Continuity and change in Ireland's schools and classrooms:

TIMSS 2011-2023

Vasiliki Pitsia, Gráinne McHugh, Sylvia Denner and Aidan Clerkin

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Primary

Aedín Ní Thuathail (Irish Primary Principals' Network)

Áine Lynch (National Parents Council – Primary)

Cormac Ó Tuairisg (Gaeloideachas)

Eddie Fox (Educate Together)

Mark Bohan (Department of Education and Youth)

Máirín Ní Chéileachair (Irish National Teachers' Organisation)

Micheál Killilea (Department of Education and Youth, Social Inclusion Unit)

Noreen Fiorentini (Department of Education and Youth Inspectorate, Chair)

Patrick Sullivan (National Council for Curriculum and Assessment)

Rory Collins (Oide)

Seán Delaney (Marino Institute of Education)

Post-primary

Anne O'Dwyer (Mary Immaculate College)

Elizabeth Smith (Department of Education and Youth)

Gerry Hyde (State Examinations Commission)

Kathy O'Sullivan (University of Galway)

Linda Ramsbottom (Department of Education and Youth Inspectorate, Chair)

Liz O'Neill (Department of Education and Youth)

Mark Bohan (Department of Education and Youth)

Niamh O'Meara (University of Limerick)

Oliver McGarr (University of Limerick)

Páraic Treacy (Mary Immaculate College)

Paul Behan (National Council for Curriculum and Assessment)

Rachel Linney (National Council for Curriculum and Assessment)

Ryan Gallagher (University College Cork)

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Acronyms and abbreviations

AI	Artificial Intelligence
CBA	Classroom-Based Assessment
COGG	An Chomhairle um Oideachas Gaeltachta & Gaelscolaíochta
CREATE	Centre for Collaborative Research Across Teacher Education (Dublin City University)
DEIS	Delivering Equality of Opportunity in Schools
ERC	Educational Research Centre
ETB	Education and Training Board
IEA	International Association for the Evaluation of Educational Achievement
NAMER	National Assessments of Mathematics and English Reading
PDMT	Professional Diploma in Mathematics for Teaching
PIRLS	Progress in International Reading Literacy Study
PISA	Programme for International Student Assessment
PLC	Post-Leaving Certificate
PME	Professional Master of Education
SSE	School Self-Evaluation
STEM	Science, Technology, Engineering, and Mathematics
TIMSS	Trends in International Mathematics and Science Study

Chapter 1: Introduction

The *Trends in International Mathematics and Science Study* (TIMSS) is an international study examining educational achievement in mathematics and science. TIMSS provides 28 years of trend data (1995-2023) to support countries in making informed policy decisions. This report presents findings related to school and classroom environments, as well as mathematics and science teaching and learning, in Ireland's primary and post-primary schools, drawing on TIMSS data between 2011 and 2023.

This chapter provides a brief description of TIMSS and the participating samples of schools and students in TIMSS 2023 in Ireland. An overview of selected previous findings is provided as an introduction to the topics that will be examined in this report, together with a discussion of the recent policy context related to mathematics and science teaching and learning in schools in Ireland. A summary and discussion of the key findings of this report is presented in Chapter 7.

What is TIMSS?

TIMSS is an international study that evaluates the mathematics and science knowledge and skills of students in Fourth Grade (Fourth Class in Ireland) and Eighth Grade (Second Year in Ireland) across participating countries. It provides both national and international comparative data to support policymakers and educators in making informed decisions. The study is directed by the TIMSS and PIRLS International Study Center at Boston College, USA and is managed by the International Association for the Evaluation of Educational Achievement (IEA), a non-profit consortium of research institutes. In Ireland, the Educational Research Centre (ERC) managed the country's participation in TIMSS 2023, as well as in previous cycles, on behalf of the Department of Education and Youth.

TIMSS is conducted every four years, with the first assessment taking place in 1995. TIMSS 2023 was the eighth cycle, with 65 participating countries (59 at Fourth Grade and 44 at Eighth Grade). Ireland has participated in five cycles of TIMSS: 1995, 2011 (at Fourth Grade only), 2015, 2019, and 2023. In the 2023 cycle, almost all participating countries, including Ireland, administered the study digitally.

Who took part in TIMSS 2023 in Ireland?

In total, 4,750 Fourth Class pupils from 153 primary schools and 5,090 Second Year students from 153 post-primary schools participated in TIMSS 2023. Table 1.1 shows the number of schools and proportions of students in TIMSS 2023 by school gender and school DEIS (Delivering Equality of Opportunity in Schools)[1] status category, in order to provide some contextual information that may assist readers when interpreting the data presented in the following chapters, as well as the appendices, which are published separately as supplementary materials to this report and can be accessed at https://doi.org/10.70092/2091333.0925.

1 More information about the DEIS programme is provided later in this chapter and can also be accessed through relevant resources on gov.ie.

Table 1.1: Description of TIMSS 2023 dataset by school gender and DEIS status, Fourth Class and Second Year

		Fourth Class		Second Year	
		N schools	% pupils (weighted)	*N* schools	% students (weighted)
Overall		153	100	153	100
School gender	**All boys**	13	9	24	15
	All girls	11	7	26	17
	Mixed	129	84	103	68
School DEIS status	**DEIS Urban 1**	16	10		
	DEIS Urban 2	14	11		
	DEIS Rural	11	9		
	DEIS			49	31
	Non-DEIS	112	70	104	69

The data presented in this report were primarily provided by the school principals and the mathematics and science teachers of participating students (typically the same teacher(s) at Fourth Class, but often different teachers at Second Year), with some data also provided by the students themselves. Further information provided by students and (at Fourth Class) their parents/guardians, can be found in separate TIMSS 2023 reports for Ireland (Clerkin et al., 2025; Denner, Clerkin, et al., 2025; Piccio et al., in press).

It should be noted that TIMSS is not designed to be representative of schools or of teachers, but it does provide nationally representative data for students and for students' educational experiences. For this reason, the percentages shown in tables and graphs refer to students, classified by the types of schools they attend and the types of teachers they have, rather than to school principals or teachers themselves. This means that the data reported in subsequent chapters can be considered as being representative of Fourth Class pupils' or Second Year students' experiences of school and of their classroom environments, as well as mathematics and science teaching and learning.

The landscape of Ireland's schools and classrooms

In this section, we provide a brief overview of selected policy-related and practical matters that are relevant to the administration and organisation of schools and classrooms in Ireland at present, with a particular focus on the changing landscape of resource availability, instruction, and classroom practices. In so doing, we do not claim to present an exhaustive description of all the factors that can affect how schools and classrooms operate – rather, we focus on areas where the TIMSS data presented in this report may offer further insight or may provide more up-to-date information than has previously been available. For example, among others, School Self-Evaluation (SSE), introduced to all schools in 2012 (Department of Education and Skills, 2012), is a central initiative designed to enhance the quality of education for all students at both primary and post-primary levels. Since its introduction, schools have adopted various approaches to using SSE for enhancing teaching, learning, and student wellbeing. While SSE is mandatory for all schools and plays a crucial role in shaping educational quality across the system, the TIMSS data presented in this report do not directly address the SSE process. As such, this section does not delve into the specifics of SSE. A number of areas where analysis of TIMSS data can provide valuable insights are noted next.

Previous research findings

Recent national reports for Ireland from the TIMSS 2023 study have shown that student performance in mathematics and science has been largely stable since 2015, and that students in Ireland achieve at a comparatively high level relative to their international peers in mathematics, science, and environmental knowledge (Clerkin et al., 2025; McHugh et al., 2024). However, issues of concern that have been identified include a significant gender gap, in favour of boys, at Second Year (but not Fourth Class) (Clerkin et al., 2025; McHugh et al., 2024) and substantial variation in achievement related to socioeconomic disadvantage at both the school (DEIS status) and student levels. In addition, Denner, Clerkin, et al. (2025) found evidence that student attitudes towards mathematics, science, and school have declined in several respects between 2015 and 2023. Variation in student attitudes in terms of school gender and school DEIS status can also be seen (Denner, Clerkin, et al., 2025).

These findings from TIMSS 2023 provide a backdrop for the current report, which focuses on describing the mathematics and science learning environments for Fourth Class pupils and Second Year students at both the school and classroom levels. The analyses presented in subsequent chapters will include examination of differences, where relevant, by school gender and school DEIS status. We also examine trends in school and classroom characteristics over the four most recent cycles of TIMSS in which Ireland has participated: 2011 (Fourth Class only), 2015, 2019, and 2023. In discussing these findings, we draw on previous reporting from earlier cycles of TIMSS and other relevant studies as points of reference against which new developments and points of interest in Ireland's schools and classrooms can be identified and interpreted.

At a high level, a key point to note is that national and international large-scale assessments have repeatedly shown that the variance in mathematics, science, or reading achievement outcomes between schools in Ireland – rather than between students – is generally low, particularly at primary level (Gilleece & Clerkin, 2020). In general, multilevel models that examine student- and class/school-level variables together in the Irish context tend to find that few class/school-level variables independently explain variance in achievement when student-level characteristics are accounted for. For example, analyses of data from TIMSS and the Progress in International Reading Literacy Study (PIRLS) (Cosgrove & Creaven, 2013; Pitsia, 2021), the National Assessments of Mathematics and English Reading (NAMER) (Kiniry et al., 2025), and the Programme for International Student Assessment (PISA) (Cosgrove & Cunningham, 2011; Denner, O'Leary, & Shiel, 2025; Pitsia, 2022; Shiel et al., 2022) have found that only school-level indicators of socioeconomic disadvantage, such as DEIS status, were statistically significantly associated with achievement. Even so, recent trend analyses suggest that the relationship between school DEIS status and student achievement weakened between NAMER 2009 and 2014 (Karakolidis et al., 2021), and between TIMSS 2011 and 2019 (Duggan et al., 2023).

The consistency of this finding means that differences in school characteristics tend to be of limited utility in explaining differences in student achievement (Gilleece & Clerkin, 2020). It also implies that student outcomes – at least in terms of their mathematics, science, or reading proficiency – tend not to depend to a large extent on the school they attend. Given this, we do not present bivariate relationships between student achievement and the school and classroom variables described in this report, as a thorough examination of the links between school and classroom characteristics are better suited to multivariate and multilevel analyses. Nonetheless, school is a key setting for the social, personal, and academic development of all students. It is important to monitor and evaluate current educational practices, resources, and needs – both to equip policymakers and practitioners with the most up-to-date information about the operation of schools and classrooms at a national level and to ensure that all students receive the best possible opportunities to learn and to grow.

An example of a previous finding that can now be usefully re-examined with more up-to-date data is the changing pattern of instructional time reported following TIMSS 2015. This showed that the time spent teaching mathematics in Fourth Class increased between 2011 and 2015, while the time spent teaching

science was substantially reduced over the same period (Clerkin et al., 2017). These changes corresponded with the introduction of the *National Strategy to Improve Literacy and Numeracy (2011-2020)* (Department of Education and Skills, 2011b) and the accompanying *Circular 0056/2011* (Department of Education and Skills, 2011a), which specified that the time for mathematics instruction for Fourth Class pupils should increase (by 70 minutes), to four hours and ten minutes per week. More recently, the *Primary Curriculum Framework* (Department of Education, 2023a) suggests four hours per week as a minimum time allocation for mathematics, and five hours per month for science, technology, and engineering education, plus eight hours per month for social and environmental education (both of which include elements of science as assessed in TIMSS). Seven hours of "flexible time" per month are also allocated within the *Primary Curriculum Framework*, which can be allocated at the school level in accordance with their particular needs and priorities. The current specifications for Junior Cycle mathematics and science indicate that the courses have been designed for a minimum of 240 hours and 200 hours, respectively, across the three-year span, which includes Second Year (Department of Education and Skills, 2015c, 2017d).

However, Martinez Sainz et al. (2023) have highlighted how the time allotted to various subject areas can vary in practice, with substantial proportions of primary teachers spending more than the recommended time on mathematics instruction while other subject areas – including science and geography which are presented as social, environmental and scientific education in the 1999 *Primary School Curriculum* – are vulnerable to receiving less than their recommended time allocation. A particularly noteworthy finding for Ireland from earlier cycles of TIMSS was that the time allocated to science instruction at primary level in Ireland was lower than in any other TIMSS country, both in absolute terms (number of hours) and relative terms (as a proportion of total instructional time) (Clerkin et al., 2017). At Second Year, the time allocated to both mathematics and science instruction was found to be relatively low in international terms (Clerkin et al., 2018), which could be linked to the shorter school year in Irish schools compared to other countries.[2] However, trend analysis of patterns of Second Year instructional time was not possible at that point as Ireland had participated in TIMSS 2011 at Fourth Class only. As a point of comparison, PIRLS data indicate that the time devoted to English language instruction in Fourth Class lessons remained broadly stable between 2016 and 2021 (Pitsia et al., 2024). The new data arising from TIMSS 2023 therefore provide a timely opportunity to examine the extent to which instructional time allocations and other classroom practices may have changed since 2015.

In general, Fourth Class pupils in Ireland have tended to be taught by a teacher with an undergraduate or (for a minority of pupils) postgraduate degree in primary education, with few pupils taught by a teacher with a specialised qualification in mathematics or science (Clerkin, 2013; Clerkin et al., 2017). At post-primary level, in TIMSS 2015, about one-third of Second Year students had a mathematics teacher whose main qualification was in mathematics but not (mathematics) education, and about half had a science teacher whose main qualification was in science but not (science) education (Clerkin et al., 2018), possibly indicating that some held a separate teaching qualification, such as a postgraduate diploma or degree rather than an undergraduate degree that combined subject content with education. Since that time, some changes in teacher qualifications may be expected. In 2014, the Professional Master of Education (PME) replaced the Higher Diploma in Education as the qualification route for both primary and post-primary teachers whose undergraduate degree was not in education. Another development, related to the specialisation of teachers at post-primary level, was the introduction of the Professional Diploma in Mathematics for Teaching (PDMT) in 2012, aimed particularly at out-of-field teachers teaching mathematics (Quirke, 2022), with research highlighting a downward trend in the proportion of out-of-field teachers teaching mathematics since its introduction (Goos et al., 2023). Several cohorts of graduates from these programmes have joined the teaching workforce since the TIMSS 2015 data were collected.

2 According to TIMSS 2023 data, primary schools in Ireland are open for 182 days per year (compared with an international average of 189), and post-primary schools are open for 166 days (compared with an international average of 190), the lowest among participating countries.

Although most teachers in Ireland typically express high levels of satisfaction with their work, contrasting patterns of job satisfaction can be seen according to school DEIS status, with higher levels of satisfaction being reported by teachers in DEIS schools than in non-DEIS schools at primary level (Clerkin, 2013; Clerkin et al., 2017), but lower job satisfaction reported by teachers in DEIS schools at post-primary level (Clerkin et al., 2018). Given that these findings pre-date the expansion of DEIS supports to additional schools in 2017 and 2022, and the implementation of a revised DEIS plan in 2017 (Department of Education and Skills, 2017b), it seems timely to re-examine the nature of teachers' own experiences in different settings as well as those of their students.

Considering the nature of TIMSS as a trend study that aims to provide comparable information as far as possible over time in order to support informed policymaking and monitoring of trends, a key focus of this report will be on examining areas where changes in the characteristics of Ireland's schools and classrooms can be seen. One topic of particular relevance in this regard relates to the availability and use of digital devices in education, given the increasing ubiquity of digital devices and the increasingly connected nature of modern life over the last decade. Data from PIRLS and TIMSS 2011 showed that more than half of Fourth Class pupils had some access to a computer in the classroom at that point, albeit that they were used by pupils relatively infrequently and often for relatively basic activities such as reading a story or looking up information (Clerkin, 2013). This is consistent with findings for Second Class and Sixth Class pupils that were reported in NAMER conducted around the same period (Eivers et al., 2010; Kavanagh et al., 2015). At post-primary level, McCoy et al. (2016) reported a similar pattern of improvements in infrastructure that were positively received by schools, but with slow progress in terms of pedagogical changes that build on the capabilities of enhanced access to devices and broadband. Using PISA 2015 data, McAteer et al. (2021) also reported a lower-than-average use of digital technology in schools in Ireland, despite investments by the Department of Education and Youth in this area around that time, and highlighted a complex interplay between the availability of technology, use of technology, and students' attitudes to using technology.

Since then, two iterations of the *Digital Strategy for Schools* have been published (Department of Education and Skills, 2015a; Department of Education, 2022a) along with a supporting *Digital Learning Framework* (Department of Education and Skills, 2017c) to support the integration of digital technologies and appropriate use of technology in teaching and learning. An evaluation of the *Digital Learning Framework* (Donohue et al., 2024) found several positive impacts, such as increased collaborative practices among teachers, increased engagement with digital technologies for pedagogy, and positive attitudes towards the use of technology among teachers and students (see also Symonds et al., 2020, for discussion of primary schools' changing use of digital technology during the COVID-19 pandemic). Nonetheless, a range of challenges were identified in the evaluation of the *Digital Learning Framework*. These included the consistently low use of digital technology for assessment, a clear need for improved infrastructure and connectivity, particularly in primary schools, and a need for greater technical support for schools (Donohue et al., 2024). In addition, many post-primary teachers express somewhat restricted views about how digital technologies could be used in their classroom practice, suggesting substantial room for more creative and innovative use of technology for pedagogical purposes (Feerick et al., 2022). The TIMSS data will provide a valuable resource, with nationally representative samples dating back to 2011 (primary) and 2015 (post-primary), to examine how the availability and use of digital resources for mathematics and science instruction have evolved up to 2023.

Policies and reforms relating to mathematics and science education in Ireland

The analyses presented in the subsequent chapters examine changes in school and classroom characteristics and practices over the period from 2011 (for Fourth Class) or 2015 (for Second Year) to 2023 (for both grade levels). Therefore, a brief description of selected significant policy and curricular developments relevant to mathematics and science education over this period is provided next. The aim is to facilitate interpretation of any changes observed in light of the overarching national policy context, where possible and relevant. However, it should be acknowledged that strong inferences of a direct causal impact of any given policy will be difficult to draw with the available data, particularly bearing in mind the difficulties of disentangling the effects of any individual policy change from changes in other policies and other external factors (Gilleece & Clerkin, 2025). Rather, we can seek to assess instances where policy developments, which are often inter-related with each other, may plausibly have had some effect or be, at least partially, related to changes observed over the corresponding timespan.

Primary School Curriculum

At primary level, the Fourth Class pupils participating in TIMSS from 2011 to 2023 received mathematics and science instruction based on the 1999 curricula (Department of Education and Science, 1999a, 1999b). More recently, at primary level, a new *Primary Mathematics Curriculum* (Department of Education, 2023b) has been developed with reference to an updated *Primary Curriculum Framework* (Department of Education, 2023a). This curriculum was initially introduced during the 2023-2024 school year and began to be implemented in schools during the 2024-2025 school year, with the *embedding* phase beginning from September 2025 (Department of Education, 2023c). These developments are of limited direct relevance to the characteristics of primary schools and Fourth Class classrooms that will be described in this report, as the Fourth Class pupils who participated in TIMSS 2023 – as well as those in TIMSS 2011, 2015, and 2019 – were taught under the outgoing mathematics curriculum (Department of Education and Science, 1999a). However, the TIMSS 2023 data provide a timely snapshot of mathematics instruction in primary schools at a point immediately before the new curriculum was introduced, which will enable comparisons to be drawn in the years ahead as further data are collected after the new curriculum and associated supports have become embedded. Similarly for science, work has been ongoing on developing a *Science, Technology and Engineering Education* specification as part of a broader redevelopment of the primary curriculum (National Council for Curriculum and Assessment, 2024). This specification, published in Autumn 2025, comprises, along with the *Primary Mathematics Framework*, the new science, technology, engineering, and mathematics (STEM) curriculum area.

Junior Cycle

At post-primary, substantial curricular reform has taken place over the last decade with the introduction of the Junior Cycle. The *Framework for Junior Cycle* set out a vision for how teaching, learning, and assessment would evolve with the introduction of the new framework (Department of Education and Skills, 2015b). It highlighted that learning, across all areas and subjects, should be informed by eight principles, 24 statements of learning, and eight key skills (Department of Education and Skills, 2015b). In relation to assessment, the framework explicitly sought to increase "the prominence given to classroom-based assessment and formative assessment" (p. 7), including the introduction of formal classroom-based assessments (CBAs) in Second Year and Third Year. Emerging evidence suggests that the introduction of CBAs has been positively received in many respects, though challenges have also been identified. For example, an ongoing longitudinal evaluation of the *Framework for Junior Cycle* has reported that:

> CBAs provide students (and teachers) with *Choice and Flexibility*, support them to be creative and innovative and enable them to develop skills (e.g. independent and research skills) that they can use in their future learning and work life [and that] CBAs also appear to support inclusion. (McGarr, McCormack, et al., 2024, pp. 107-108)

At the same time, Junior Cycle students report feeling overwhelmed at times, with homework, examinations, and overlapping deadlines for finalising and submitting multiple CBAs identified as causes of stress (McGarr et al., 2023). Teachers and principals have also expressed reservations about the extent to which Junior Cycle curriculum goals, instructional practices, and assessment are aligned in practice, which McGarr, O'Reilly, et al. (2024) note "helps explain the preoccupation with issues related to assessment by both teachers and principals" (p. 124).

The Junior Cycle science specification (Department of Education and Skills, 2015c) was introduced to First Year students from September 2017 and would have been the curriculum in effect for the Second Year students who participated in both TIMSS 2019 and 2023. The Junior Cycle science specification seeks to enhance students' evidence-based understanding, broaden their skills to work scientifically, and increase their confidence and competence in applying science (Department of Education and Skills, 2015c). Students learning science at Junior Cycle are expected to have regular opportunities to engage in inquiry-based learning so as to "develop their understanding of scientific processes to use evidence to support explanations and to develop their inquiry skills to a point where they can conduct their own investigations from start to finish" (Department of Education and Skills, 2015c, p. 13).

The Junior Cycle mathematics specification (Department of Education and Skills, 2017d) was introduced to First Year students from September 2018, which means that the cohort of Second Year students who participated in TIMSS 2023 were the first to have studied under the current curriculum.[3] The aim of Junior Cycle mathematics is to provide "relevant and challenging opportunities for all students to become mathematically proficient" (p. 5) through five interconnected components: (i) conceptual understanding, (ii) procedural fluency, (iii) strategic competence, (iv) adaptive reasoning, and (v) productive disposition (Department of Education and Skills, 2017d).

DEIS

DEIS is the government's flagship policy for addressing educational disadvantage in school settings. Introduced in 2005 to consolidate and expand earlier schemes targeting educational disadvantage (Department of Education and Science, 2005), the policy was updated together with a revised school identification model in 2017 (Department of Education and Skills, 2017b), with additional refinements to the identification model in 2022 (Department of Education, 2022b). In both the 2017 and 2022 updates, the programme was expanded, with additional schools being identified as eligible to receive additional supports.

In the context of the current report, supports to schools provided under the 2017 DEIS plan included priority access to professional development opportunities for principals and teachers in DEIS schools, actions to support both student and teacher wellbeing and a safe learning environment at school, provision of teaching resources to limit class sizes for primary-level pupils with the highest risk of educational disadvantage, and planning and implementation of actions aimed at improving standards of numeracy and literacy (Department of Education and Skills, 2017b). The latter goal was explicitly linked to targets set out in the contemporaneous *National Strategy to Improve Literacy and Numeracy (2011-2020)*, which is discussed further below.

3 As testing in TIMSS 2019 took place near the end of the 2018-2019 school year, the Second Year students who participated would have studied under the previous specifications.

Digital Strategy for Schools

As noted above, significant efforts have been made over the last decade to improve the digital infrastructure of schools at both primary and post-primary levels, and to expand the uses of digital technology for educational purposes. These include two iterations of the *Digital Strategy for Schools* (Department of Education and Skills, 2015a; Department of Education, 2022a) and the *Digital Learning Framework* (Department of Education and Skills, 2017c). These were accompanied by substantial investment and practical resources targeted at schools to assist educators in implementing the framework, such as the "DL Planning" website developed by the Oide Technology in Education team (https://www.dlplanning.ie), and associated guidelines for planning digital learning (Department of Education and Skills, 2018).

The most recent digital strategy implementation plan (Department of Education, 2024b) builds on these documents by specifying actions to address each of the three main pillars of the current strategy. These are: (i) supporting the embedding of digital technologies in teaching, learning, and assessment, (ii) development of digital technology infrastructure, and (iii) related policy, research, and digital leadership activities. The current implementation plan is due to be reviewed and replaced by an updated implementation plan during the second half of 2025 (Department of Education, 2024b).

In the context of monitoring trends in the use of technology for mathematics and science instruction, it is worth noting that the COVID-19 pandemic, which occurred between the TIMSS 2019 and 2023 cycles, and brought unprecedented challenges to education in Ireland and the rest of the world, is reported to have contributed to increased use of technology at both primary and post-primary levels, increased teacher confidence in using digital technologies for pedagogical purposes, increased use of technology for project work and homework at primary level, and increased sharing of resources online at post-primary level (Donohue et al., 2024).

