulty was relatively infrequently identified in both groups as a reason for part-time special education. It is conceivable that the tasks used to evaluate early-stage arithmetic skill acquisition may not reveal difficulties in fluency (Koponen et al., 2018), so complicating precise identification of the difficulty. Previous studies (e.g., Zhang et al., 2020) have also reported that difficulties in arithmetic fluency become apparent only after they begin to accumulate.

Although differences between the LLS and ESS groups in terms of additional learning-related difficulties reported by teachers did not quite reach the accepted significance level (.05), the LLS group outnumbered the ESS group in four categories: attentional difficulty, receptive language difficulty, memory difficulty, and motivation difficulty. As we anticipated, the most frequently reported RD-related issue in both support groups was attention difficulty, and this aligns with earlier studies (Grills-Taquechel et al., 2013; Prochnow et al., 2013; Peterson et al., 2017). The inattentive subtype of ADHD (ADHD-I) is more strongly linked with difficulties in learning than hyperactivity-impulsivity (Masseti et al., 2008). In particular, children who exhibit inattentiveness at school entry continue to have poor literacy outcomes throughout elementary school (Prochnow et al., 2013) or poorer reading and mathematics outcomes when compared to a control group without ADHD (Masseti et al., 2008).

Contrary to expectation, there were no reports of overlap between arithmetic difficulty and the main reasons for part-time special education provision. This may reflect SEN teachers' lower preparedness to identify children struggling with math. In Finnish schools, learning to read and spell are generally considered the key skills to be acquired at the beginning of compulsory education (Takala et al., 2009; Takala & Ahl, 2014). Additionally, SEN teacher education typically emphasizes literacy assessment and interventions, which prepare teachers to support students with reading difficulties more than those struggling with arithmetic. The observed co-occurrence of RD and expressive or receptive language difficulty aligns with previous evidence (Cabbage et al., 2018; Isoaho et al., 2016; Skibbe et al., 2008; Snowling & Melby-Lervåg, 2016) regarding difficulties in developing academic skills. Although language impairment is known to be highly heterogeneous, it has been shown to constitute a significant risk of literacy learning difficulties for some school-age children (Isoaho et al., 2016).

There is also evidence that deficits in working memory contribute to poor school achievement, especially in reading and math, and co-occurrence with ADHD and working memory problems has been reported across Grades 2 to 4 (Maehler & Schuchardt, 2016). Low school motivation has also been linked to poor reading and math performance and low academic well-being, as well as to risk of eventual education dropout (Parhiala et al., 2018; Torppa et al., 2020; Korhonen et al., 2014), although these findings relate to older students (i.e., 15–16-year-olds).

Existing evidence that overlapping difficulties can obscure the main difficulty and so complicate targeted support highlights the importance of early identification, thorough evaluation of skills, and periodic individual assessment (Peterson et al., 2017). Students with co-occurring learning difficulties and ADHD have previously manifested a lack of responsiveness to support (DuPaul et al., 2013; Vaughn & Fuchs, 2003). Our study lends support to these findings and confirms that co-occurrence of learning and other difficulties seems to increase the risk of non-responsiveness to support. It has also been shown that students with overlapping difficulties

experience poorer outcomes in all areas than peers whose difficulty is confined to a single domain (Cirino et al., 2015; Willcutt et al., 2013) and tend to respond inadequately to proven interventions (Fuchs et al., 2004).

4.3. Skills Development: Grades 1 to 4

As expected, the ESS group differed somewhat from the control group in Grade 1 reading fluency and comprehension but not in arithmetic fluency. As also expected, the skills gap between ESS and control group narrowed, and there was no significant difference between them at the final follow-up point in Grade 4. One possible explanation for this positive development is that support could be accurately targeted because the most commonly reported reason for part-time special education provision in the ESS group was RD alone (44%) or expressive language difficulty alone (31%).

As hypothesized, the LLS group and the control group differed on every skill in Grade 1. Across Grades 1 to 4, the LLS group was slower than the control group in developing reading fluency, reading comprehension, and arithmetic fluency, and those differences persisted until Grade 4. Grade 1 effect sizes show that the two support groups differed in terms of starting points for reading fluency (.43) and reading comprehension (.39), both of which favored the ESS group. While there were no statistically significant differences between the ESS and LLS groups in Grade 1, the former had achieved better reading fluency by Grade 4. In consistent orthographies like Finnish, dysfluency is the most widely acknowledged indicator of RD risk (Eklund et al., 2015; Torppa et al., 2017; Solheim et al., 2020; Share, 2008). In such transparent orthographies, accurate decoding skill is relatively easy to master, even for those at risk for RD, but they may encounter persistent reading fluency difficulties in later grades (Torppa et al., 2017). Students in the ESS group exhibited reading difficulties on commencing school, but these were resolved once they learned to decode and achieved typical reading accuracy (see Torppa et al., 2015). In contrast, fluency difficulties are often persistent (Moll et al., 2020) and less easily remediated.