STEM Education Policy Statement

The development of a 10-year *STEM Education Policy Statement (2017-2026)* (Department of Education and Skills, 2017f) arose as a commitment from the *Action Plan for Education 2017* (Department of Education and Skills, 2017a). This, in turn, was inspired by the findings of a STEM Education Review Group (2016), who had conducted an in-depth review of STEM education in Ireland. The review group recommended the development of a national STEM education policy statement, among many recommendations that were broadly grouped under five themes:

- Preparing primary and post-primary teachers for STEM education, including initial teacher education for future cohorts.
- Supporting active STEM teachers via provision of relevant teacher professional learning opportunities.
- Introducing new teaching and learning modalities to enhance STEM education in schools, including via innovative methods of assessment.
- Using technology to enhance the learning of STEM subjects, including appropriate professional development to enable teachers to use technologies in innovative ways.
- Promoting STEM careers and engaging students in learning STEM subjects.

Accordingly, the aims of the *STEM Education Policy Statement (2017-2026)* (Department of Education and Skills, 2017f) included:

- increasing student proficiency in STEM disciplines;
- developing problem-solving skills and collaboration (or teamworking) skills, with an explicit eye on "demands from the world of work" (p. 10);

- increasing the number of students selecting STEM subjects for study at post-primary level, in further or higher education;
- increasing the number of students progressing to STEM careers;
- increasing the participation of females in the study of STEM subjects and take-up of STEM-related careers;
- raising awareness of, and interest in, the range of STEM careers that are available to students; and
- generally encouraging young people to remain involved in STEM education.

The plan was originally laid out in three phases, with an *enhancing* phase envisaged to take place from 2017-2019, an *embedding* phase planned from 2020-2022, and a *realising* phase from 2023-2026. However, due to the disruptions caused by the COVID-19 pandemic, Phase 1 was extended to 2022, with Phases 2 and 3 combined into one final phase running from 2022 to 2026 (Government of Ireland, 2023). The aims of this final phase were informed by a review of progress based on the implementation of the (extended) Phase 1 efforts at *enhancing* STEM education to that point (Department of Education, 2023d). Both the original and the updated implementation plans are based around four pillars: (i) nurturing learner engagement and participation, (ii) enhancing early years educator and teacher skills, (iii) supporting STEM education practice, and (iv) using evidence to support STEM education.

Literacy and Numeracy

Since 2011, there have been a series of plans aimed at raising standards of numeracy and literacy nationwide. An initial strategy running from 2011 to 2020 (Department of Education and Skills, 2011b) was reviewed and revised with updated targets in 2017 (Department of Education and Skills, 2017e). Although the original strategy was intended to run up to 2020, the disruptions arising from the COVID-19 pandemic delayed the introduction of its successor. In 2024, a new decade-long *Literacy, Numeracy and Digital Literacy Strategy (2024-2033)* was published (Department of Education, 2024c) together with an implementation plan covering the first half of the new strategy's envisaged lifespan (Department of Education, 2024d).

The current strategy (Department of Education, 2024c, 2024d) incorporates an increased focus on the integration of numeracy and literacy development with Irish-language education, the development of digital literacy skills and awareness, and an explicit focus on addressing several specific areas of weakness related to numeracy identified by large-scale assessments, such as TIMSS, PISA, and NAMER (such as in the areas of geometry and measurement, and in supporting the development of positive attitudes to mathematics, particularly among girls). A point of note, in light of the earlier discussion of a sustained focus on increasing the uses of digital technology for education, is the addition of digital literacy as a key outcome of interest in the current strategy alongside numeracy and literacy.

Structure of this report

The remainder of this report is structured as follows: Chapter 2 and Chapter 3 focus on the characteristics and practices of primary schools and Fourth Class classrooms, respectively, with a particular emphasis on mathematics and science education. Chapter 4 describes the characteristics of post-primary schools, while Chapters 5 and 6 focus on the characteristics of mathematics and science classes for Second Year students. Finally, Chapter 7 provides a summary of key findings and discusses them in the broader national context.

Chapter 2:
The primary school

As described in Chapter 1, principals of participating schools and teachers of participating classes complete questionnaires as part of TIMSS. This chapter focuses on primary schools in Ireland, drawing insights from these responses. Data from 2023 are compared to those from previous TIMSS cycles in 2011, 2015, and 2019, where available, to examine trends. Subgroup differences by school gender and school DEIS status are also referenced in text, while all subgroup analysis outputs can be found in the Chapter 2 Appendix of this report.

School composition

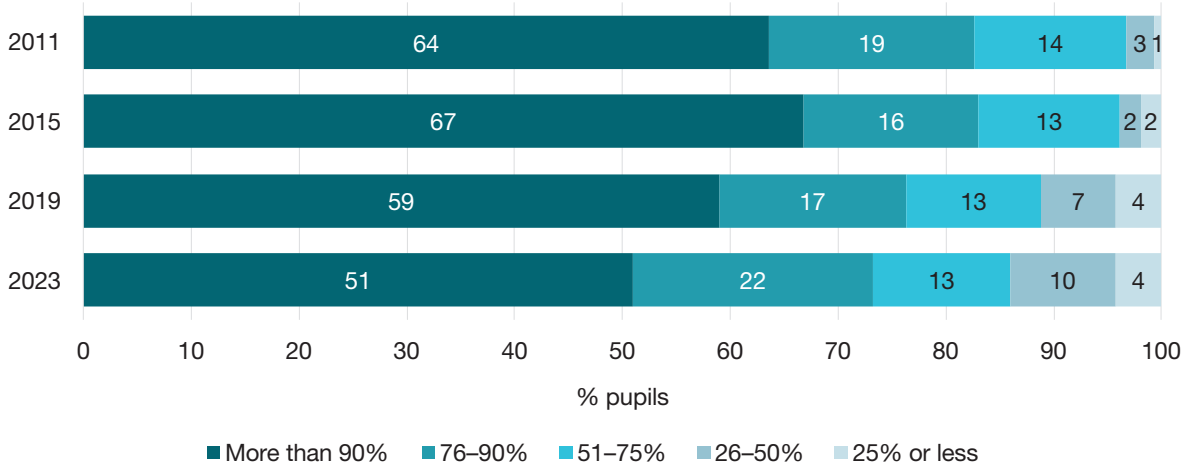
This section focuses on the linguistic and socioeconomic composition of schools, pupils' literacy and numeracy readiness at the beginning of First Class, and teacher characteristics, including their formal education, major or main areas of study and specialisation, job satisfaction, and professional development in mathematics and science education.

Pupils with English or Irish as their native language

In 2011, 2015, 2019, and 2023, school principals were asked to estimate the proportion of pupils in their school that had English or Irish, the languages of the TIMSS assessment in Ireland, as their native language. Figure 2.1 shows the proportions of pupils within schools in Ireland that had English or Irish as their native language across the four TIMSS cycles. In 2011 and 2015, 64% and 67% of pupils, respectively, attended schools where more than 90% of pupils spoke English or Irish as their native language. This declined to 59% in 2019 and 51% in 2023. The proportions of pupils attending schools where 51–90% of pupils spoke English or Irish as their native language remained relatively steady, with 33% in 2011, 29% in 2015, 30% in 2019, and 35% in 2023. However, the proportions of pupils in schools where 26–50% spoke English or Irish as their native language increased from 3% in 2011 to 10% in 2023, while the proportions of pupils in schools with 25% or fewer native English or Irish speakers also increased, from 1–2% in 2011 and 2015 to 4% in 2019 and 2023. These figures indicate a gradual decline in the proportion of pupils attending schools where the majority of pupils speak English or Irish as their native language and a corresponding increase in more linguistically diverse school environments over time.

The proportions of pupils in schools where English or Irish is the native language of the majority varied by school gender and DEIS status in 2023 (Appendix Table A2.1). Mixed-gender schools had the greatest linguistic diversity, with 53% of pupils in schools where more than 90% of pupils spoke English or Irish as their native language, but notable representation in all other categories, including 5% in schools where 25% or fewer pupils spoke English or Irish as their native language. Boys' and girls' schools were relatively less diverse. The highest proportions of pupils in schools where over 90% spoke English or Irish as their native language were in DEIS Rural (83%) and non-DEIS schools (56%), while DEIS Urban schools had much lower proportions (Band 1: 33%; Band 2: 4%). Also, between one-quarter and one-third of pupils in DEIS Urban schools attended schools where fewer than half of the pupils were native English or Irish speakers.

Figure 2.1: School principals' estimations of the proportion of pupils in their schools with English or Irish as their native language, Fourth Class (2011, 2015, 2019, 2023)



School socioeconomic composition

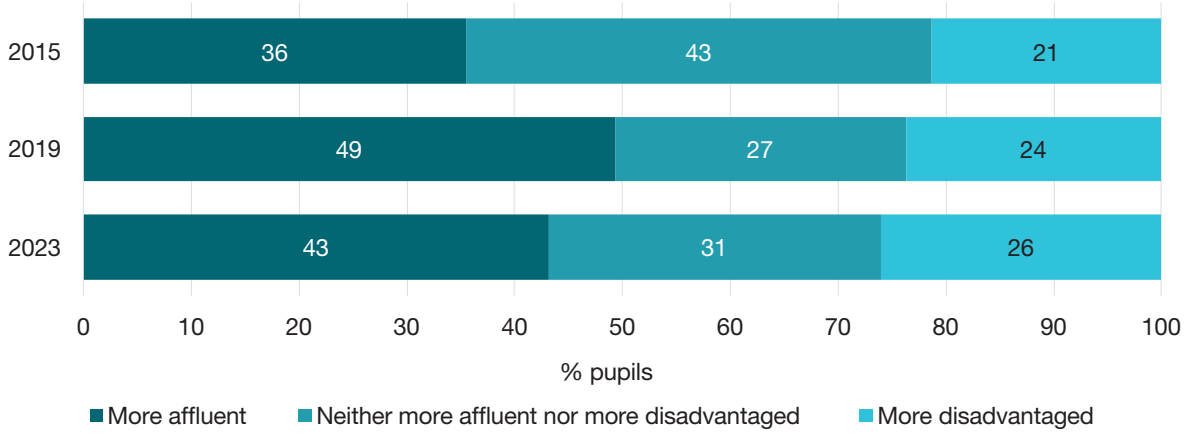
In 2015, 2019, and 2023, school principals were asked to estimate the proportion of pupils in their school who came from economically disadvantaged and economically affluent backgrounds. The response options provided were *0 to 10%*, *11 to 25%*, *26 to 50%*, and *more than 50%*. For each of the participating countries, including Ireland, responses were used by the IEA and the TIMSS & PIRLS International Study Center at Boston College to create the TIMSS *School Composition by Socioeconomic Background of the Student Body* index, on the basis of which pupils were described as attending *more affluent*, *neither more affluent nor more disadvantaged*, and *more disadvantaged* schools.[4]

In 2023, 43% of pupils attended schools with more affluent pupil bodies, 26% attended schools with more disadvantaged pupil bodies, and the remaining 31% were in schools of neither more affluent nor more disadvantaged composition. The proportion in schools with more affluent pupil bodies decreased from 49% in 2019 to 43% in 2023 but remained higher than in 2015 (36%). Meanwhile, the proportion in schools with more disadvantaged pupil bodies has steadily increased, from 21% in 2015 to 24% in 2019 and 26% in 2023 (Figure 2.2).

The socioeconomic composition of schools varied by school gender and DEIS status in 2023 (Appendix Table A2.2). While the distribution of pupils across the three socioeconomic categories in mixed-gender schools was similar to that of the overall sample (42% more affluent, 32% neither, and 26% more disadvantaged), girls' schools were reported by their principals to be composed of a higher proportion of pupils from more affluent backgrounds (61%) compared to boys' schools (33%). Non-DEIS and DEIS Rural schools were reported by their principals to have more pupils from affluent backgrounds than DEIS Urban schools. DEIS Urban Band 1 schools had the highest concentration of pupils from economically disadvantaged backgrounds (90%), considerably higher than DEIS Urban Band 2 (53%), DEIS Rural (25%), and non-DEIS schools (13%).

4 *More affluent* schools are those that were estimated to have more than 25% of pupils from economically affluent backgrounds and not more than 25% from economically disadvantaged backgrounds, while *more disadvantaged* schools are those that were estimated to have more than 25% of pupils from disadvantaged backgrounds and not more than 25% from affluent backgrounds. All other combinations are considered to be *neither more affluent nor more disadvantaged* (von Davier et al., 2024).

Figure 2.2: School principals' estimations of the socioeconomic composition of the pupil body, Fourth Class (2015, 2019, 2023)



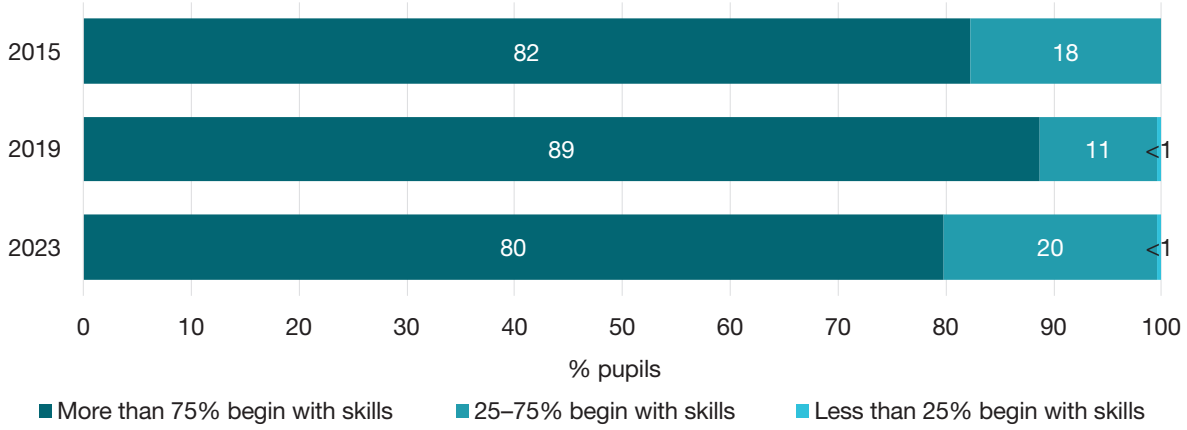
Pupils' literacy and numeracy readiness

In 2015, 2019, and 2023, school principals were asked to estimate the proportion of pupils in their school who could do a range of literacy and numeracy tasks (e.g., read some words, write numbers from 1–10, etc.) at the beginning of First Class. The response options provided were *more than 75%*, *51–75%*, *25–50%*, and *less than 25%*. For each of the participating countries, including Ireland, responses were used by the IEA and the TIMSS & PIRLS International Study Center at Boston College to create the TIMSS *Literacy and Numeracy Skills of Entering Student Body* scale, on the basis of which pupils were described as attending schools in which *more than 75% begin with skills*, *25–75% begin with skills*, and *less than 25% begin with skills*.

Over the years, most pupils (≥80%) attended schools where more than 75% of pupils were able to perform a range of literacy and numeracy tasks at the beginning of First Class (Figure 2.3). The remaining pupils were in schools where this applied to between 25% and 75% of pupils. However, the distribution of pupils in 2023 was similar to that of 2015, showing a decrease in the proportion of pupils attending schools where over 75% of pupils could complete these tasks, along with a corresponding increase in the proportion attending schools where this applied to between 25% and 75% of pupils compared to 2019.

The composition of schools with regards to pupils' literacy and numeracy readiness varied by school gender and DEIS status in 2023 (Appendix Table A2.3). Girls' schools had the highest proportion of pupils (90%) in schools where more than 75% of pupils had basic literacy and numeracy skills at the beginning of First Class. In comparison, 79% of pupils in mixed-gender schools and 77% in boys' schools attended schools with similar proportions of pupils starting with these skills. A small proportion of pupils in boys' schools (5%) were in schools where less than 25% of pupils had these skills at the beginning of First Class, while no pupils in girls' or mixed-gender schools attended schools with such low levels of readiness. Regarding DEIS status, non-DEIS schools had the highest proportion of pupils (89%) in schools where more than 75% of pupils started First Class with basic literacy and numeracy skills, with only 1% attending schools where fewer than 25% of pupils had these skills. In contrast, DEIS Urban Band 1 schools had the lowest proportion (42%) of pupils in schools where more than 75% of pupils had these skills, with the majority (58%) attending schools where 25% to 75% of pupils had these skills. In DEIS Urban Band 2 and DEIS Rural schools, around two-thirds of pupils attended schools where more than 75% of pupils began First Class with basic literacy and numeracy skills.

Figure 2.3: School principals' estimations of the proportion of pupils starting First Class with basic literacy and numeracy skills, Fourth Class (2015, 2019, 2023)



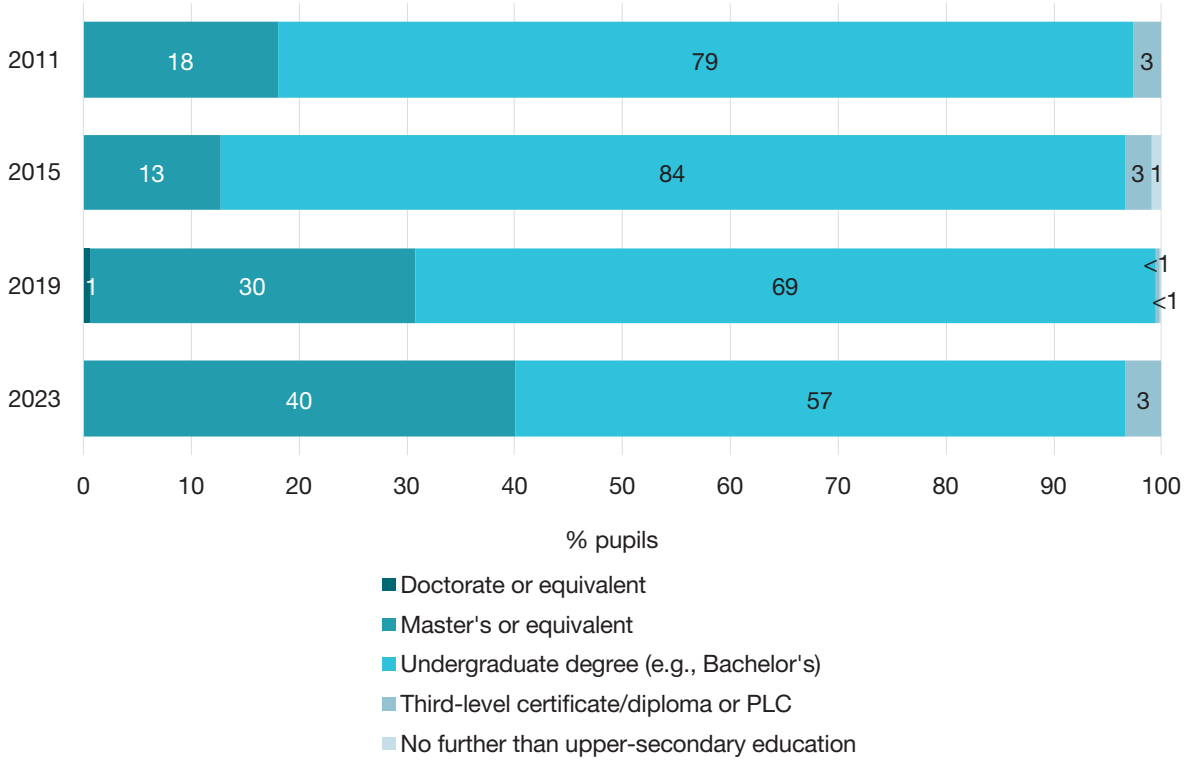
Teacher characteristics

Formal education

Figure 2.4 presents details on teachers' formal education level. Although the proportion of pupils taught by teachers with a master's or equivalent degree decreased from 18% in 2011 to 13% in 2015, there has been a steady increase since 2015. By 2023, 40% of pupils were taught by teachers holding a master's or equivalent degree. Over the years, very few or no pupils have been taught by teachers with a Doctorate or equivalent degree, or by teachers with education levels lower than an undergraduate degree.

Teacher education levels varied somewhat across school types in 2023 (Appendix Table A2.4). Specifically, slightly fewer pupils were taught by teachers holding a master's or equivalent degree in girls' schools (35%) than in boys' (38%) and mixed-gender (41%) schools. In terms of DEIS status, the highest proportion of pupils being taught by teachers with a master's or equivalent degree was noted in DEIS Urban Band 2 schools (52%), while the lowest was in DEIS Urban Band 1 schools (28%).

Figure 2.4: Teachers' formal education level, Fourth Class (2011, 2015, 2019, 2023)



Major or main area(s) of study and specialisation during third-level education

In 2011, 2015, 2019, and 2023, teachers were asked about their major or main area(s) of study and specialisation during their third-level education. The available response options for the major or main area(s) of study were: *Education—Primary*, *Education—Secondary*, *Mathematics*, *Science*, *English or Irish*, and *Other*. For specialisation, the options were: *Mathematics*, *Science*, *Language/reading*, and *Other subject*. For each of the participating countries, including Ireland, responses to both questions were combined by the IEA and the TIMSS & PIRLS International Study Center at Boston College to create two TIMSS indices: *Teachers Majored in Mathematics and Mathematics Education* and *Teachers Majored in Science and Science Education*, within which teachers were grouped into four categories: *major in primary education and major (or specialisation) in mathematics/science*, *major in primary education but no major (or specialisation) in mathematics/science*, *major in mathematics/science but no major in primary education*, and *all other majors*. It is worth noting that a definition of major or main area(s) of study was not provided as part of the teacher questionnaire; thus, reliance was on the teachers' interpretation of the question.

Over the years, most pupils (≥78%) were taught by teachers who reported to have a major in primary education but no major (or specialisation) in mathematics or science (Figures 2.5 and 2.6). Notably, the proportions of pupils taught by teachers with a dual major or specialisation in primary education and mathematics or science have gradually decreased over time. Specifically, the percentage of pupils taught by teachers reporting to have majored in both primary education and mathematics declined from 14% in 2011 to 7% in 2023, while those taught by teachers majoring in both primary education and science declined from 11% in 2011 to 6% in 2023. Small proportions of pupils across the TIMSS cycles were taught by teachers with other majors or specialisations.

Although, in 2023, teachers in boys' and mixed-gender schools were broadly similar to each other and the overall sample (presented in Figures 2.5 and 2.6) with regards to their major or main area(s) of study and specialisation during their third-level education, a different pattern was observed in girls' schools (Appendix

Tables A2.5 and A2.6). Specifically, no pupils in girls' schools were taught by teachers with a dual major or specialisation in primary education and mathematics, while one-quarter of pupils in these schools were taught by teachers classified under the *all other majors* category for both mathematics and science. In terms of DEIS status, DEIS Rural schools had a higher proportion of pupils taught by teachers with a major in primary education and a major (or specialisation) in mathematics, though this was not the case in science (Appendix Tables A2.5 and A2.6).

Figure 2.5: Teachers' major or main area(s) of study and specialisation during third-level education (mathematics), Fourth Class (2011, 2015, 2019, 2023)

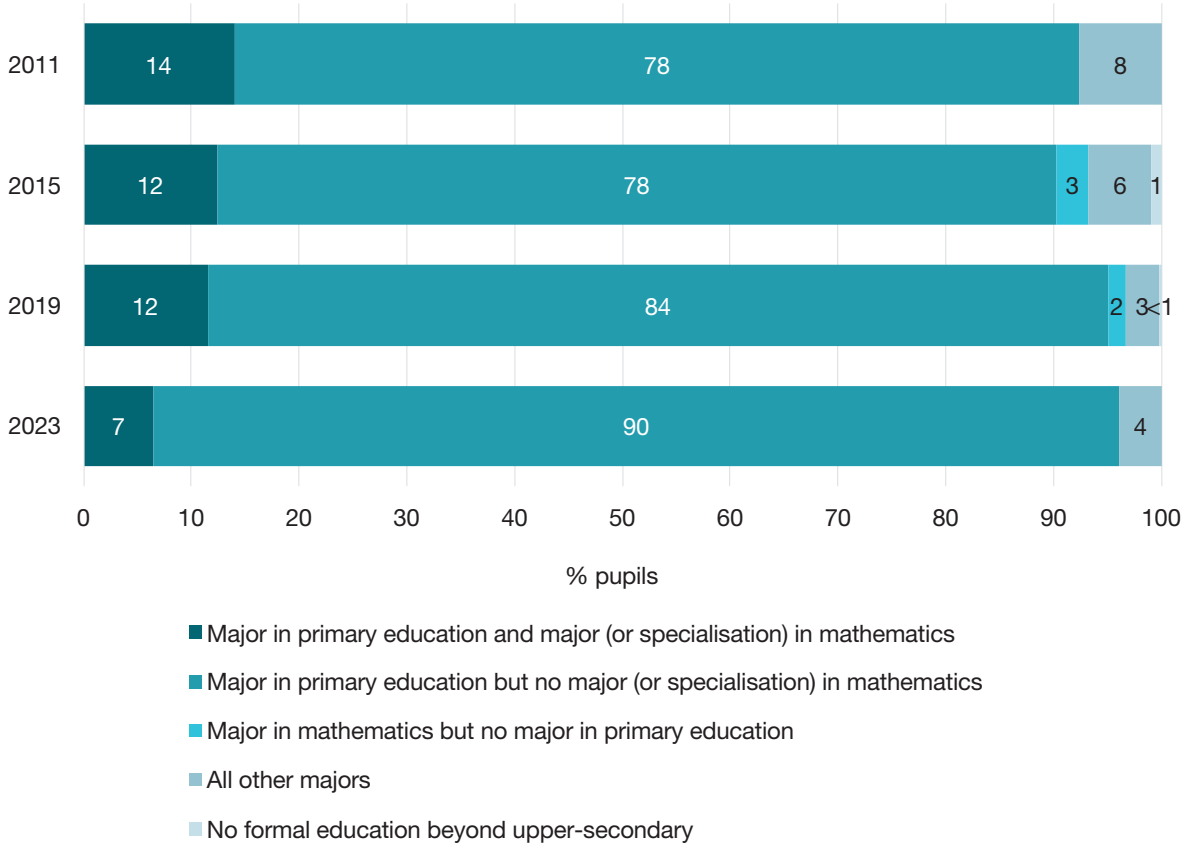
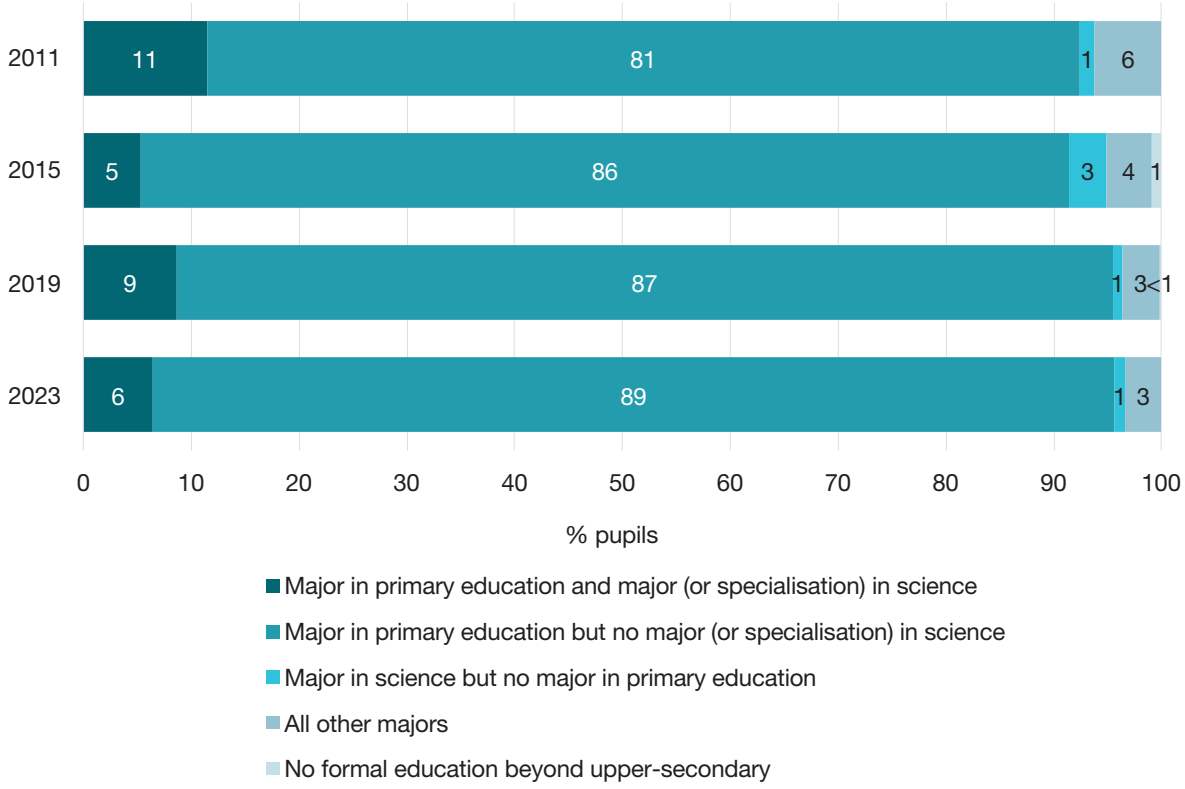


Figure 2.6: Teachers' major or main area(s) of study and specialisation during third-level education (science), Fourth Class (2011, 2015, 2019, 2023)



Job satisfaction

In 2011, 2015, 2019, and 2023, teachers were asked to rate their level of satisfaction with their job. The 2023 teacher questionnaire included seven items on job satisfaction: *I am content with my profession as a teacher*; *I find my work full of meaning and purpose*; *I am enthusiastic about my job*; *My work inspires me*; *I am proud of the work I do*; *I feel appreciated as a teacher*; *I enjoy the challenges of teaching*.[5] Teachers were asked to indicate the frequency with which they felt that way about being a teacher for each of these statements and, for each of the participating countries, including Ireland, their responses were used by the IEA and the TIMSS & PIRLS International Study Center at Boston College to create the TIMSS *Teacher Job Satisfaction* scale, on the basis of which teachers were grouped into three categories: *very satisfied*, *somewhat satisfied*, and *less than satisfied*.

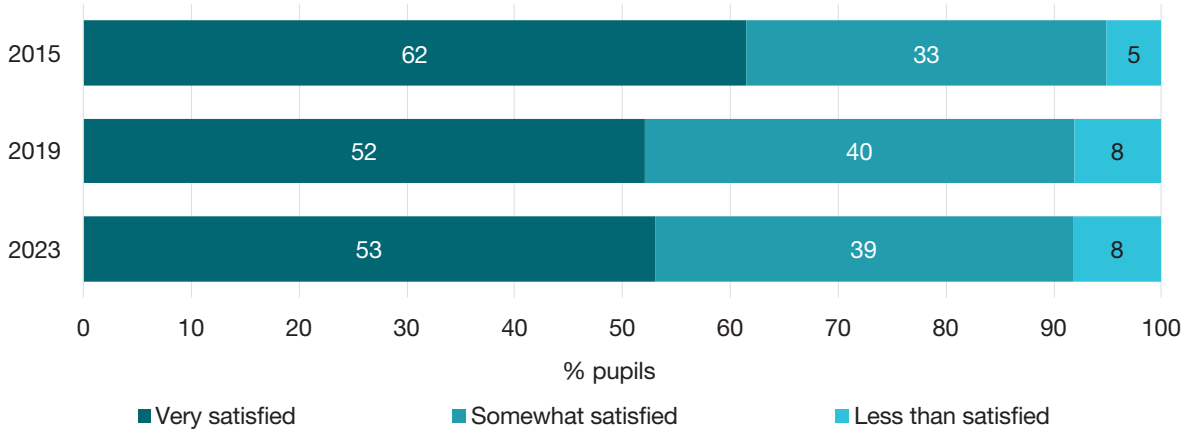
Over the years, more than half of pupils were taught by teachers who were very satisfied with their job (Figure 2.7). However, this proportion decreased from 2015 (62%) to 2023 (53%). Correspondingly, the proportion of pupils taught by teachers who were less than satisfied with their job slightly increased from 5% in 2015 to 8% in both 2019 and 2023.

Teachers' job satisfaction varied somewhat by school gender and DEIS status in 2023 (Appendix Table A2.7). Among school gender types, girls' schools had the lowest proportion of pupils (23%) taught by teachers

5 In 2019, the *Teacher Job Satisfaction* scale was based on the first five items from the 2023 scale. In 2015, the scale was based on these five items plus two additional items: *I am satisfied with being a teacher at this school* and *I am going to continue teaching for as long as I can*. The 2011 scale differed more from those in subsequent years, including the following items: *I am content with my profession as a teacher*; *I am satisfied with being a teacher at this school*; *I had more enthusiasm when I began teaching than I have now*; *I do important work as a teacher*; *I plan to continue as a teacher for as long as I can*; *I am frustrated as a teacher*. As a result, the 2011 scale is not directly comparable to the 2015, 2019, and 2023 scales and is not presented here.

who were very satisfied, and the highest proportion (13%) taught by teachers who were less than satisfied. In terms of DEIS status, DEIS Urban Band 2 schools had the lowest proportion of pupils (44%) taught by teachers who were very satisfied, and the highest proportion (22%) taught by teachers who were less than satisfied, while other schools had more similar distributions.

Figure 2.7: Teachers' job satisfaction, Fourth Class (2015, 2019, 2023)



Professional development in mathematics and science education

As part of their questionnaire across all TIMSS cycles, teachers were asked to indicate whether they had completed professional development in various areas of mathematics and science in the two years preceding each TIMSS administration. In 2019 and 2023, teachers were also asked whether they need future professional development in these areas. Tables 2.1 and 2.2 present the percentages of pupils by their teachers' reported participation in and need for professional development in mathematics and science education, respectively.

Overall, lower proportions of pupils were taught by teachers who had completed professional development in various areas of mathematics in 2023 compared to previous years, with the highest proportions observed in 2015. The need for future professional development in these areas either remained relatively stable or increased between 2019 and 2023, with the largest differences noted in the areas of mathematics curriculum, improving pupils' critical thinking or problem-solving skills, and addressing pupils' language needs in learning mathematics (Table 2.1).

Table 2.1: Percentages of pupils by teachers' professional development in mathematics, Fourth Class (2011, 2015, 2019, 2023)

	Completed				Future needs	
	2011	2015	2019	2023	2019	2023
Mathematics content						
Yes	32	46	36	30	37	39
No	68	54	64	70	63	61
Mathematics pedagogy/instruction						
Yes	32	37	33	24	54	53
No	68	63	67	76	46	47
Mathematics curriculum						
Yes	34	38	23	25	37	43
No	66	62	77	75	63	57
Integrating technology into mathematics instruction						
Yes	31	34	23	27	81	81
No	69	66	77	73	19	19
Improving pupils' critical thinking or problem-solving skills						
Yes	–	45	34	34	75	85
No	–	55	66	66	25	15
Mathematics assessment						
Yes	25	25	19	15	49	46
No	75	75	81	85	51	54
Addressing individual pupils' needs						
Yes	33	27	31	33	58	61
No	67	73	69	67	42	39
Addressing pupils' language needs in learning mathematics						
Yes	–	–	19	17	59	69
No	–	–	81	83	41	31

Notes. In 2011 and 2015, the item *Integrating technology into mathematics instruction* was phrased *Integrating information technology into mathematics*. A dash (–) indicates that data are not available.

Overall, lower proportions of pupils were taught by teachers who had completed professional development in various areas of science in 2023 compared to previous years (except for the area of addressing individual pupils' needs, where more pupils were taught by teachers who had completed professional development in this area in 2023), with the highest proportions observed primarily in 2019. The need for future professional development in these areas either remained relatively stable or increased between 2019 and 2023, with the largest difference noted in the area of science content (Table 2.2).

Table 2.2: Percentages of pupils by teachers' professional development in science, Fourth Class (2011, 2015, 2019, 2023)

	Completed				Future needs	
	2011	2015	2019	2023	2019	2023
Science content						
Yes	23	18	25	15	47	60
No	77	82	75	85	53	40
Science pedagogy/instruction						
Yes	16	14	22	15	58	64
No	84	86	78	85	42	36
Science curriculum						
Yes	24	20	21	14	42	49
No	76	80	79	86	58	51
Integrating technology into science instruction						
Yes	17	12	22	10	78	84
No	83	88	78	90	22	16
Improving pupils' critical thinking or inquiry skills						
Yes	–	17	29	22	73	78
No	–	83	71	78	27	22
Science assessment						
Yes	9	7	12	5	62	59
No	91	93	88	95	38	41
Addressing individual pupils' needs						
Yes	12	13	19	22	54	55
No	88	87	81	78	46	45
Integrating science with other subjects (e.g., mathematics, technology)						
Yes	–	24	28	17	67	67
No	–	76	72	83	33	33
Integrating environmentalism and sustainability into science instruction						
Yes	–	–	–	16	–	62
No	–	–	–	84	–	38
Addressing pupils' language needs in learning science						
Yes	–	–	10	7	57	61
No	–	–	90	93	43	39

Notes. In 2011 and 2015, the item *Integrating technology into science instruction* was phrased *Integrating information technology into science*. A dash (–) indicates that data are not available.

The proportions of pupils taught by teachers who reported to either have completed or to need professional development in various areas of mathematics and science varied by school gender and DEIS status in 2023 (Appendix Tables A2.8 and A2.9). Overall, lower proportions of pupils in girls' schools were taught by teachers who had completed professional development in the various areas of mathematics in the two years preceding the TIMSS administration than in boys' and mixed-gender schools. Boys' schools appeared to have a slight

advantage over mixed-gender schools in this regard. No clear-cut patterns of differences by school gender were found in science professional development. In terms of DEIS status, DEIS Rural schools generally had the lowest proportions of pupils being taught by teachers who had completed professional development in the various areas of either mathematics or science, while DEIS Urban Band 1 schools had the highest proportions.

When considering teachers' future professional development needs in mathematics and science, lower proportions of pupils in boys' schools were taught by teachers who reported needing professional development in the various areas of both subjects than in girls' and mixed-gender schools. However, no clear-cut patterns of differences in teachers' future needs for professional development emerged based on school DEIS status (Appendix Tables A2.8 and A2.9).

School-level resources

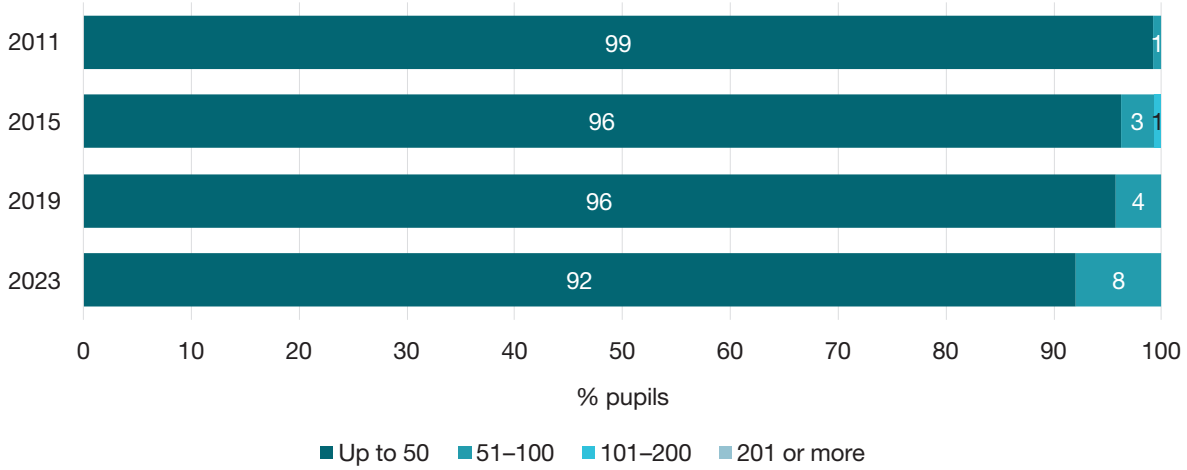
This section focuses on resources in the school that can be used by Fourth Class pupils, including computers/tablets, science laboratories, online learning management systems, school libraries or media centres, and high-speed internet.

Number of computers

Across all TIMSS cycles, school principals were asked to report the number of computers (including tablets, from 2015 onwards) their school had for use by Fourth Class pupils. The average number of computers/tablets per school gradually increased over time, from 12 in 2011 to 18 in 2015, 23 in 2019, and 28 in 2023. This translated to a steady improvement in pupil access; the pupil-to-computer ratio decreased from 53:1 in 2011 and 57:1 in 2015 to 25:1 in 2019 and 15:1 in 2023. School principals' responses were also grouped into four categories: *up to 50*, *51–100*, *101–200*, and *201 or more*. Figure 2.8 shows the proportions of pupils within each of these categories across the four TIMSS cycles. Although almost all pupils attended schools with up to 50 computers/tablets in 2011, this proportion has gradually decreased over time, with more pupils attending schools with 51 or more computers/tablets. However, most pupils (>90%) attended schools with up to 50 computers/tablets in 2023.

The number of computers/tablets in schools for use by Fourth Class pupils varied somewhat by school gender and DEIS status in 2023 (Appendix Table A2.10). All pupils in both boys' and girls' schools had up to 50 computers/tablets at their disposal. This proportion was 91% in mixed-gender schools, with 9% of pupils in those schools having 51–100 computers/tablets at their disposal. In terms of DEIS status, DEIS Urban Band 1 schools were found to be slightly better equipped with computers/tablets compared to other schools.

Figure 2.8: School principals' estimations of the number of computers available for use by Fourth Class pupils, Fourth Class (2011, 2015, 2019, 2023)



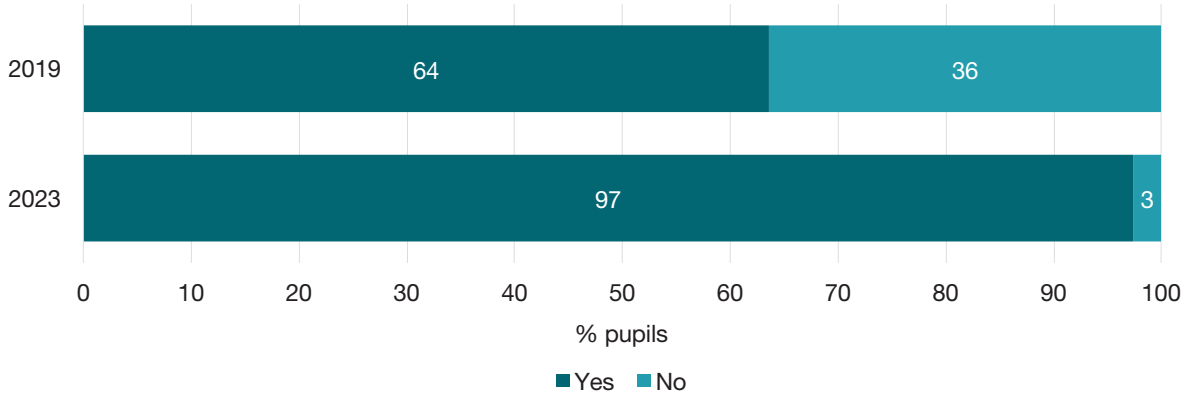
Science laboratory

Across all cycles of TIMSS, almost all Fourth Class pupils attended schools without a science laboratory available for them to use (2011: 100%; 2015: 99%; 2019: 98%; 2023: 99%), according to their school principals' reports, with no differences found by school gender or DEIS status in 2023 (Appendix Table A2.11).

Online learning management system

In 2019 and 2023, school principals were asked whether their school used an online learning management system to support learning (e.g., teacher-pupil communication, posting of grades, pupil access to course materials; e.g., Aladdin, Seesaw). The proportion of pupils attending schools that used such a system increased between 2019 (64%) and 2023 (97%), with only 3% of pupils in 2023 attending schools that did not use such systems (Figure 2.9). Small variations in the use of online learning management systems were found by school gender and DEIS status in 2023 (Appendix Table A2.12), with slightly fewer pupils in mixed-gender schools than in boys' and girls' schools, and slightly fewer pupils in DEIS Rural and non-DEIS schools than in DEIS Urban schools, attending schools that used such systems.

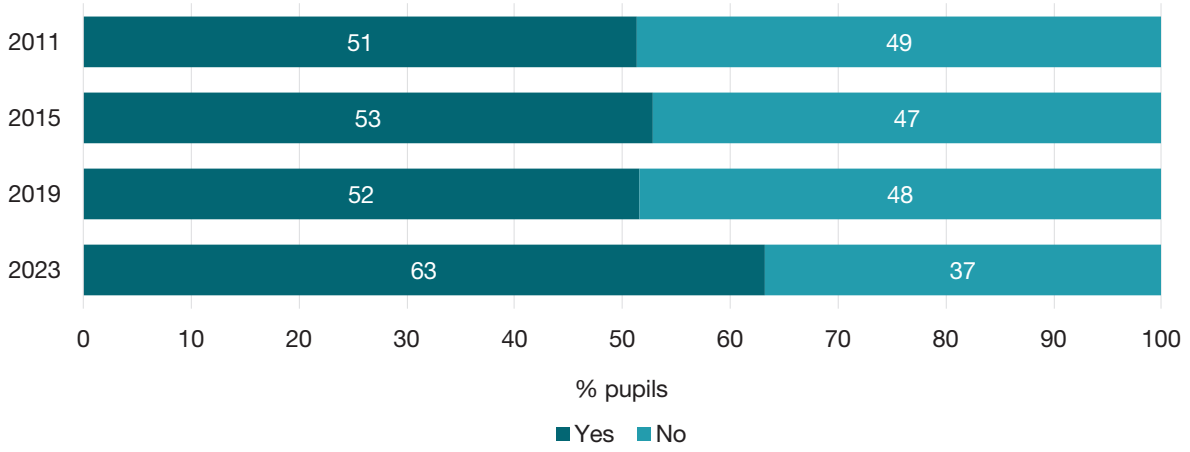
Figure 2.9: School use of online learning management system to support learning, Fourth Class (2019, 2023)



School library or media centre

Across all TIMSS cycles, school principals were asked whether the pupils in their school had access to a library. In 2023, the question also referred to pupils' access to a media centre.[6] Although the proportion of pupils attending schools in which they had access to a library remained stable between 2011 and 2019, around 52%, it increased to 63% in 2023 (Figure 2.10). However, the change to the phrasing of the question ("A library" to "A library or media centre") might be related to this increase. Pupils' access to a library or media centre in the school varied somewhat by school gender and DEIS status in 2023 (Appendix Table A2.13). More pupils in boys' schools (75%) than in girls' (56%) and mixed-gender schools (63%), and more pupils in DEIS Urban schools (Band 1: 73%; Band 2: 70%) than in DEIS Rural (62%) and non-DEIS schools (61%) had access to these resources.

Figure 2.10: Pupils' access to a library or media centre in the school, Fourth Class (2011, 2015, 2019, 2023)



Note. In 2023, school principals were asked about pupils' access to a library or media centre in the school. In 2011, 2015, and 2019, the question focused solely on pupils' access to a library in the school.

High-speed internet

In 2023, school principals were asked whether the pupils in their school had access to high-speed internet – a question that was not included in previous TIMSS cycles. Approximately nine in 10 pupils (87%) attended schools where there was high-speed internet. This distribution was slightly different across the different school types in 2023 (Appendix Table A2.14). Specifically, while all pupils in boys' schools had access to high-speed internet, this figure stood at 80% in girls' schools, and 87% in mixed-gender schools. DEIS Urban Band 2 schools had the highest proportion of pupils (94%) with access to high-speed internet, followed by non-DEIS schools (89%). In DEIS Rural and DEIS Urban Band 1 schools, these proportions were 81% and 72%, respectively.

School environment

This section focuses on aspects of the school environment, including the school's emphasis on academic success, teachers' professional collaboration, school discipline, safety, and order.

6 It is worth noting that a definition of a media centre was not provided as part of the school questionnaire; thus, reliance was on the school principals' interpretation of the term.

School emphasis on academic success

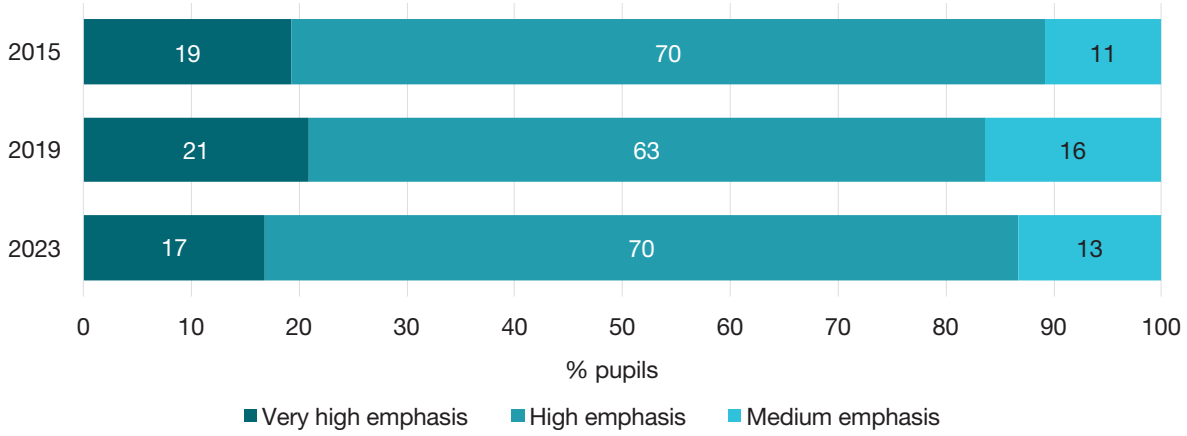
In 2011, 2015, 2019, and 2023, school principals were asked to report the extent of their school's expectations for academic achievement; in particular, their views on teacher perceptions, parent/guardian perceptions, and pupil perceptions on the extent to which their school is focused on academic success. The 2023 school questionnaire included 11 items on school emphasis on academic success: *Teachers' understanding of the school's curricular goals*; *Teachers' degree of success in implementing the school's curriculum*; *Teachers' expectations for pupil achievement*; *Teachers' ability to inspire pupils*; *Parental involvement in school activities*; *Parental commitment to ensure that pupils are ready to learn*; *Parental expectations for pupil achievement*; *Parental support for pupil achievement*; *Pupils' desire to do well in school*; *Pupils' ability to reach school's academic goals*; *Pupils' respect for classmates who excel academically*.[7] The response options provided were *very high*, *high*, *medium*, *low*, and *very low*, and for each of the participating countries, including Ireland, school principals' responses were used by the IEA and the TIMSS & PIRLS International Study Center at Boston College to create the TIMSS *School Emphasis on Academic Success* scale, on the basis of which pupils were described as attending schools with *very high emphasis*, *high emphasis*, and *medium emphasis* on academic success.