The slower development of academic skills in the LLS group can be partly explained by the greater number of reported reasons for part-time special education provision (e.g., RD with arithmetic difficulty, RD with some other difficulty) as compared to the ESS group. Although the LSS group exhibited significantly more difficulties related to attention, receptive language, memory, and motivation, there was no significant difference between the groups in terms of overlapping learning-related difficulties. To meet specific individual needs, the offered support must address a wide range of learning-related challenges, which explains the weaker response to support and the observed need to prolong that support. Recent studies have also shown that overlapping reading and arithmetic difficulties are more stable than single-domain difficulties (Koponen et al., 2018; Cirino et al., 2018), and Griffiths and Stuart (2013) and Soodla et al. (2019) have suggested that efficacy of intervention is not necessarily linked to duration. Other studies (e.g., Soodla et al., 2019; Vaughn & Wanzek, 2014; Wanzek et al., 2014) have also reported that the persistent nature of some students' learning challenges makes these difficult to remediate, even with special educational support over several years.

While all students who show early signs of learning difficulties can be provided with part-time special education, that support may end once they have acquired the typical age-level skills, and this requires systematic progress monitoring. In the present case, SEN teachers provided support over a longer period to students with more severe or comorbid difficulties while students who reached their classmates' typical skill level were supported for a shorter time.

4.4. Limitations

The present study has some limitations that should be addressed in future research. First, this study was conducted in educational settings within a single European country, and Finland's education system differs in a number of respects from other countries. For example, Finnish children enter first grade at seven years of age, which is 1 or 2 years later than in many other countries. Additionally, the provision of part-time special education is not based on any formal

diagnosis. It follows that our results cannot necessarily be generalized to other learning contexts. Second, this study focused on duration rather than extent of support, which has been investigated using the same follow-up data from Grades 1 and 2 in a recent study by Holopainen et al. (2018). Third, we did not address the methods used by SEN teachers to identify support needs or to provide support, although teachers' ability and their approach to identifying reading difficulties in Grades 1 and 6 have been explored in recent studies using the same follow-up data (Virinkoski et al., 2018; Virinkoski et al., 2020). To deepen understanding of the relationship between part-time special education and skills development, it would be useful to incorporate earlier evidence. Finally, all of the achievement tests used in this study were group-administered, which can be more difficult to monitor and control in terms of ensuring that students correctly understand and are properly focused on the task.

4.5. Conclusions and Implications for Practice

This study examined the efficacy of part-time special education in Finland as currently implemented across Grades 1 to 4. Despite the scarcity of assessment tools, variations in assessment practices, and the absence of standardized follow-up procedures, special education resources in Finland seem to be used flexibly and in many cases align well with individual needs. This view is supported by the ESS group's ability to catch up with their classmates and the decisions taken by SEN teachers to confine extra support for these students to one or two years. A recent comparative study of reading acquisition rates in Norway and Finland by Solheim et al. (2020) confirmed that early identification followed by intensive support is the most effective solution to literacy learning difficulties. Targeted early intervention for students who need it most requires close attention to how students respond to instruction in the first months of school. This ensures that students whose progress is slower than expected can receive more intensive support in small groups while others continue with mainstream classroom instruction (Solheim et al., 2020). To provide targeted support,

learning difficulties must be assessed using screening instruments that are sensitive to national educational context, including issues such as orthography (Solheim et al., 2020).

The present findings confirm that students who experience persistent difficulties in reading fluency in tandem with other learning-related difficulties typically receive part-time special education for several years. Unfortunately, it seems clear that this support does not help these students to catch up with their peers in terms of academic skills. Although the Finnish education system allocates significant resources to early needs-based support of this kind, support decisions generally depend on teachers' observations (Virinkoski et al., 2018; Virinkoski et al., 2020), and it appears that SEN teachers may lack both the time and the competence to help students with multiple learning challenges (see Cancio et al., 2018; Langher et al., 2017). It seems likely that more effective and individually targeted methods of assessment and support are needed for these students, but further research is needed to clarify this issue.

In conclusion, for students with mild or limited learning difficulties, shorter support periods of part-time special education seem adequate to enable them to catch up with their peers. However, for students with persistent and multiple overlapping learning challenges, even the longer support currently offered seems insufficient. As we did not consider the nature and extent of that longer support, it remains a possibility that even individually tailored and carefully targeted support may not help those students.

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