School emphasis on academic success remained relatively stable over time, with between 17% and 21% of pupils attending schools that placed very high emphasis on academic success, between 63% and 70% of pupils attending schools that placed high emphasis on academic success, and between 11% and 16% of pupils attending schools that placed medium emphasis on academic success (Figure 2.11).

The proportions of pupils attending schools with varying levels of emphasis on academic success varied by school gender and DEIS status in 2023 (Appendix Table A2.15). Girls' schools had the highest proportion of pupils (30%) in schools that placed very high emphasis on academic success and boys' schools had the lowest proportion (11%). Regarding DEIS status, non-DEIS and DEIS Rural schools had the highest proportions of pupils in schools that placed very high emphasis on academic success (21% and 20%, respectively), while no pupils in DEIS Urban schools attended schools with such a level of emphasis on academic success. Notably, 48% of pupils in DEIS Urban Band 1 schools attended schools that placed medium emphasis on academic success.

7 In 2019, the *School Emphasis on Academic Success* scale was based on the same items from the 2023 scale. In 2015, the scale was based on these 11 items plus two additional items: *Teachers working together to improve pupil achievement* and *Parental pressure for the school to maintain high academic standards*, while the item *Pupils' respect for classmates who excel academically* was phrased *Pupils' respect for classmates who excel in school*. The 2011 scale differed more from those in subsequent years, including the following items: *Teachers' understanding of the school's curricular goals; Teachers' degree of success in implementing the school's curriculum; Teachers' expectations for student achievement; Parental support for student achievement; Students' desire to do well in school*. As a result, the 2011 scale is not directly comparable to the 2015, 2019, and 2023 scales and is not presented here.

Figure 2.11: School emphasis on academic success, Fourth Class (2015, 2019, 2023)



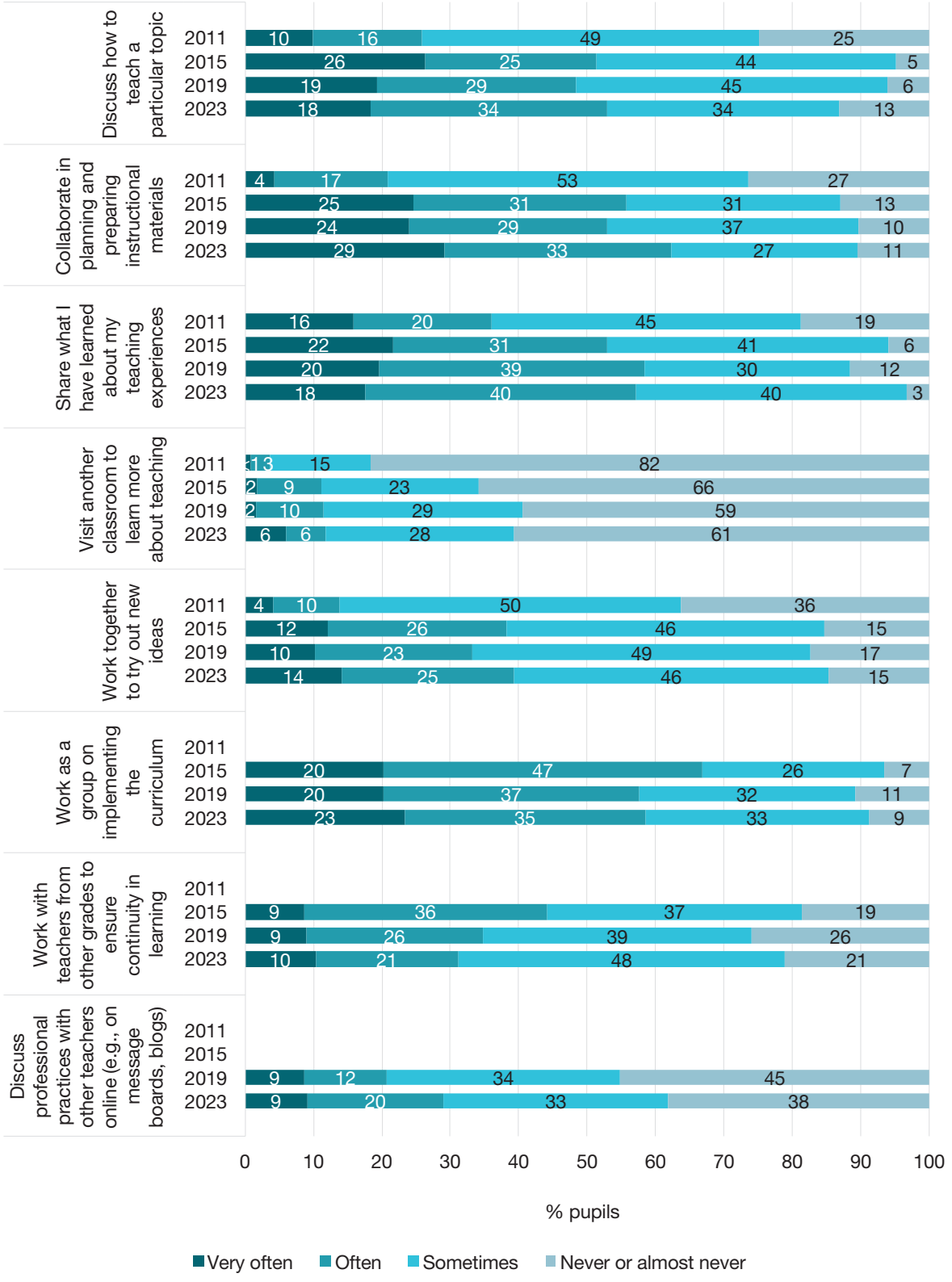
Professional collaboration

As part of the teacher questionnaire across all TIMSS cycles, teachers were asked about their engagement in various types of professional interactions with other teachers inside and outside their school. Figure 2.12 presents all these items for 2023 and previous TIMSS cycles, where available. Over time, the types of interactions taking place more frequently included teachers discussing how to teach a particular topic, collaborating in planning and preparing instructional materials, sharing what they have learned about their teaching experiences, and working as a group on implementing the curriculum.

The frequency of certain types of interactions increased over time, with the most notable shifts recorded between 2011 and 2015, and patterns remaining relatively stable in subsequent years. For example, 26% of pupils were taught by teachers who reported that they would discuss how to teach a particular topic with other teachers either very often or often in 2011. This proportion increased to 51% in 2015 and remained relatively stable in 2019 (48%) and 2023 (52%). There were certain types of interactions that also decreased in frequency over time. These interactions included working as a group on implementing the curriculum and working with teachers from other grades to ensure continuity in learning.

The frequency with which pupils' teachers engaged in various types of professional interactions with other teachers varied somewhat by school gender and DEIS status in 2023 (Appendix Table A2.16). Lower proportions of pupils in girls' schools were taught by teachers who very often engaged in most types of interactions (10% on average) than in boys' schools (22% on average) and mixed-gender schools (16% on average). In terms of DEIS status, DEIS Rural schools had the highest proportions of pupils taught by teachers who very often engaged in most types of interactions (25% on average), while non-DEIS schools had the lowest proportions (14% on average). No consistent patterns of differences were found by school gender or DEIS status for the *never or almost never* category.

Figure 2.12: Teachers' professional collaboration, Fourth Class (2011, 2015, 2019, 2023)



Note. In 2011, the response options were: *daily or almost daily, 1–3 times per week, 2 or 3 times per month,* and *never or almost never.*

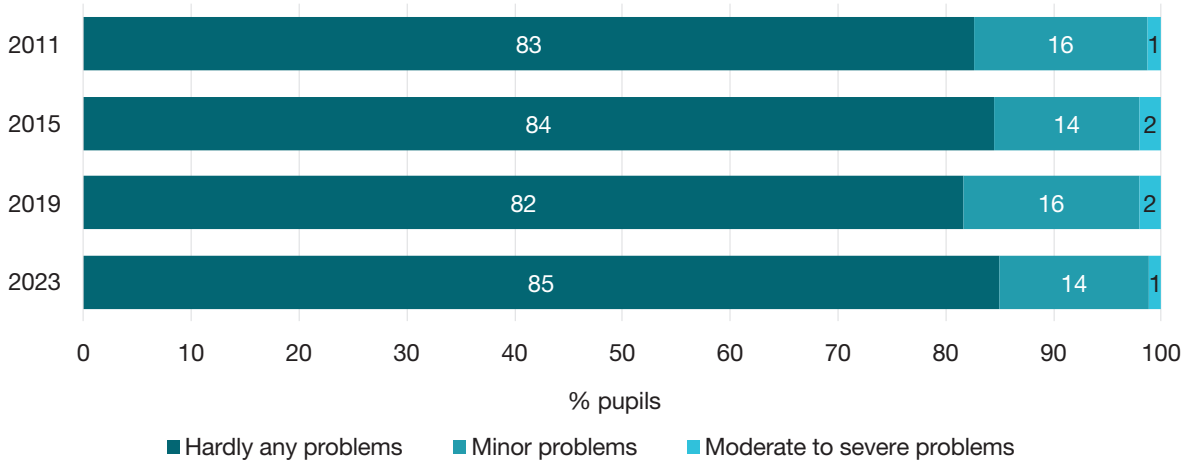
School discipline

Across all TIMSS cycles, school principals were asked to report the extent to which 10 discipline-related behaviours among Fourth Class pupils were a problem in their school. These behaviours were: *Arriving late at school*; *Absenteeism (i.e., unjustified absences)*; *Classroom disturbance*; *Cheating*; *Profanity*; *Vandalism*; *Theft*; *Intimidation or verbal abuse among pupils (including messaging, emailing, etc.)*; *Physical fights among pupils*; *Intimidation or verbal abuse of teachers or staff (including messaging, emailing, etc.)*. The response options provided were *not a problem*, *minor problem*, *moderate problem*, and *serious problem*, and for each of the participating countries, including Ireland, school principals' responses were used by the IEA and the TIMSS & PIRLS International Study Center at Boston College to create the TIMSS *School Discipline* scale, on the basis of which pupils were described as attending schools with *hardly any problems*, *minor problems*, and *moderate to severe problems*.

School discipline problems remained relatively stable over time, with between 82% and 85% of pupils attending schools with hardly any problems, between 14% and 16% of pupils attending schools with minor problems, and between 1% and 2% of pupils attending schools with moderate to severe problems.

Pupils' school discipline problems varied by school gender and DEIS status in 2023 (Appendix Table A2.17). Boys' schools had the highest proportions of pupils in the *minor problems* (43%) and *moderate to severe problems* (9%) categories, with girls' and mixed-gender schools having no or almost no pupils in the *moderate to severe* category and most of their pupils in the *hardly any problems* category. Regarding DEIS status, 11% of pupils in DEIS Urban Band 1 schools attended schools with moderate to severe problems, with the equivalent percentage in all other DEIS categories being 0%. Non-DEIS and DEIS Rural schools had the highest proportions of pupils (94% and 80%, respectively) in the *hardly any problems* category.

Figure 2.13: School discipline, Fourth Class (2011, 2015, 2019, 2023)



Note. In 2011, the *Moderate to severe problems* category was phrased *Moderate problems.*

School safety and order

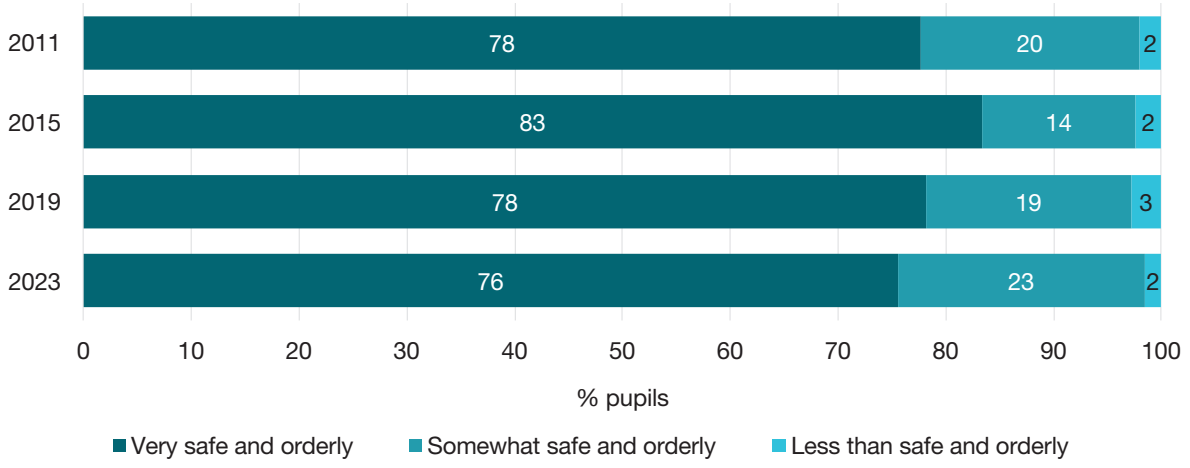
Across all TIMSS cycles, teachers were asked to report their level of agreement with statements related to their school's safety and order. The 2023 teacher questionnaire included the following seven items: *I feel safe at this school; This school's security policies and practices are sufficient; The pupils behave in an orderly manner; The pupils are respectful of the teachers; The pupils respect school property; This school has clear rules about pupil*

conduct; This school's rules are enforced in a fair and consistent manner.[8] For each of the participating countries, including Ireland, teachers' responses were used by the IEA and the TIMSS & PIRLS International Study Center at Boston College to create the TIMSS *Safe and Orderly School* scale, on the basis of which pupils were described as attending schools judged by their teachers to be *very safe and orderly*, *somewhat safe and orderly*, and *less than safe and orderly*.

Although school safety and order remained relatively stable over time, a declining trend has emerged between 2015 and 2023, with the proportion of pupils attending very safe and orderly schools going from 83% in 2015 to 78% in 2019 and 76% in 2023 (Figure 2.14). A corresponding gradual increase has also been noted in the *somewhat safe and orderly* category, going from 14% in 2015 to 23% in 2023. Proportions of pupils attending less than safe and orderly schools have remained low over time (between 2% and 3%).

Pupils' school safety and order varied by school gender and DEIS status in 2023 (Appendix Table A2.18). Boys' schools had the highest proportions of pupils in the *somewhat safe and orderly* (33%) and *less than safe and orderly* (7%) categories, with girls' and mixed-gender schools having no or almost no pupils in the *less than safe and orderly* category. Regarding DEIS status, 9% of pupils in DEIS Urban Band 1 schools and 4% of pupils in DEIS Urban Band 2 schools attended less than safe and orderly schools, with the equivalent percentage in DEIS Rural and non-DEIS schools being 0%. Non-DEIS and DEIS Rural schools had the highest proportions of pupils (76% and 94%, respectively) in the *very safe and orderly* category.

Figure 2.14: School safety and order, Fourth Class (2011, 2015, 2019, 2023)



Note. In 2015, the *Somewhat safe and orderly* category was phrased *Safe and orderly*. In 2011, the three categories were phrased: *Safe and orderly*, *Somewhat safe and orderly*, and *Not safe and orderly*.

8 In 2015 and 2019, the *Safe and Orderly School* scale was based on the same seven items from the 2023 scale plus one additional item: *This school is located in a safe neighbourhood*. The 2011 scale differed more from those in subsequent years, including the following items: *This school is located in a safe neighbourhood*; *I feel safe at this school*; *This school's security policies and practices are sufficient*; *The pupils behave in an orderly manner*; *The pupils show respect to the teachers*. In spite of these differences, the 2011 scale is comparable to the 2015, 2019, and 2023 scales and is, thus, presented here.

Chapter 3:
The primary classroom

As part of TIMSS 2023, teachers of Fourth Class pupils were asked to complete a teacher questionnaire. This chapter focuses mainly on the findings from this questionnaire to provide an insight into primary classrooms. Three main areas are explored: (i) organisation of mathematics and science instruction, teaching, and assessment, (ii) challenges in mathematics and science instruction, and (iii) digital devices in mathematics and science lessons. This chapter also includes reports from participating pupils on the frequency with which they conducted science experiments and from principals of participating schools on the extent to which instruction in their schools was affected by shortages in mathematics and science resources.

Ireland's 2023 data for all pupils are compared to those from the previous three cycles of TIMSS (2011, 2015, and 2019). Subgroup differences by school gender and school DEIS status are also referenced in text, while all subgroup analysis outputs can be found in the Chapter 3 Appendix of this report.

Organisation of mathematics and science instruction, teaching, and assessment

This section focuses on time spent on mathematics and science instruction, strategies and activities used in mathematics and science lessons, use of calculators during mathematics lessons, frequency of conducting science experiments, mathematics and science homework, and assessment strategies in mathematics and science.

Time spent on mathematics and science instruction

Teachers were asked to indicate how much time per week they spent on teaching mathematics and science to the class that participated in TIMSS. The average time spent teaching mathematics to the sampled class was approximately four hours and 30 minutes per week (272 minutes), with a standard deviation of 45 minutes. The most common responses were five hours (300 minutes) (reported by 40% of pupils' teachers) and four hours and 10 minutes (250 minutes) (reported by 14% of pupils' teachers). Broadly similar average times were reported in the previous two cycles of TIMSS, with approximately four hours and 30 minutes in both 2015 and 2019. This was higher than the four hours and seven minutes (247 minutes) reported in 2011.

In 2023, teachers in girls' schools reported spending slightly more time teaching mathematics (approximately four hours and 45 minutes) than in boys' or mixed-gender schools (approximately four hours and 30 minutes). Looking at the differences by school DEIS status, teachers in DEIS Urban Band 2 schools also reported spending slightly more time (approximately four hours and 45 minutes) teaching mathematics than in each of the other DEIS categories (Appendix Table A3.1).

The average time spent teaching science to the sampled class was approximately one hour per week (56 minutes), with a standard deviation of 23 minutes. The most common responses were one hour (60 minutes) (reported by 49% of pupils' teachers) and 30 minutes (reported by 13% of pupils' teachers). Broadly similar average times were reported in the previous two cycles of TIMSS, with 53 minutes in 2015 and 56 minutes in 2019. However, these times were substantially lower than the one hour and 44 minutes (104 minutes) reported in 2011. The average times were similar across the three school gender types and across the four school DEIS categories (Appendix Table A3.1).

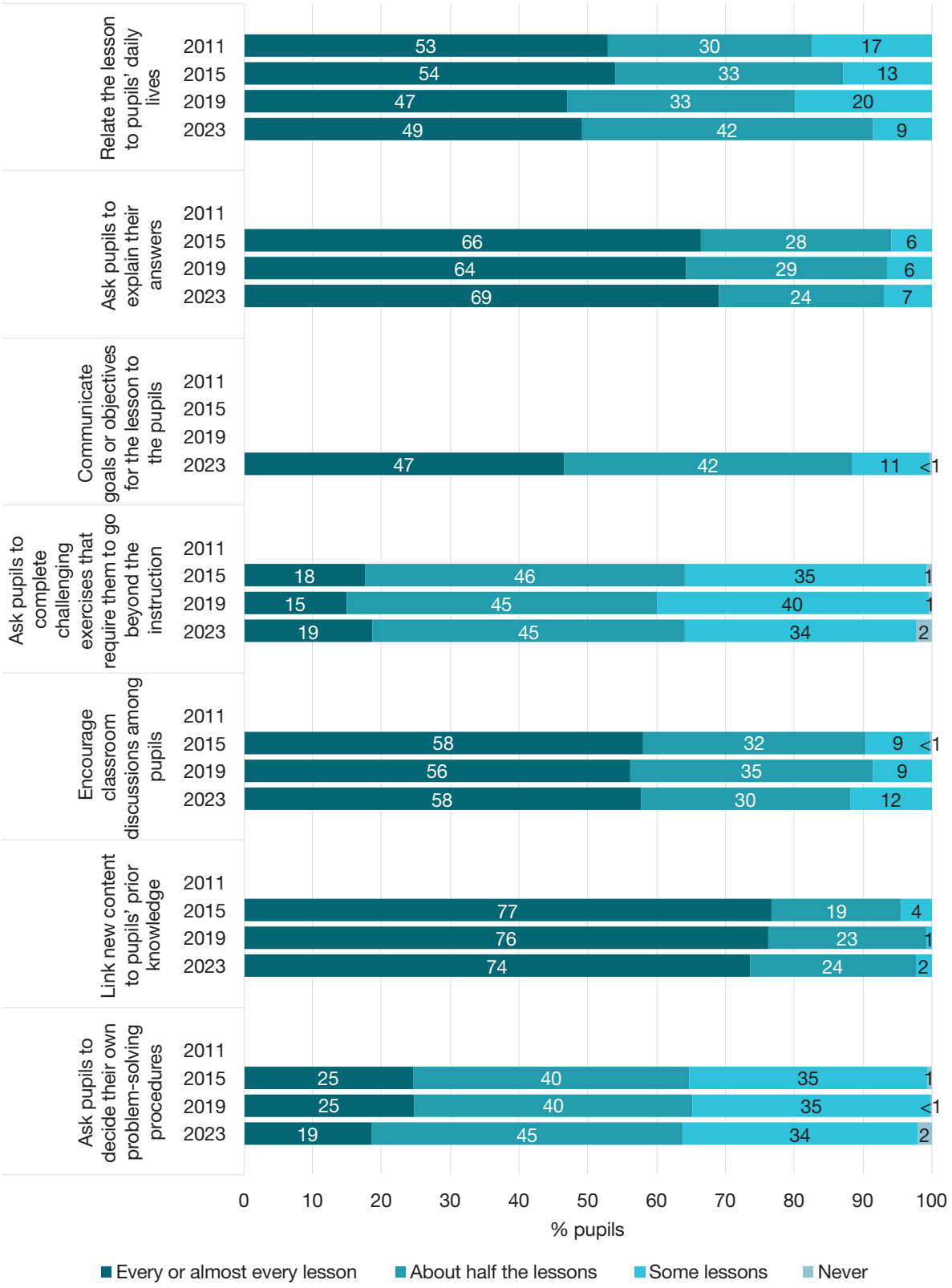
Strategies and activities used in mathematics and science lessons

The strategies and activities used in mathematics and science lessons were captured through three questions in the TIMSS 2023 teacher questionnaire at Fourth Class. Teachers were asked to indicate the frequency with which they used specific strategies and activities in their lessons with response options ranging from *every or almost every lesson* to *never*.

The first question related to specific teaching and learning strategies, and responses for 2011, 2015, 2019, and 2023, where available, are presented in Figure 3.1. In 2023, the majority of pupils had teachers who, in every or almost every lesson, reported that they linked new content to pupils' prior knowledge (74%), asked pupils to explain their answers (69%), and encouraged classroom discussion among pupils (58%). Approximately half of pupils were taught by teachers who related the lesson to pupils' daily lives (49%) and communicated goals or objectives for the lesson to pupils (47%) in every or almost every lesson. Only one-fifth of pupils (19%) were taught by teachers who asked them to complete challenging exercises that required them to go beyond the instruction on a frequent basis. Small fluctuations can be observed across the various strategies over time.

On average, in 2023, higher proportions of pupils in boys' schools were taught by teachers who used these various strategies in every or almost every lesson than in girls' and mixed-gender schools. Also, slightly higher proportions of pupils in DEIS Rural schools were taught by teachers who used these various strategies in every or almost every lesson, while the corresponding proportions were lower in DEIS Urban Band 1 schools (Appendix Table A3.2).

Figure 3.1: Teaching strategies during mathematics and science lessons, Fourth Class (2011, 2015, 2019, 2023)

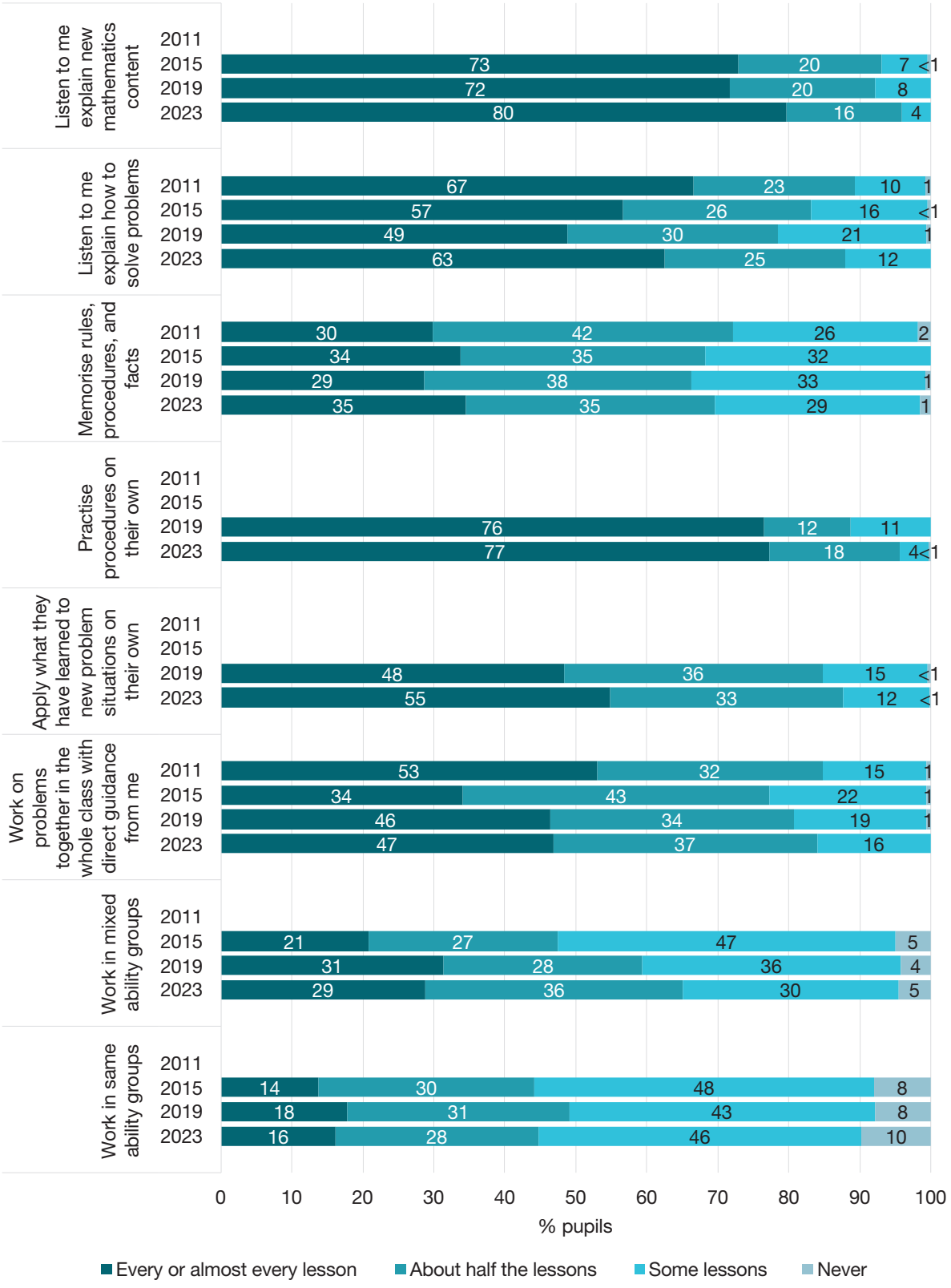


The second question related to the engagement in specific activities during mathematics lessons (Figure 3.2). Approximately three-quarters of pupils were taught by teachers who had pupils listen to the teacher explain new mathematics content (80%) or practise procedures on their own (77%), and two-thirds were taught by teachers who had pupils listen to them explain how to solve problems (63%) in every or almost every lesson in 2023. Smaller, yet substantial, proportions of pupils were asked by their teachers to apply what they had learned to new problem situations on their own (55%) and work on problems together in the whole class with direct guidance from the teacher (47%) in every or almost every lesson. Mixed-ability groupwork was experienced in every or almost every lesson by approximately one-quarter of pupils (29%), while same-ability groupwork was experienced at that frequency by less than one-fifth of pupils (16%).

Looking at the changes over time, the proportion of pupils who were asked to listen to their teacher explain new mathematics content in every or almost every lesson has increased from 73% in 2015 and 72% in 2019 to 80% in 2023. There has also been a marked increase in the proportion of pupils who were asked to listen to their teacher explain how to solve problems in every or almost every lesson between 2019 (49%) and 2023 (63%), though this was following a gradual decrease across 2011 (67%), 2015 (57%), and 2019 (49%). While the frequency with which same-ability and mixed-ability groupwork occurred increased from 2015 to 2019, the proportions were broadly similar in 2019 and 2023.

The frequency with which pupils engaged in these mathematics activities during mathematics lessons, in 2023, was broadly similar in boys', girls', and mixed-gender schools, with slightly higher proportions of pupils in boys' schools being taught by teachers who engaged the pupils in these activities in every or almost every lesson (Appendix Table A3.3). Differences were relatively more pronounced by school DEIS status. Overall, lower proportions of pupils in DEIS Urban Band 1 schools were taught by teachers who engaged pupils in the various activities in every or almost every mathematics lesson, and more pupils in DEIS Rural schools experienced this level of engagement. For example, lower proportions of pupils in DEIS Urban Band 1 schools were taught by teachers who had pupils apply what they had learned to new problem situations on their own (40%) when compared to DEIS Urban Band 2 schools (51%), DEIS Rural (61%), and non-DEIS schools (57%). Notably, same-ability groupwork was experienced in every or almost every mathematics lesson by a very small proportion in DEIS Urban Band 2 schools (4%); the corresponding proportions in DEIS Urban Band 1, DEIS Rural, and non-DEIS schools were 27%, 30%, and 15%, respectively.

Figure 3.2: Pupils' engagement in specific mathematics activities during mathematics lessons, Fourth Class (2011, 2015, 2019, 2023)

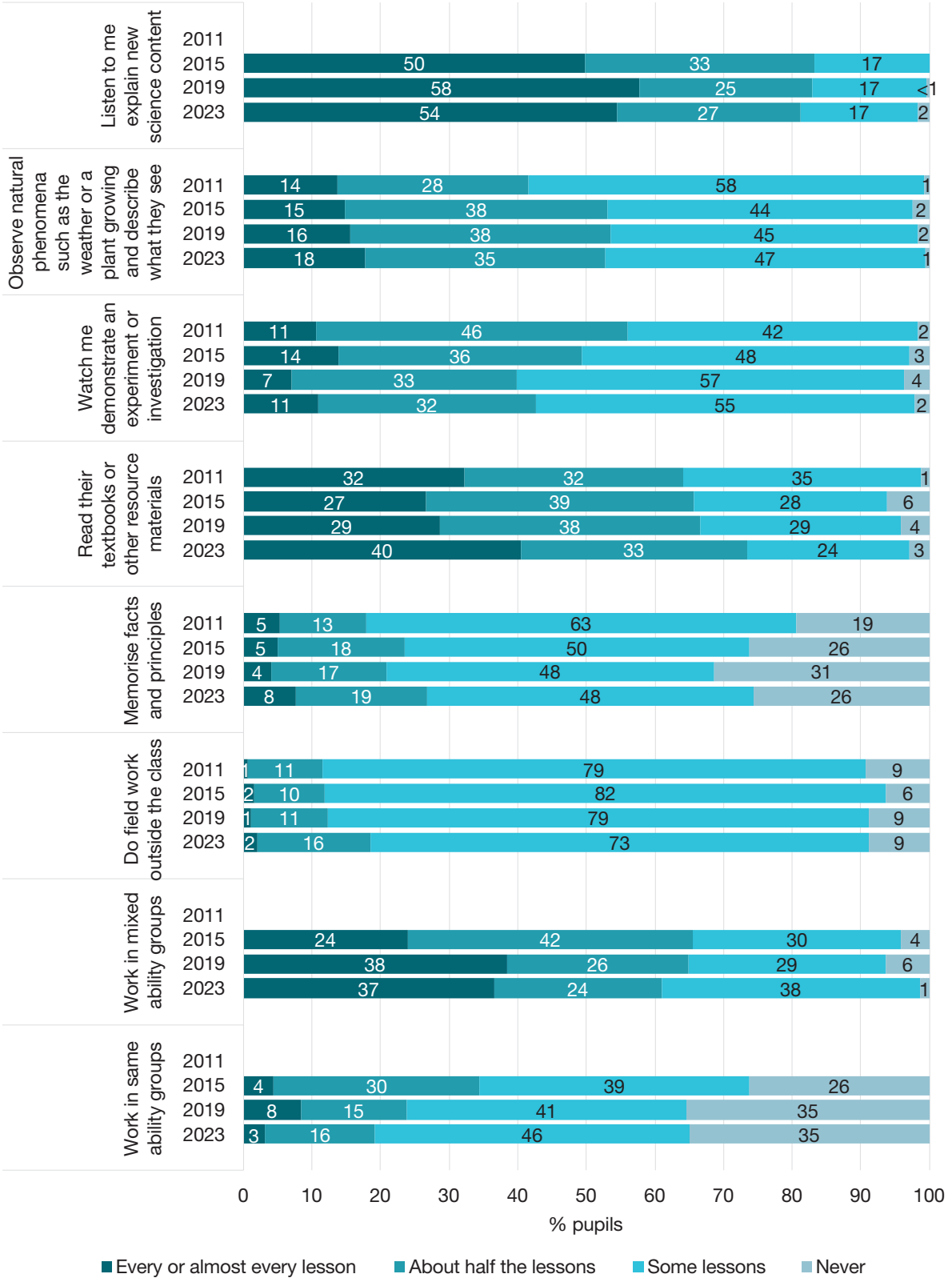


The third question related to the engagement in specific activities during science lessons (Figure 3.3). Approximately half of pupils were taught by teachers who had pupils listen to the teacher explain new science content and two-fifths were taught by teachers who had pupils read their textbooks or resource materials in every or almost every lesson in 2023. Much fewer pupils were asked by their teachers to observe and describe natural phenomena such as the weather or a plant growing (18%) and watch their teacher demonstrate an experiment or investigation (11%) in every or almost every lesson. A very small proportion of pupils (2%) were taught by teachers who did field work outside the class frequently, but the majority of pupils engaged in this activity in at least some lessons (91%). Mixed-ability groupwork was experienced in every or almost every lesson by approximately two-fifths of pupils (37%), while same-ability groupwork was experienced at that frequency by a very small proportion of pupils (3%).

Looking at the changes over time, the proportion of pupils who were asked to read their textbooks or resource materials in every or almost every lesson has increased from 27% in 2015 and 29% in 2019 to 40% in 2023, though this was following a decrease between 2011 (32%) and 2015 (27%). There was an increase in the proportion of pupils who were asked to listen to their teacher explain new science content in every or almost every lesson between 2015 (50%) and 2019 (58%), but the proportion decreased slightly from 2019 to 2023 (54%). The use of mixed-ability groupwork increased from 2015 (24%) to 2019 (38%) and remained relatively stable from 2019 to 2023 (37%), while same-ability groupwork was not experienced by approximately one-third of pupils in both 2019 and 2023, an increase compared to 2015.

In 2023, higher proportions of pupils in boys' and girls' schools were taught by teachers who had pupils observe and describe natural phenomena such as the weather or a plant growing (30% and 48%, respectively) compared to mixed-gender schools (14%). Same-ability groupwork was never experienced by approximately half of the pupils in boys' schools (48%) compared to 43% in girls' schools and 33% in mixed-gender schools. The frequency with which pupils engaged in some of these science activities also somewhat varied across the four school DEIS categories; however, no consistent patterns were observed (Appendix Table A3.4).

Figure 3.3: Pupils' engagement in specific science activities during science lessons, Fourth Class (2011, 2015, 2019, 2023)

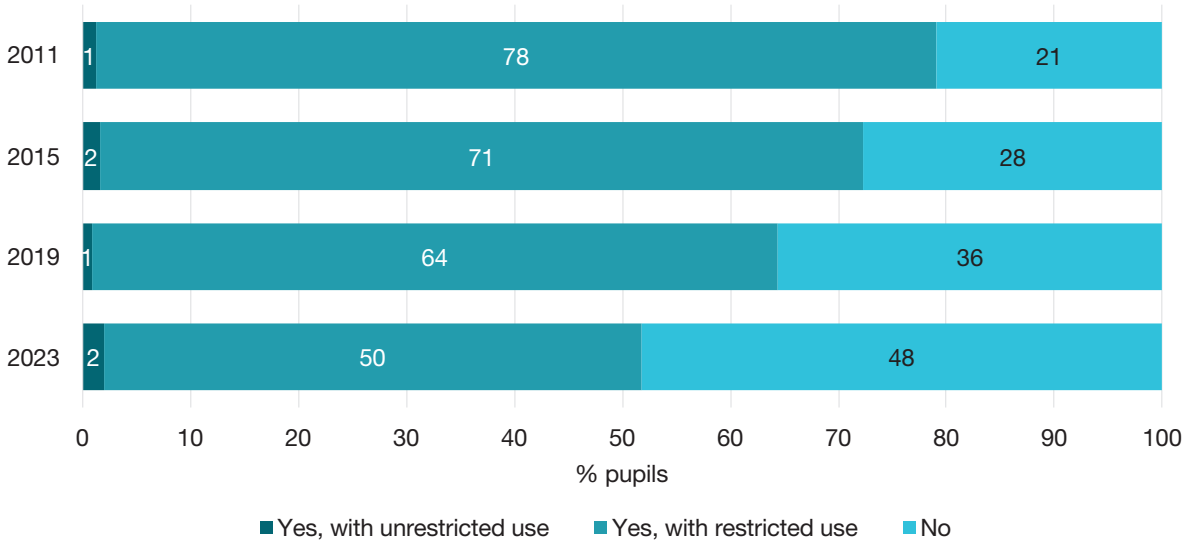


Use of calculators during mathematics lessons

As part of their questionnaire across all TIMSS cycles, teachers were asked if pupils were permitted to use calculators during mathematics lessons. In 2023, half of pupils (50%) had restricted access and 2% had unrestricted access to calculators during mathematics lessons (Figure 3.4). The proportion of pupils who were permitted to use calculators during mathematics lessons decreased gradually from 2011 to 2023, and accordingly the proportions with no access to calculators increased gradually. Very small proportions (2% or less) had unrestricted access to calculators in each of the cycles.

In 2023, a higher proportion of pupils in boys' schools had no access to calculators (64%) than in girls' (52%) and mixed-gender schools (46%) (Appendix Table A3.5). Also, a higher proportion of pupils in DEIS Urban Band 1 schools had no access to calculators (68%) than in each of the other school DEIS categories.

Figure 3.4: Access to calculators during mathematics lessons, Fourth Class (2011, 2015, 2019, 2023)



Conducting experiments during science lessons

As part of their questionnaire, pupils were asked how often their teacher asked them to conduct science experiments, with response options ranging from *at least once a week* to *never*. In 2023, less than one-tenth of pupils conducted experiments at least once a week (8%), one-third conducted experiments once or twice a month (31%), half of pupils conducted experiments a few times a year (50%), and approximately one-tenth never conducted experiments (11%). This question was also asked in 2019 and the frequency with which pupils were asked to conduct science experiments then was broadly similar to that in 2023, with slightly more pupils being asked to conduct experiments at least once a week in 2019 (13%) compared to 2023 (8%).

In 2023, a higher proportion of pupils in boys' schools (15%) conducted experiments at least once a week compared to girls' and mixed-gender schools (8%, respectively). The frequency with which pupils were asked to conduct science experiments was broadly similar across the four school DEIS categories (Appendix Table A3.6).

Mathematics and science homework

Teachers were asked questions relating to both mathematics and science homework. Firstly, for both mathematics and science, they were asked to indicate how often they assigned homework to the class that participated in TIMSS (*every day*, *1 or 2 times a week*, *3 or 4 times a week*, *less than once a week*, or *I do not assign mathematics homework*). Secondly, they were asked to indicate how frequently (*always or almost always*, *sometimes*, or *never or almost never*) they conducted various activities with pupils' homework including: *Correct assignments and give feedback to pupils; Have pupils correct their own homework; Discuss the homework in class; Monitor whether or not the homework was completed; Use the homework to contribute towards pupils' grades or marks*.

Approximately three-fifths of pupils (58%) had teachers who assigned mathematics homework every day, while approximately one-third (36%) were assigned mathematics homework once or twice a week (Figure 3.5). Less than 1% of pupils had teachers who assigned mathematics homework less than once a week or did not assign mathematics homework. Of those pupils who were assigned mathematics homework, most had teachers who reported that they, always or almost always, monitored whether or not homework was completed (94%), discussed the homework in class (89%), and corrected assignments and gave feedback to pupils (86%).

There was a small decrease in the number of pupils whose teachers assigned mathematics homework every day from 2011 (62%) to 2015 (54%), and this remained stable between 2015 and 2019 (54%), before slightly increasing again in 2023 (58%) to a broadly similar proportion as in 2011 (Figure 3.5). Across all four cycles, all pupils (99% or more) were assigned mathematics homework at least once or twice a week with almost all (94% or more) assigned homework at least three or four times a week.

The frequency with which pupils were assigned mathematics homework was broadly similar by school DEIS status (Appendix Table A3.7). However, when examining the frequency of mathematics homework by school gender, some differences were observed. Substantially more pupils in girls' schools received homework every day (95%) than in boys' (52%) and mixed-gender schools (56%). The proportions who were assigned homework less frequently (once or twice a week or less) were similar across all school gender types (Appendix Table A3.7).

Figure 3.5: Assignment of mathematics homework, Fourth Class (2011, 2015, 2019, 2023)

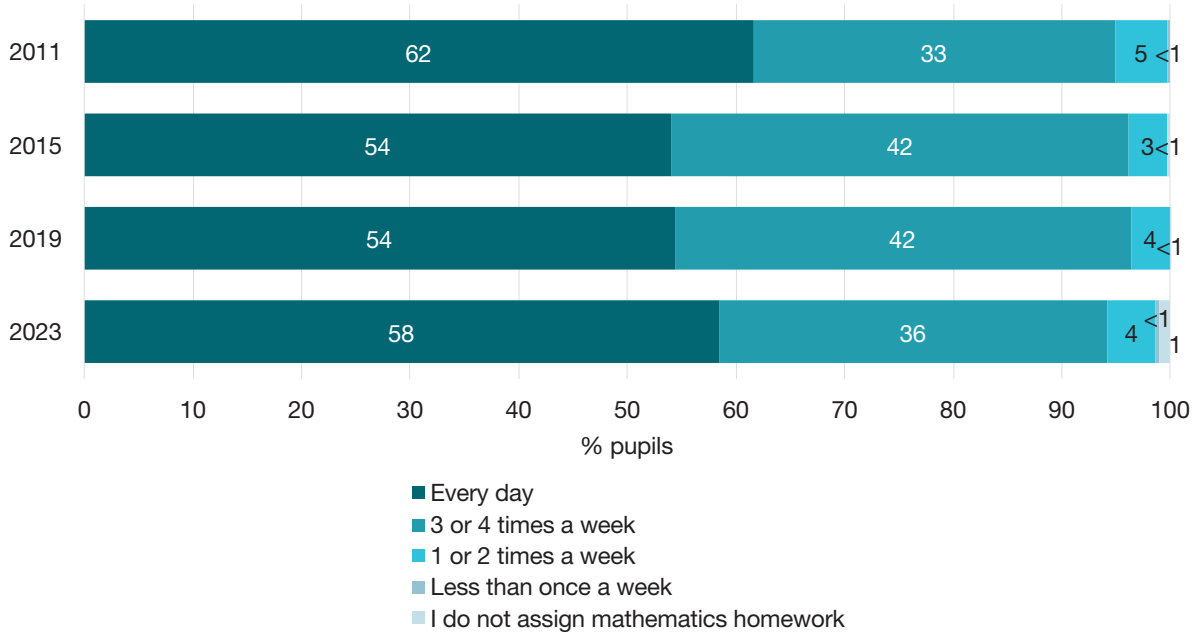
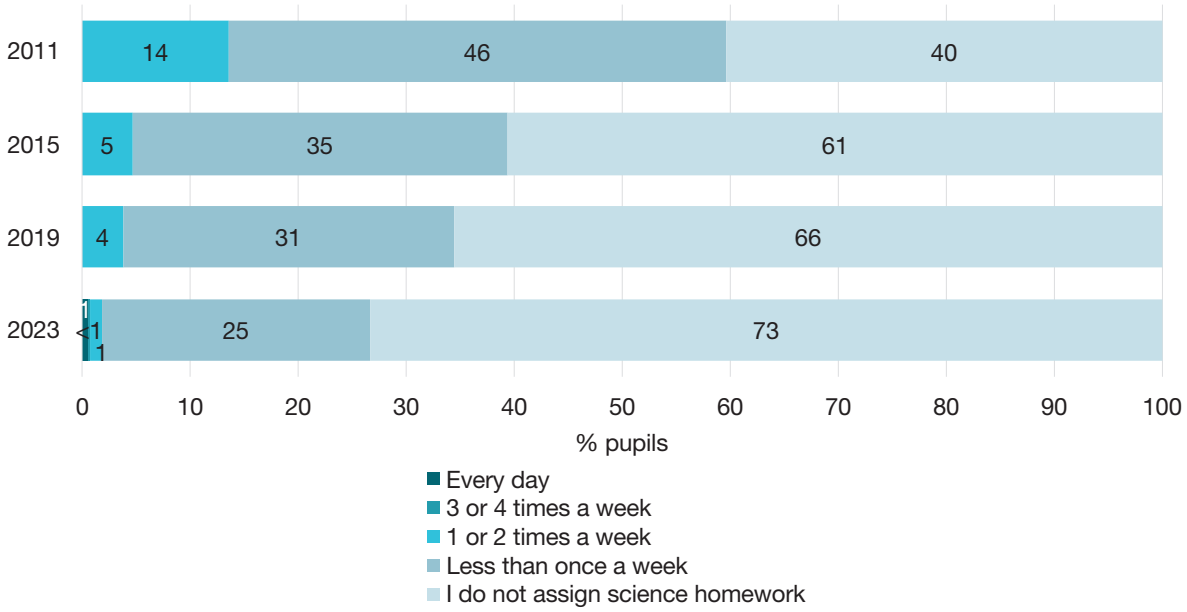


Figure 3.6 presents the frequency with which teachers assigned science homework in 2011, 2015, 2019, and 2023. Approximately three-quarters of pupils (73%) had teachers who did not assign science homework and one-quarter of pupils had teachers who assigned science homework less than once a week in 2023. Of the small proportion of pupils who were assigned science homework, most had teachers who reported that they, always or almost always, monitored whether or not homework was completed (78%), discussed the homework in class (73%), and corrected assignments and gave feedback to pupils (60%).

There was a marked increase in the proportion of pupils whose teachers did not assign science homework from two-fifths of pupils in 2011 and approximately three-fifths of pupils in 2015 and 2019 (61% and 66%, respectively) to almost three-quarters of pupils in 2023 (73%) (Figure 3.6).

In 2023, there was a lot of variation in the frequency with which pupils were assigned science homework by school gender and DEIS status. Substantially higher proportions of pupils in boys' schools (92%) and DEIS Urban Band 1 schools (100%) had teachers who did not assign science homework than in the other school types (Appendix Table A3.8).

Figure 3.6: Assignment of science homework, Fourth Class (2011, 2015, 2019, 2023)



Assessment strategies in mathematics and science

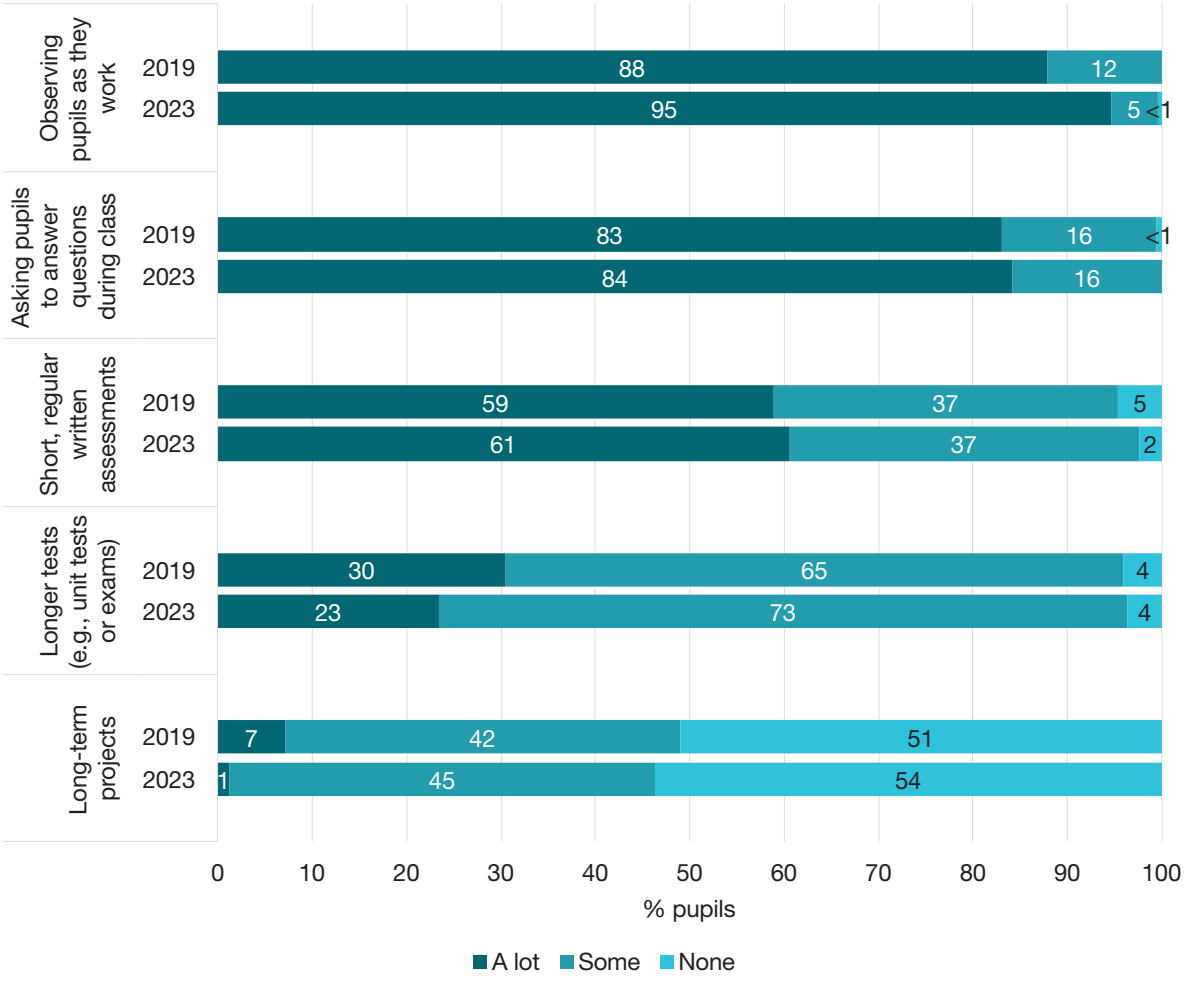
Teachers were asked about the importance they placed on various assessment strategies in mathematics and science. Figure 3.7 presents the percentages of pupils based on their teachers' reports of the importance placed on assessment strategies in mathematics lessons, and Figure 3.8 presents the equivalent information for science lessons. This question was redeveloped in TIMSS 2019 so comparisons to previous cycles are not possible.

In 2023, very high proportions of pupils had teachers who placed a lot of importance on observing pupils as they work (95%) and asking pupils to answer questions during class (84%) in mathematics lessons (Figure 3.7). Approximately three-fifths of pupils had teachers who placed a lot of importance on short, regular written assessments (61%). Approximately one-quarter of pupils had teachers who placed a lot of importance on longer tests (e.g., unit tests or exams) (23%) and very few pupils had teachers who placed a lot of importance on long-term projects (1%) in mathematics lessons. Small fluctuations can be observed across the various items

between 2019 and 2023. The proportion of pupils whose teachers placed a lot of importance on observing pupils as they work increased from 88% in 2019 to 95% in 2023, while the proportions of pupils whose teachers placed a lot of importance on longer tests and long-term projects decreased.

The importance placed on the various assessment strategies in mathematics lessons varied somewhat across different school types in 2023 (Appendix Table A3.9). The proportion of pupils whose teachers placed a lot of importance on longer tests (e.g., unit tests or exams) was higher in boys' (52%) and in girls' schools (46%) than in mixed-gender schools (18%). A lower proportion of pupils in girls' schools were taught by teachers who placed a lot of importance on asking pupils to answer questions during class (65%) than in boys' (90%) and mixed-gender schools (85%) (Appendix Table A3.9). In terms of DEIS status, a lower proportion of pupils in DEIS Urban Band 2 schools were taught by teachers who placed a lot of importance on asking pupils to answer questions during class (63%) than in DEIS Urban Band 1 (85%), DEIS Rural (88%), and non-DEIS schools (87%), while a lower proportion of pupils in DEIS Rural schools were taught by teachers who placed no importance on long-term projects (34%) than in DEIS Urban Band 1 (55%), DEIS Urban Band 2 (59%), and non-DEIS schools (55%) (Appendix Table A3.9).

Figure 3.7: Importance placed on assessment strategies in mathematics lessons, Fourth Class (2019, 2023)

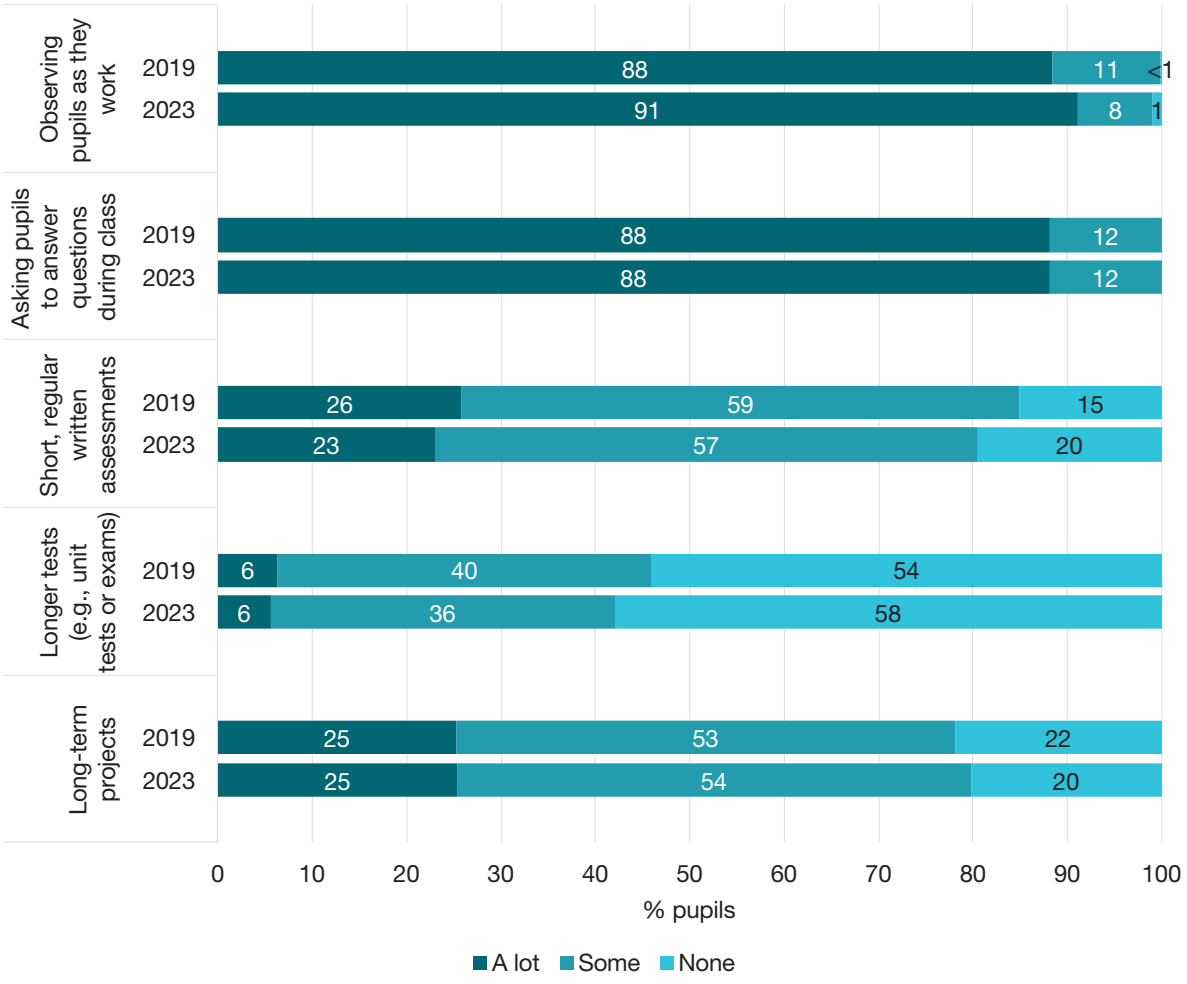


Similarly, for science lessons, very high proportions of pupils had teachers who placed a lot of importance on observing pupils as they work (91%) and asking pupils to answer questions during class (88%) (Figure 3.8). Approximately one-quarter of pupils had teachers who placed a lot of importance on short, regular written assessments (23%) and long-term projects (25%). Very few pupils had teachers who placed a lot of importance

on longer tests (e.g., unit tests or exams) (6%). There was little variation in the proportions reported in 2019 and 2023, with a slight increase in the proportion of pupils whose teachers placed no importance on short, regular written assessments and longer tests (e.g., unit tests or exams).

In 2023, some variation in the importance placed on the various assessment strategies in science lessons was observed by school gender and DEIS status. A higher proportion of pupils in boys' schools (42%) had teachers who placed a lot of importance on short, regular written assessments compared to the proportions in girls' schools (13%) and mixed-gender schools (22%). Teachers in girls' schools were more likely to place a lot of importance on longer tests (e.g., unit tests or exams), while teachers in boys' schools were less likely to place a lot of importance on long-term projects, as were teachers in DEIS Urban schools. Another difference observed by school DEIS status was that a lower proportion of pupils in DEIS Urban Band 2 schools (68%) had teachers who placed a lot of importance on asking pupils to answer questions during class compared to each of the other three DEIS categories (DEIS Urban Band 1: 95%; DEIS Rural: 100%; non-DEIS: 89%) (Appendix Table A3.10).

Figure 3.8: Importance placed on assessment strategies in science lessons, Fourth Class (2019, 2023)



Challenges in mathematics and science instruction

This section focuses on two key challenges faced by teachers. The first challenge, instruction affected by mathematics and science resource shortages, is based on data collected from school principals. The second challenge, teaching limited by pupils not ready for instruction, is based on data collected from teachers themselves.

Instruction affected by mathematics and science resource shortages

The extent to which instruction at the school level was affected by mathematics and science resource shortages was captured through a question in the school questionnaire. School principals were asked to indicate how much (*not at all, a little, some*, or *a lot*) their school's capacity to provide mathematics and science instruction was affected by a shortage or inadequacy of resources in three areas: general school resources, resources for mathematics instruction, and resources for science instruction. General school resources covered areas like instructional materials (e.g., textbooks), school buildings and grounds, instructional space (e.g., classroom), digital resources (e.g., interactive whiteboards), as well as resources for pupils with disabilities. Resources for mathematics instruction covered areas like teachers with a specialisation in mathematics, calculators for mathematics instruction, and concrete objects or materials to help pupils understand quantities or procedures. Resources for science instruction covered areas like teachers with a specialisation in science, library resources relevant to science instruction, and science equipment and materials for experiments. For each of the participating countries, including Ireland, responses to these items were used by the IEA and the TIMSS & PIRLS International Study Center at Boston College to create two scales: TIMSS *Instruction Affected by Mathematics Resource Shortages* scale (from general and mathematics-specific resources) and TIMSS *Instruction Affected by Science Resource Shortages* scale (from general and science-specific resources), on the basis of which schools were grouped into three categories: *affected a lot, somewhat affected*, and *not affected*.

Figure 3.9 presents the percentages of pupils in each category of the TIMSS *Instruction Affected by Mathematics Resource Shortages* and the *Instruction Affected by Science Resource Shortages* scales for 2011, 2015, 2019, and 2023. In 2023, approximately three-quarters of pupils were in schools that were somewhat affected by a shortage in mathematics resources (72%), while a slightly higher proportion, more than four-fifths of pupils (82%), were in schools that were somewhat affected by a shortage in science resources. Approximately one-quarter of pupils were in schools that were not affected by a shortage in mathematics resources (26%), while approximately one-fifth of pupils were in schools that were not affected by a shortage in science resources (18%). A very small proportion, less than 2% of pupils, were in schools that were affected a lot by a shortage in mathematics or science resource shortages.

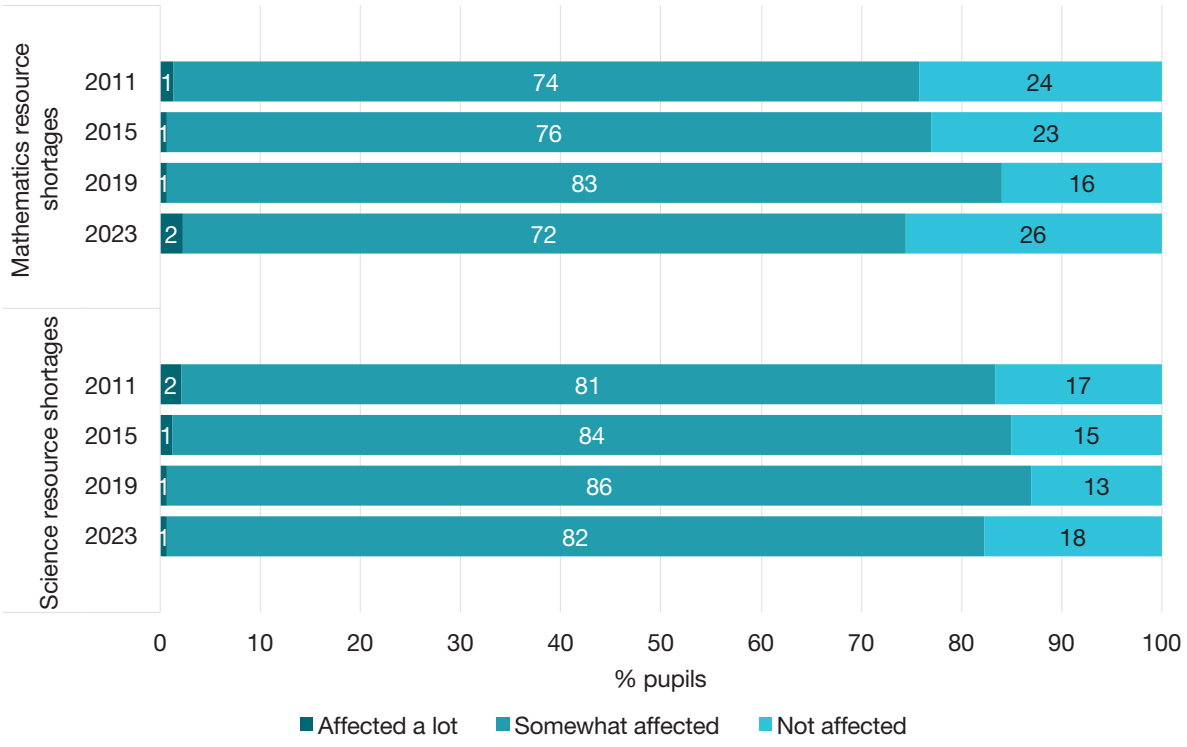
Looking at the individual component items of the scales, the proportion of pupils whose school principals reported that their schools were affected a lot by a shortage of each resource type was 10% or lower for most of the general resources and mathematics-specific resources. Exceptions to this included school buildings and grounds (11%), instructional space (e.g., classrooms) (13%), and library resources relevant to mathematics instruction (11%). For each of the science-specific resources, the proportion of pupils whose school principals reported that their schools were affected a lot by a shortage of each resource type ranged between 10% and 20%, including teachers with a specialisation in science (19%), science equipment and materials for experiments (18%), computer software or application for science instruction (14%), and library resources relevant for science instruction (14%).

The proportions of pupils attending schools that were not affected by mathematics and science resource shortages increased between 2019 and 2023 (Figure 3.9). Accordingly, the proportion of pupils attending schools

that were somewhat affected decreased between 2019 and 2023. In all four cycles, very small proportions of pupils (2% or less) attended schools that were affected a lot by mathematics and science resource shortages.

In 2023, higher proportions of pupils in girls' schools attended schools that were not affected by a shortage in mathematics resources (33%) compared to mixed-gender schools (25%) and boys' schools (20%) (Appendix Table A3.11). Regarding science resources, higher proportions of pupils in girls' and mixed-gender schools attended schools that were not affected compared to boys' schools (Appendix Table A3.12). There were also differences observed for both subjects by school DEIS status. Non-DEIS schools had higher proportions of pupils in schools that were not affected from mathematics (32%) and science resource (25%) shortages than each of the other three DEIS categories (Appendix Tables A3.11 and A3.12).

Figure 3.9: Instruction affected by mathematics and science resource shortages, Fourth Class (2011, 2015, 2019, 2023)



Note. In 2015, the *Somewhat affected* category was phrased *Affected*.

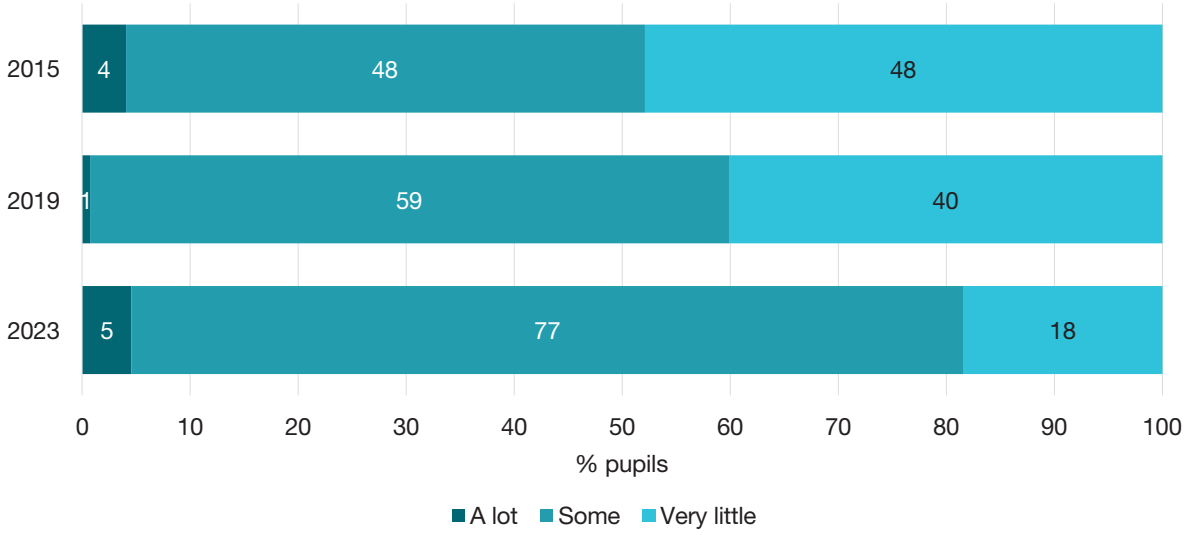
Teaching limited by pupils not ready for instruction

The teacher questionnaire included a question asking teachers to what extent (*not at all, some*, or *a lot*) various factors limited how they taught the TIMSS class. These factors included: *Pupils lacking prerequisite knowledge or skills; Pupils suffering from lack of basic nutrition; Pupils suffering from not enough sleep; Pupils absent from class; Disruptive pupils; Uninterested pupils; Distracted pupils; Pupils with mental, emotional, or psychological impairment; Pupils with difficulties understanding the language of instruction; Pupils with physical disabilities*. For each of the participating countries, including Ireland, responses from teachers were used by the IEA and the TIMSS & PIRLS International Study Center at Boston College to create the TIMSS *Teaching Limited by Students not Ready for Instruction* scale, on the basis of which pupils were described as receiving teaching that, according to their teachers, was limited by pupils not being ready for instruction *a lot, some,* and *very little*.

Figure 3.10 presents the percentages of pupils in each category of the TIMSS *Teaching Limited by Students not Ready for Instruction* scale for 2015, 2019, and 2023.[9] In 2023, teachers of most pupils (77%) reported that their teaching was limited to some extent by pupils not being ready for instruction. Smaller proportions of pupils had teachers who reported that their teaching was limited very little (18%) or a lot (5%). Looking at the individual items of this scale, the percentages of pupils whose teachers reported that their teaching was limited a lot by pupils not being ready for instruction was generally 15% or less, including pupils being absent from class (14%), distracted pupils (14%), disruptive pupils (13%), and pupils lacking pre-requisite knowledge or skills (12%). The proportions of pupils whose teachers reported that their teaching was limited very little by pupils not being ready for instruction have decreased over the past three cycles of TIMSS, but a marked decrease was observed from 2019 (40%) to 2023 (18%) (Figure 3.10). Accordingly, the proportion of pupils taught by teachers whose teaching was somewhat limited has increased from 48% in 2015 and 59% in 2019 to 77% in 2023.

Looking at differences by school gender and school DEIS status in 2023, more pupils in girls' schools (31%) were taught by teachers whose teaching was limited very little by pupils not being ready for instruction than in boys' schools (18%) and mixed-gender schools (17%) (Appendix Table A3.13). Higher proportions of pupils in DEIS Urban schools were taught by teachers who reported that their teaching was limited a lot by pupils not being ready for instruction. Accordingly, higher proportions of pupils in DEIS Rural and non-DEIS schools had teachers who reported that their instruction was limited very little (36% and 21%, respectively) than in DEIS Urban schools (Band 1: 3%; Band 2: 0%).

Figure 3.10: Teaching limited by pupils not ready for instruction, Fourth Class (2015, 2019, 2023)



Note. In 2015, the three categories were phrased: *Very limited, Somewhat limited,* and *Not limited*.

Digital devices in mathematics and science lessons

The teacher questionnaire included questions regarding Fourth Class pupils' access to digital devices during mathematics and science lessons. This section focuses on the availability and use of digital devices during mathematics and science lessons, and obstacles to using digital devices, a new question introduced in 2023.

9 The scale was constructed in 2015, so comparisons to 2011 are not possible.

Availability and use of digital devices

In 2023, teachers were asked if their pupils had digital devices (including computers, tablets, or smartphones) available to use during mathematics and science lessons. Those who had digital devices available were asked three follow-up questions relating to the access pupils had to these digital devices, how often they used these digital devices during mathematics and science lessons, and how often they completed various activities using digital devices.

Approximately half of pupils (46%) had digital devices available to use during mathematics lessons and two-thirds of pupils (65%) had digital devices available to use during science lessons. Of these pupils who had digital devices available for mathematics and science lessons, the majority (84% for mathematics and 87% for science) were in schools that had digital devices that the class could use sometimes, approximately one-third (34% in mathematics and 36% in science) were in a class that had digital devices for each pupil to use, and more than half of pupils were in classes that had digital devices that pupils could share (54% in mathematics and 61% in science). A very small proportion of those who had digital devices (less than 5%) were in schools that allowed pupils to bring their own digital devices.

According to teachers' reports, approximately two-fifths of pupils (44%) who had devices available to them used them at least once a week in mathematics lessons and a further one-third used them once or twice a month. For science lessons, of those who had devices available to them, less than one-fifth (16%) used them at least once a week and approximately one-third (31%) used them once or twice a month.

Among pupils who had digital devices available during mathematics lessons, the most frequent activities included playing games involving mathematics calculations or concepts (46%), reading the textbook or watching instructional videos (32%), and practising problems and procedures (26%). Among pupils who had digital devices available during science lessons, the activity conducted most frequently was reading the textbook or watching instructional videos, with 36% of pupils engaging in this at least once or twice a month. Approximately half of those who had digital devices available during mathematics lessons (49%) and more than three-quarters of those who had digital devices available during science lessons (77%) never or almost never used them to take a test.

In previous cycles of TIMSS, teachers were asked a similar question about whether computers, in 2011, or computers and tablets, in 2015 and 2019, were available to use during mathematics and science lessons. In 2023, however, the question was expanded to include smartphones. The inclusion of smartphones in 2023 means that trend comparisons should be interpreted cautiously. More than half of pupils had computers available to use during mathematics (55%) and science (62%) lessons in 2011. In both 2015 and 2019, approximately two-fifths of pupils had computers (including tablets) available to use during mathematics and science lessons. In 2023, approximately half of pupils had digital devices (including computers, tablets, and smartphones) available to use during mathematics lessons and approximately two-thirds of pupils had digital devices (including computers, tablets, and smartphones) available to use during science lessons.

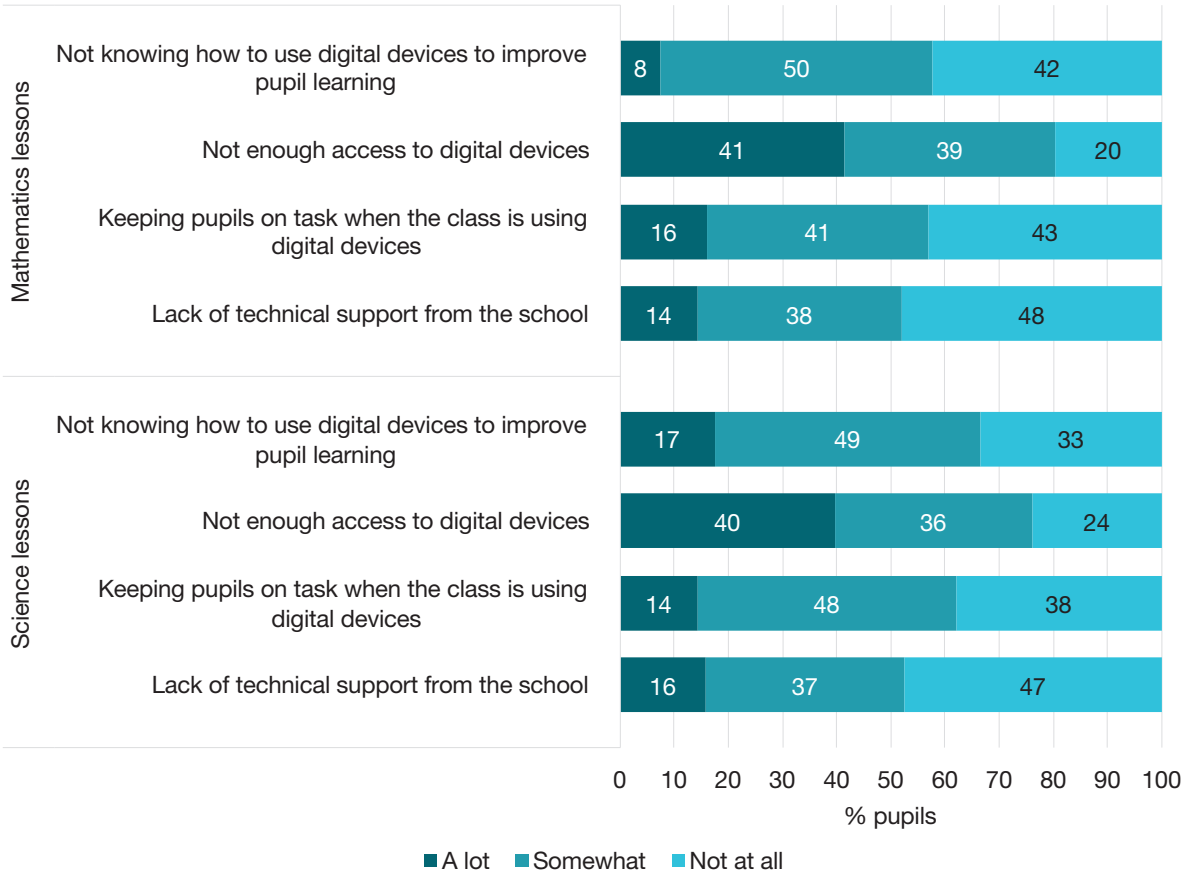
In 2023, the proportions of pupils who had digital devices available during mathematics lessons were broadly similar across the school gender categories. However, slightly higher proportions of pupils in boys' (70%) and girls' schools (76%) had digital devices available during science lessons than in mixed-gender schools (63%) (Appendix Table A3.14). Looking at school DEIS status, a higher proportion of pupils in DEIS Urban Band 1 schools (56%) had digital devices available to use during mathematics lessons than in DEIS Urban Band 2 schools (29%) as well as DEIS Rural (36%) and non-DEIS schools (48%), while a lower proportion of pupils in DEIS Rural schools had digital devices available to use during science lessons than in the other DEIS categories (Appendix Table A3.14).

Obstacles to using digital devices

A new question was added to the teacher questionnaire in 2023 asking teachers about the extent (*not at all, somewhat,* or *a lot*) to which they faced various obstacles in incorporating digital devices into mathematics and science lessons. The obstacles included: *Not knowing how to use digital devices to improve pupil learning*; *Not enough access to digital devices*; *Keeping pupils on task when the class is using digital devices*; *Lack of technical support from the school*. Figure 3.11 presents the percentages of pupils taught by teachers facing these obstacles in incorporating digital devices into mathematics and science lessons. Approximately two-fifths of pupils were taught by teachers who reported that not enough access to digital devices (41% and 40%, respectively) kept them a lot from using digital devices in mathematics and science lessons. Less than one-fifth of pupils had teachers who reported that keeping pupils on task when the class is using digital devices and a lack of technical support from the school kept them a lot from incorporating digital devices into mathematics and science lessons.

Higher proportions of pupils in boys' schools (44% and 46%, respectively) had teachers who reported that keeping pupils on task when the class was using digital devices hindered them a lot from incorporating digital devices into mathematics and science lessons, while higher proportions in girls' schools had teachers who reported that not enough access to digital devices was an obstacle to incorporating digital devices into mathematics and science lessons (Appendix Tables A3.15 and A3.16). While there was some variation in the extent to which different obstacles hindered teachers from incorporating digital devices into mathematics and science lessons across the four school DEIS categories, no consistent patterns were observed (Appendix Tables A3.15 and A3.16).

Figure 3.11: Obstacles to incorporating digital devices into mathematics and science lessons, Fourth Class (2023)



Chapter 4:
The post-primary school

As described in Chapter 1, principals of participating schools and teachers of participating classes complete questionnaires as part of TIMSS. This chapter focuses on post-primary schools in Ireland, drawing insights from these responses. Data from 2023 are compared to those from previous TIMSS cycles in 2015 and 2019, where available, to examine trends. Subgroup differences by school gender and school DEIS status are also referenced in text, while all subgroup analysis outputs can be found in the Chapter 4 Appendix of this report.

School composition

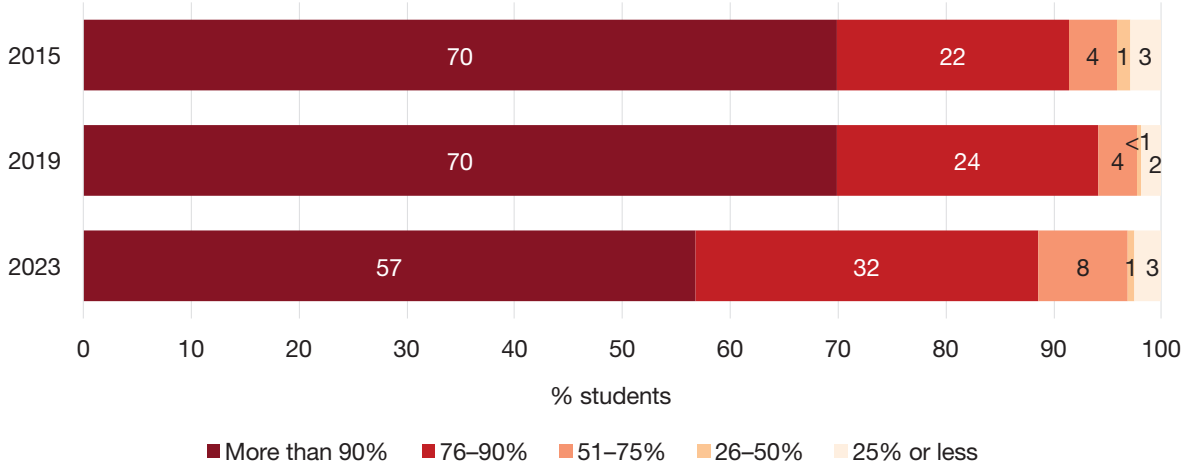
This section focuses on the linguistic and socioeconomic composition of schools, and teacher characteristics, including their formal education, major or main areas of study, job satisfaction, and professional development in mathematics and science education.

Students with English or Irish as their native language

In 2015, 2019 and 2023, school principals were asked to estimate the proportion of students in their school that had English or Irish, the languages of the TIMSS assessment in Ireland, as their native language. Figure 4.1 shows the proportions of students within schools in Ireland that had English or Irish as their native language across the three TIMSS cycles. In both 2015 and 2019, 70% of students attended schools where more than 90% of students spoke English or Irish as their native language. This percentage declined to 57% in 2023. Accordingly, the proportions of students attending schools where 76–90% of students spoke English or Irish as their native language remained relatively steady between 2015 and 2019 (22% and 24%, respectively) with an increase observed in 2023 (32%).

Across the school gender groups, boys' schools had relatively lower linguistic diversity compared to girls' and mixed-gender schools. Almost all students (98%) in boys' schools attended schools where over 76% of students spoke English or Irish as their native language (91% in girls' schools; 86% in mixed-gender schools). Linguistic diversity was greater in DEIS schools than in non-DEIS schools. Approximately 43% of students in DEIS schools attended schools where more than 90% of students were English or Irish native speakers, compared to 62% of students in non-DEIS schools (Appendix Table A4.1).

Figure 4.1: School principals' estimations of the proportion of students in their schools with English or Irish as their native language, Second Year (2015, 2019, 2023)



School socioeconomic composition

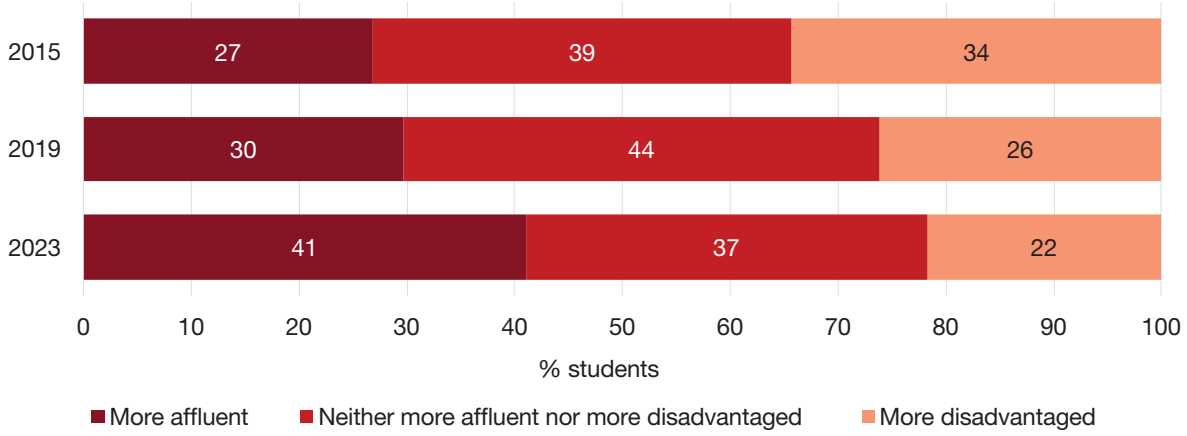
In 2015, 2019, and 2023, school principals were asked to estimate the proportion of students in their school who came from economically disadvantaged and economically affluent backgrounds. The response options provided were *0 to 10%*, *11 to 25%*, *26 to 50%*, and *more than 50%*. For each of the participating countries, including Ireland, responses were used by the IEA and the TIMSS & PIRLS International Study Center at Boston College to create the TIMSS *School Composition by Socioeconomic Background of the Student Body* index, on the basis of which students were described as attending *more affluent*, *neither more affluent nor more disadvantaged*, and *more disadvantaged* schools.[10]

In 2023, 41% of students attended schools with more affluent student bodies, an increase from 2019 (30%) and 2015 (27%) (Figure 4.2). Accordingly, there has been a decrease across years in the proportion of students attending schools with more disadvantaged student bodies (34%, 26%, and 22%, respectively).

Higher proportions of students in boys' schools (58%) and girls' schools (52%) attended schools with more affluent composition than in mixed-gender schools (34%) (Appendix Table A4.2). Comparing DEIS and non-DEIS schools, a substantially higher proportion of students in non-DEIS schools (56%) were in more affluent settings than students in DEIS schools (3%). Accordingly, a substantially higher proportion of students in DEIS schools (58%) attended schools with more disadvantaged composition than in non-DEIS schools (7%) (Appendix Table A4.2).

10 *More affluent* schools are those that were estimated to have more than 25% of students from economically affluent backgrounds and not more than 25% from economically disadvantaged backgrounds, while *more disadvantaged* schools are those that were estimated to have more than 25% of students from disadvantaged backgrounds and not more than 25% from affluent backgrounds. All other combinations are considered to be *neither more affluent nor more disadvantaged* (von Davier et al., 2024).

Figure 4.2: School principals' estimations of the socioeconomic composition of the student body, Second Year (2015, 2019, 2023)



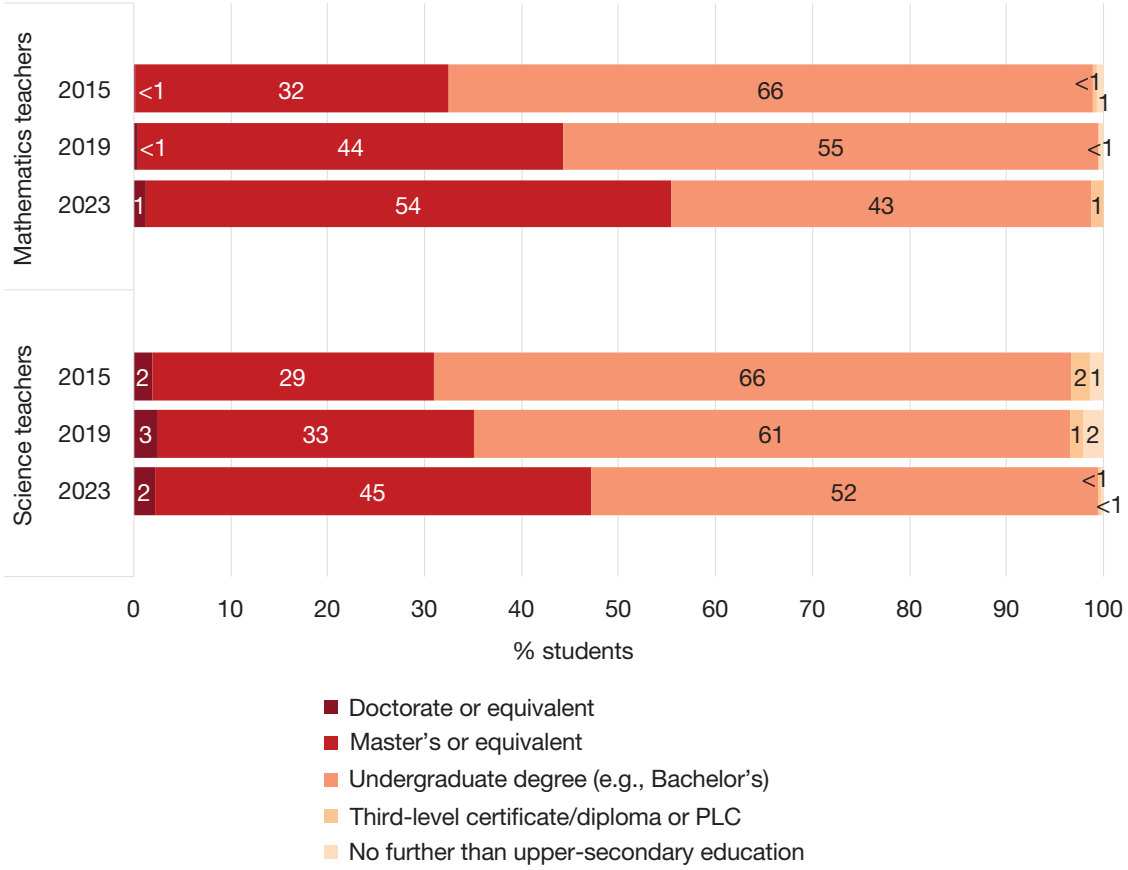
Teacher characteristics

Formal education

Figure 4.3 presents details on teachers' formal education level. In 2023, over half of students (54%) were taught by mathematics teachers who had a master's or equivalent degree, and a further 43% by teachers whose highest level of education was an undergraduate degree. There has been an increase in the proportion of students with mathematics teachers who hold a master's or equivalent degree across the TIMSS cycles (2015: 32%; 2019: 44%). Similar increases can be seen in the proportion of students with science teachers holding a master's or equivalent degree. In 2015, 29% of students were taught by science teachers holding a master's or equivalent degree, with this increasing to 33% in 2019 and 45% in 2023. Marginally more students were taught by science teachers holding a doctorate or equivalent degree compared to mathematics teachers.

Although broadly similar levels of formal education were recorded for both mathematics and science teachers across the various school types examined in this report, there were slightly more students in girls' and mixed-gender schools than in boys' schools being taught by mathematics teachers holding a master's or equivalent degree, and slightly more students in non-DEIS schools than in DEIS schools being taught by science teachers holding a master's or equivalent degree (Appendix Table A4.3).

Figure 4.3: Teachers' formal education level, Second Year (2015, 2019, 2023)



Major or main area(s) of study during third-level education

In 2015, 2019, and 2023, students' mathematics and science teachers were asked about their major or main area(s) of study during their third-level education. The available response options were: *Mathematics*, *Biology*, *Physics*, *Chemistry*, *Earth Science (e.g., geology, meteorology, hydrology)*, *Education—Mathematics*, *Education—Science*, *Education—General,* and *Other*. For each of the participating countries, including Ireland, responses were used by the IEA and the TIMSS & PIRLS International Study Center at Boston College to create two TIMSS indices: *Teachers Majored in Mathematics and Mathematics Education* and *Teachers Majored in Science and Science Education*, within which teachers were grouped into four categories: *major in mathematics/science and mathematics/science education*, *major in mathematics/science but no major in mathematics/science education, major in mathematics/science education but no major in mathematics/science*, and *all other majors*. It is worth noting that a definition of major or main area(s) of study was not provided as part of the teacher questionnaires; thus, reliance was on the teachers' interpretation of the question.

In 2023, 51% of students had mathematics teachers who reported to have majored in both mathematics and mathematics education, an increase from 2019 (38%) and 2015 (33%) (Figure 4.4). In 2015, Second Year students in Ireland were more likely to be taught mathematics by a teacher who reported that their major or main area(s) of study was something other than mathematics or mathematics education (22%) compared to 2019 (14%) and 2023 (11%).

A lower proportion of students in girls' schools (43%) were taught by mathematics teachers with a major in mathematics and mathematics education than in boys' and mixed-gender schools (53% and 52%, respectively). A larger proportion of students in DEIS schools were taught by mathematics teachers who reported to have

majored in both mathematics and mathematics education (56%) than in non-DEIS schools (48%) (Appendix Table A4.4).

Figure 4.4: Mathematics teachers' major or main area(s) of study during third-level education, Second Year (2015, 2019, 2023)

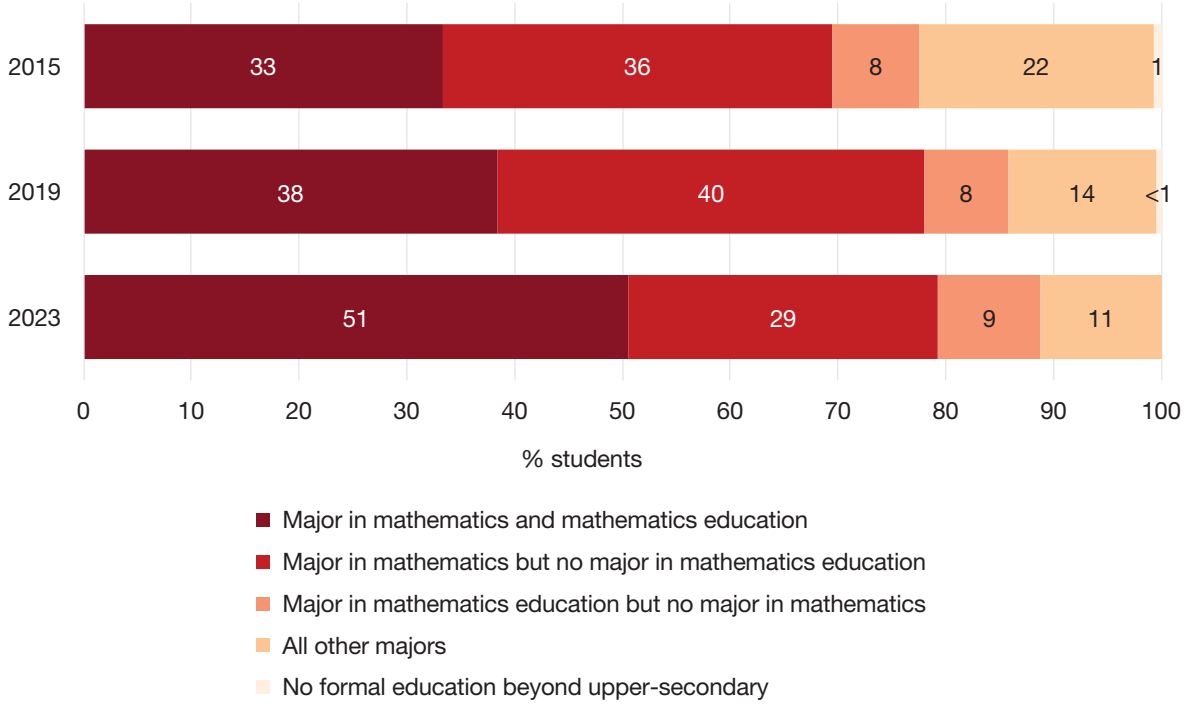
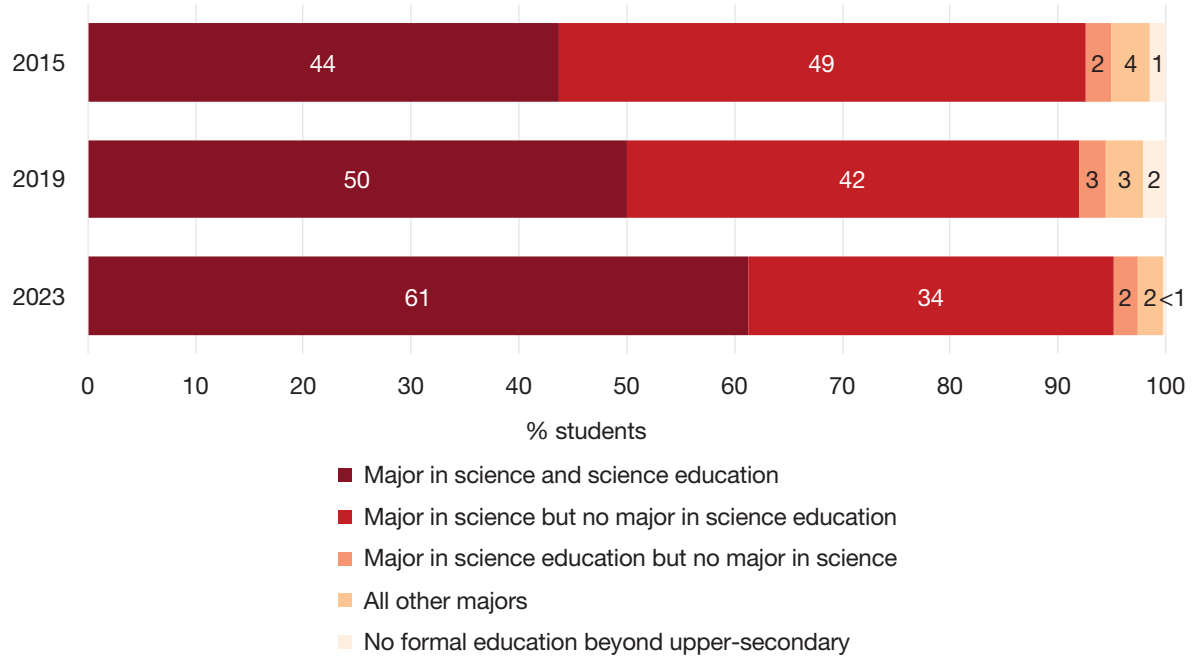


Figure 4.5 presents details on science teachers' reports of their major or main area(s) of study during third-level education. In contrast to mathematics, much smaller proportions of students were taught by science teachers who reported that their main area(s) of study was something other than science or science education, ranging between 2% and 4% across the three TIMSS cycles. Since 2019, there has been a higher proportion of students taught by science teachers who reported to have majored in both science and science education (2019: 50%; 2023: 61%) compared to science teachers who reported to have majored in science but not science education (2019: 42%; 2023: 34%).

Similar proportions of students in girls' and boys' schools were taught by science teachers who majored in both science and science education (70% and 71%, respectively), while this proportion was lower in mixed-gender schools (57%) (Appendix Table A4.5). Teachers in DEIS and non-DEIS schools were broadly similar to each other with regards to their major or main area(s) of study during their third-level education (Appendix Table A4.5).

Figure 4.5: Science teachers' major or main area(s) of study during third-level education, Second Year (2015, 2019, 2023)



Job satisfaction

In 2015, 2019, and 2023, teachers were asked to rate their level of satisfaction with their job. The 2023 teacher questionnaires included seven items on job satisfaction: *I am content with my profession as a teacher*; *I find my work full of meaning and purpose*; *I am enthusiastic about my job*; *My work inspires me*; *I am proud of the work I do*; *I feel appreciated as a teacher*; *I enjoy the challenges of teaching*.[11] Teachers were asked to indicate the frequency with which they felt that way about being a teacher for each of these statements and, for each of the participating countries, including Ireland, their responses were used by the IEA and the TIMSS & PIRLS International Study Center at Boston College to create the TIMSS *Teacher Job Satisfaction* scale, on the basis of which teachers were grouped into three categories: *very satisfied*, *somewhat satisfied,* and *less than satisfied*.

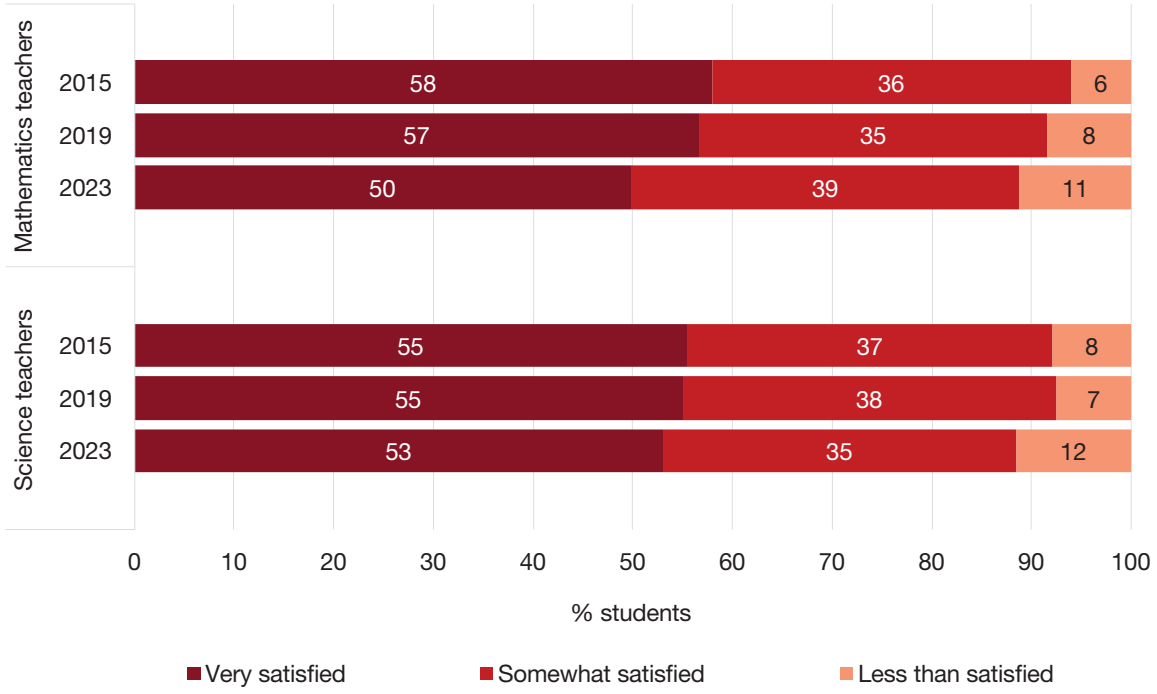
In 2023, half of Second Year students were taught by mathematics teachers who were very satisfied with their job (Figure 4.6). A further 39% were taught by mathematics teachers who were somewhat satisfied and 11% by mathematics teachers who were less than satisfied. The level of job satisfaction for mathematics teachers has decreased over time. In 2019, 57% of students were taught by mathematics teachers who were very satisfied with their job and a similar proportion was reported in 2015 (58%).

The level of job satisfaction has remained relatively more stable among science teachers (Figure 4.6). In 2023, 53% of students were taught by science teachers who reported being very satisfied with their job, a difference of two percentage points from 2019 to 2015 (both 55%). However, there has been a slight increase in the proportion of students' science teachers being less than satisfied with their job from 2015 (8%) and 2019 (7%) to 2023 (12%).

11 In 2019, the *Teacher Job Satisfaction* scale was based on the first five items from the 2023 scale. In 2015, the scale was based on these five items plus two additional items: *I am satisfied with being a teacher at this school* and *I am going to continue teaching for as long as I can*.

In 2023, the level of job satisfaction for mathematics teachers was relatively similar in boys', girls', and mixed-gender schools. A higher proportion of students in girls' schools (64%), though, were taught by science teachers who were very satisfied with their job than in mixed-gender (52%) and boys' schools (46%). While a slightly higher proportion of students in DEIS schools than non-DEIS schools were taught by mathematics teachers who were very satisfied with their job, similar proportions of students were taught by very satisfied science teachers in DEIS and non-DEIS schools (both 53%). Notably, however, higher proportions of students in DEIS schools (18% and 17%, respectively) were taught by mathematics and science teachers who were less than satisfied with their job compared to those in non-DEIS schools (8% and 9%, respectively) (Appendix Table A4.6).

Figure 4.6: Teachers' job satisfaction, Second Year (2015, 2019, 2023)



Professional development in mathematics and science education

As part of their questionnaire across all TIMSS cycles, mathematics and science teachers were asked to indicate whether they had completed professional development in various areas of mathematics and science in the two years preceding each TIMSS administration. In 2019 and 2023, teachers were also asked whether they need future professional development in these areas.

Table 4.1 presents details in relation to mathematics teachers' professional development across the three TIMSS cycles. In 2023, Second Year students were more likely to have mathematics teachers who participated in professional development in the areas of mathematics content (75%), curriculum (71%), and pedagogy/instruction (67%). While these were also the areas in which mathematics teachers more often participated in professional development in 2015 (content: 94%; curriculum: 91%; pedagogy/instruction: 78%) and 2019 (content: 83%; curriculum: 86%; pedagogy/instruction: 72%), the proportions of students taught by teachers who participated in professional development in mathematics content and curriculum declined by approximately 20 percentage points between 2015 and 2023.

In 2023, Second Year students were more likely to have mathematics teachers who indicated a requirement for professional development in the area of improving students' critical thinking or problem-solving skills (76%), although there was a slight decline since 2019 (84%). Integrating technology into mathematics instruction, addressing individual students' needs, and addressing students' language needs in learning mathematics were also areas for which the majority of teachers reported needing future professional development in 2023, although, again, slight declines were observed from 2019.

Table 4.1: Percentages of students by mathematics teachers' professional development in mathematics, Second Year (2015, 2019, 2023)

	Completed			Future needs	
	2015	2019	2023	2019	2023
Mathematics content					
Yes	94	83	75	54	34
No	6	17	25	46	66
Mathematics pedagogy/instruction					
Yes	78	72	67	61	46
No	22	28	33	39	54
Mathematics curriculum					
Yes	91	86	71	67	39
No	9	14	29	33	61
Integrating technology into mathematics instruction					
Yes	65	38	41	79	72
No	35	62	59	21	28
Improving students' critical thinking or problem-solving skills					
Yes	71	55	50	84	76
No	29	45	50	16	24
Mathematics assessment					
Yes	40	48	53	66	44
No	60	52	47	34	56
Addressing individual students' needs					
Yes	35	32	39	71	67
No	65	68	61	29	33
Addressing students' language needs in learning mathematics					
Yes	–	18	16	71	66
No	–	82	84	29	34

Notes. In 2015, the item *Integrating technology into mathematics instruction* was phrased *Integrating information technology into mathematics*. A dash (–) indicates that data are not available.

Table 4.2 presents details in relation to science teachers' professional development across the three TIMSS cycles. There has been a substantial increase in participation in professional development across all the areas presented to the science teachers of Second Year students between 2015 and 2023. Science curriculum had the largest increase; in 2015, 28% of students had science teachers who had participated in professional development in this area, compared to 95% in 2019, with this decreasing to 79% in 2023. Similarly, there was a 37-percentage-point increase in the proportion of students taught by science teachers who had participated in professional development in science content, and a 32-percentage-point increase in the proportion of students taught by science teachers who had participated in professional development in science pedagogy/instruction between 2015 and 2023. Participation in professional development in integrating technology into science instruction has increased gradually from 36% in 2015 to 50% in 2023. Similarly, participation in professional development in addressing individual students' needs has increased over the three cycles (2015: 24%; 2019: 34%; 2023: 45%).

In 2023, Second Year students were more likely to have science teachers who indicated a requirement for professional development in the area of improving students' critical thinking or inquiry skills (76%), although there was a slight decline since 2019 (79%). Overall, the findings show a slight decline between 2019 and 2023 in the reported need for future professional development across all the science-related areas presented to science teachers in the teacher questionnaire.

Table 4.2: Percentages of students by science teachers' professional development in science, Second Year (2015, 2019, 2023)

	Completed			Future needs	
	2015	2019	2023	2019	2023
Science content					
Yes	42	87	79	56	50
No	58	13	21	44	50
Science pedagogy/instruction					
Yes	38	76	70	58	52
No	62	24	30	42	48
Science curriculum					
Yes	28	95	79	63	48
No	72	5	21	37	52
Integrating technology into science instruction					
Yes	36	39	50	76	65
No	64	61	50	24	35
Improving students' critical thinking or inquiry skills					
Yes	34	51	49	79	76
No	66	49	51	21	24
Science assessment					
Yes	26	74	53	59	47
No	74	26	47	41	53
Addressing individual students' needs					
Yes	24	34	45	71	68
No	76	66	55	29	32
Integrating environmentalism and sustainability into science instruction					
Yes	–	–	27	–	60
No	–	–	73	–	40
Addressing students' language needs in learning science					
Yes	–	21	22	69	66
No	–	79	78	31	34

Notes. In 2015, the item *Integrating technology into science instruction* was phrased *Integrating information technology into science*. A dash (–) indicates that data are not available.

The proportions of students taught by mathematics and science teachers who reported to either have completed or to need professional development in various areas of mathematics and science varied to some extent by school gender and DEIS status in 2023 (Appendix Tables A4.7 and A4.8). Overall, lower proportions of students in boys' schools were taught by mathematics teachers who had completed professional development in the various areas of mathematics in the two years preceding the TIMSS administration than in girls' and mixed-gender schools. No clear-cut patterns of differences by school DEIS status were found in mathematics professional development among mathematics teachers. This absence of patterns was also evident for both school gender and DEIS status in relation to science professional development among science teachers.

When considering teachers' future professional development needs in mathematics and science, higher proportions of students in mixed-gender schools were taught by mathematics and science teachers who reported needing professional development in the various areas of both subjects than in boys' and girls' and schools. However, no clear-cut patterns of differences emerged in teachers' future needs for professional development in either subject based on school DEIS status (Appendix Tables A4.7 and A4.8).

School-level resources

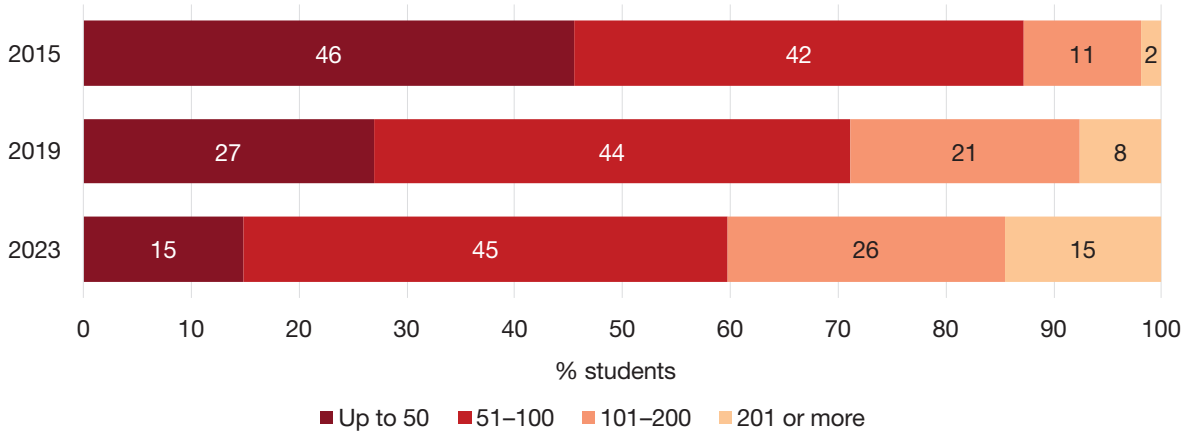
This section focuses on resources in the school that can be used by Second Year students, including computers/tablets, science laboratories, online learning management systems, school libraries or media centres, and high-speed internet.

Number of computers

Across all TIMSS cycles, school principals were asked to report the number of computers (including tablets) their school had for use by Second Year students. The average number of computers/tablets per school has gradually increased over time, from 65 in 2015 to 89 in 2019 and 112 in 2023. This translated to a steady improvement in student access; the student-to-computer ratio decreased from 13:1 in 2015 to 10:1 in 2019 and 8:1 in 2023. School principals' responses were also grouped into four categories: *up to 50*, *51–100*, *101–200*, and *201 or more*. Figure 4.7 shows the proportions of students within each of these categories across the three TIMSS cycles. There has been a steady increase in the proportion of students attending schools in which there are over 200 computers/tablets, from 2% in 2015 to 8% in 2019 and 15% in 2023. Similarly, the proportion of students attending schools with 101–200 computers/tablets increased from 2015 (11%) to 2023 (26%).

There was a higher proportion of students in boys' schools (20%) attending schools with over 200 computers/tablets compared to girls' schools (0%) and mixed-gender schools (17%). Non-DEIS schools were found to be slightly better equipped with computers/tablets compared to DEIS schools (Appendix Table A4.9).

Figure 4.7: School principals' estimations of the number of computers available for use by Second Year students, Second Year (2015, 2019, 2023)



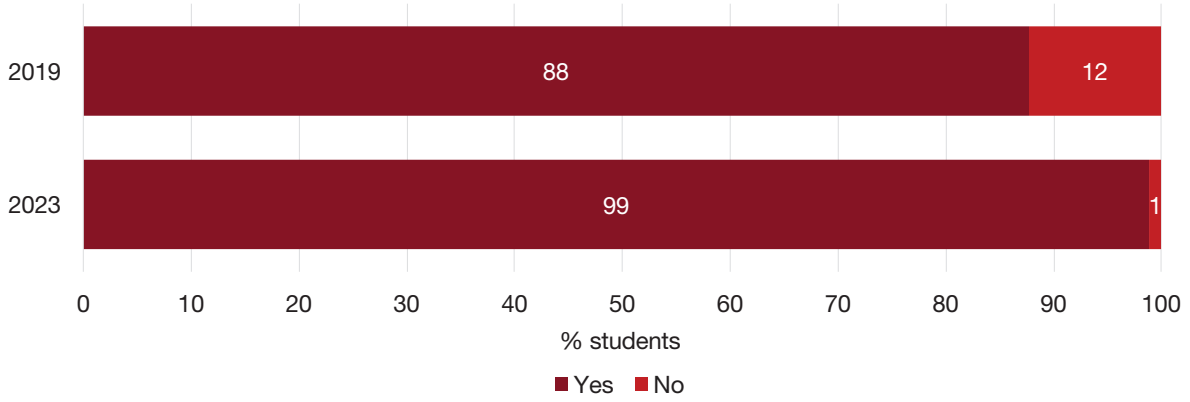
Science laboratory

In 2023, 97% of Second Year students were in schools where there was a science laboratory available to them, while in 2019 and 2015, all students were in schools where there was a science laboratory available to them. Slightly fewer students in mixed-gender and DEIS schools were in schools where there was a science laboratory available for them to use compared to the other school types (Appendix Table A4.10).

Online learning management system

In 2019 and 2023, school principals were asked whether their school used an online learning management system to support learning (e.g., teacher-student communication, posting of grades, student access to course materials, e.g., Moodle). In 2019, 88% of students were attending schools where there was an online learning management system to support learning, with this proportion increasing to nearly all students in 2023 (99%) (Figure 4.8). There were similar reports across the three school gender types, as well as DEIS and non-DEIS schools, on the use of online learning management systems in 2023, with only slightly fewer students in mixed-gender schools than in boys' and girls' schools attending schools that used such systems (Appendix Table A4.11).

Figure 4.8: School use of online learning management system to support learning, Second Year (2019, 2023)

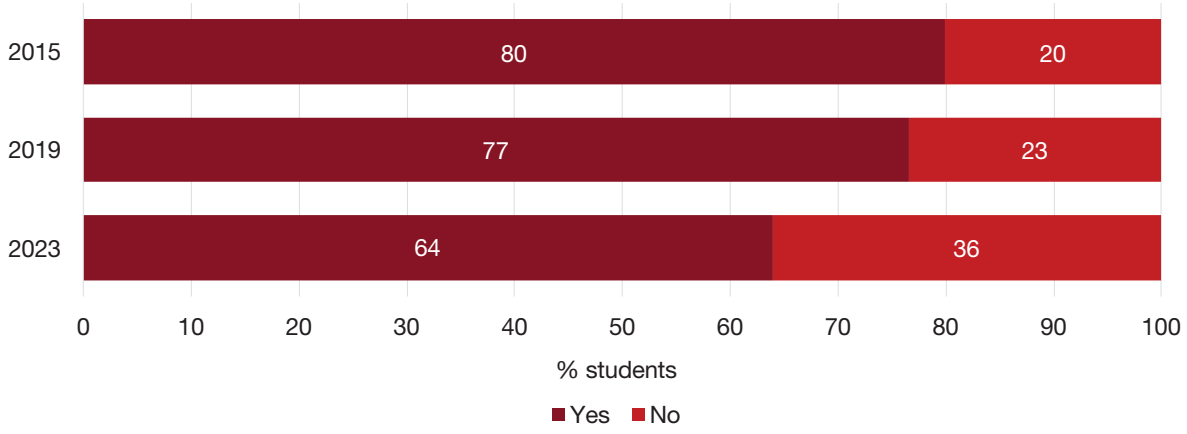


School library or media centre

Across all TIMSS cycles, school principals were asked whether the students in their school had access to a library. In 2023, the question also referred to students' access to a media centre.[12] In 2015, 80% of students attended schools where they had access to a library, while a slightly smaller percentage (77%) attended schools with access to a library in 2019 (Figure 4.9). In 2023, 64% of students attended schools that had a library or a media centre, with higher proportions of students in boys' schools (71%) having access to these resources than in girls' schools (68%) and mixed-gender schools (61%). Access to these resources was similar in DEIS and non-DEIS schools (Appendix Table A4.12).

12 It is worth noting that a definition of a media centre was not provided as part of the school questionnaire; thus, reliance was on the school principals' interpretation of the term.

Figure 4.9: Students' access to a library or media centre in the school, Second Year (2015, 2019, 2023)



Note. In 2023, school principals were asked about students' access to a library or media centre in the school. In 2015 and 2019, the question focused solely on students' access to a school library.

High-speed internet

In 2023, school principals were asked whether the students in their school had access to high-speed internet – a question that was not included in previous TIMSS cycles. Nearly all students attended schools where there was high-speed internet (96%). There were similar reports across the three school gender types, as well as DEIS and non-DEIS schools, on students' access to high-speed internet (Appendix Table A4.13).

School environment

This section focuses on aspects of the school environment, including the school's emphasis on academic success, teachers' professional collaboration, school discipline, safety, and order.

School emphasis on academic success

Across all TIMSS cycles, school principals were asked about their school's expectations for academic achievement; in particular, their views on teacher perceptions, parent/guardian perceptions, and student perceptions on the extent to which their school is focused on academic success. The 2023 school questionnaire included 11 items on school emphasis on academic success: *Teachers' understanding of the school's curricular goals*; *Teachers' degree of success in implementing the school's curriculum*; *Teachers' expectations for student achievement*; *Teachers' ability to inspire students*; *Parental involvement in school activities*; *Parental commitment to ensure that students are ready to learn*; *Parental expectations for student achievement*; *Parental support for student achievement*; *Students' desire to do well in school*; *Students' ability to reach school's academic goals*; *Students' respect for classmates who excel academically*.[13] The response options provided were *very high*, *high*, *medium*, *low*, and *very low*, and for each of the participating countries, including Ireland, school principals' responses were used by the IEA and the TIMSS & PIRLS International Study Center at Boston College to create the TIMSS *School*

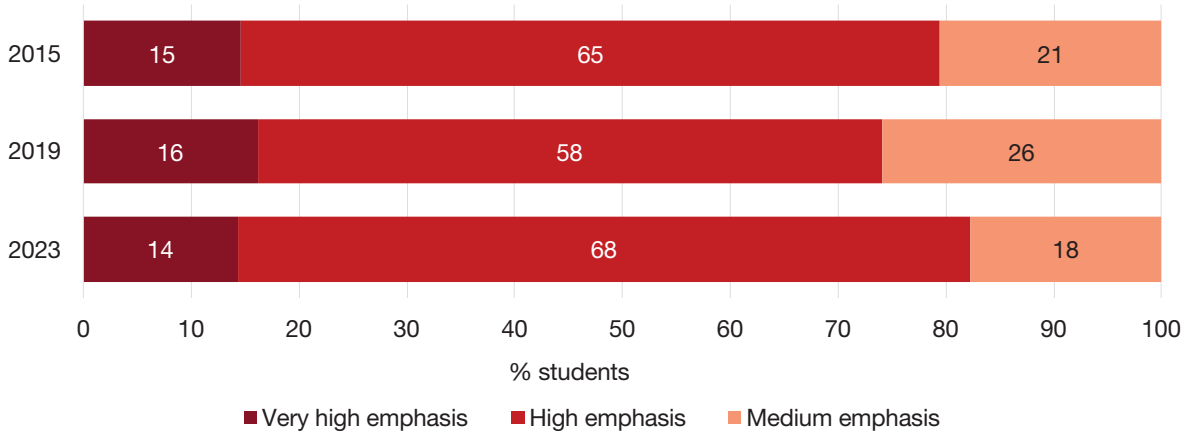
13 In 2019, the *School Emphasis on Academic Success* scale was based on the same items from the 2023 scale. In 2015, the scale was based on these 11 items plus two additional items: *Teachers working together to improve student achievement* and *Parental pressure for the school to maintain high academic standards*, while the item *Students' respect for classmates who excel academically* was phrased *Students' respect for classmates who excel in school*.

Emphasis on Academic Success scale, on the basis of which students were described as attending schools with *very high emphasis*, *high emphasis*, and *medium emphasis* on academic success.

In 2023, 14% of Second Year students attended schools where the principal reported a very high emphasis on academic success. This was similar in both 2019 (16%) and 2015 (15%). The majority of students, ranging between 58% and 68% across the three TIMSS cycles, attended schools that placed high emphasis on academic success (Figure 4.10).

In 2023, a higher proportion of students in boys' schools (34%) attended schools where there was a very high emphasis on academic success than in girls' schools (13%) and mixed-gender schools (10%). When comparing DEIS and non-DEIS schools, a substantially higher proportion of students in non-DEIS schools attended schools that placed a very high emphasis on academic success (20%) compared to DEIS schools (1%) (Appendix Table A4.14).

Figure 4.10: School emphasis on academic success, Second Year (2015, 2019, 2023)



Professional collaboration

Across the three cycles of TIMSS, teachers were asked about their engagement in various types of professional interactions with other teachers inside and outside their school. Figure 4.11 presents details of the various types of interactions of mathematics teachers between 2015 and 2023, where available. In both 2019 and 2023, the interaction reported by mathematics teachers as taking place most frequently (very often or often) was collaboration in planning and preparing instructional materials. Across the three cycles (2015, 2019, and 2023), high proportions of students were also taught by mathematics teachers who reported very often or often discussing how to teach a particular topic with other teachers (56%, 67%, and 64%, respectively), sharing what they have learned about teaching experiences (54%, 61%, and 61%, respectively), and working as a group on implementing the curriculum (63%, 66%, and 64%, respectively).

In 2015, 72% of Second Year students had mathematics teachers who never or almost never visited another classroom to learn more about teaching. While this remained a majority in 2019 (64%) and 2023 (62%), the proportion has decreased over time. Discussing professional practices with other teachers online and working together to try out new ideas were not common types of interactions among mathematics teachers over the years.

The frequency with which students' mathematics teachers engaged in various types of professional interactions with other teachers varied somewhat by school gender and DEIS status in 2023 (Appendix Table A4.15). Lower proportions of students in boys' schools were taught by mathematics teachers who very often engaged in most types of interactions (19% on average) and, accordingly, higher proportions of students in boys' schools were taught by mathematics teachers who never or almost never engaged in most types of interactions

(31% on average) than in girls' (24% and 19%, on average, respectively) and mixed-gender schools (23% and 21%, on average, respectively). In terms of DEIS status, DEIS schools had higher proportions of students taught by mathematics teachers who very often engaged in most types of interactions (28% on average) compared to non-DEIS schools (20% on average). No consistent patterns of differences were found by school DEIS status for the *never or almost never* category.

Figure 4.11: Mathematics teachers' professional collaboration, Second Year (2015, 2019, 2023)

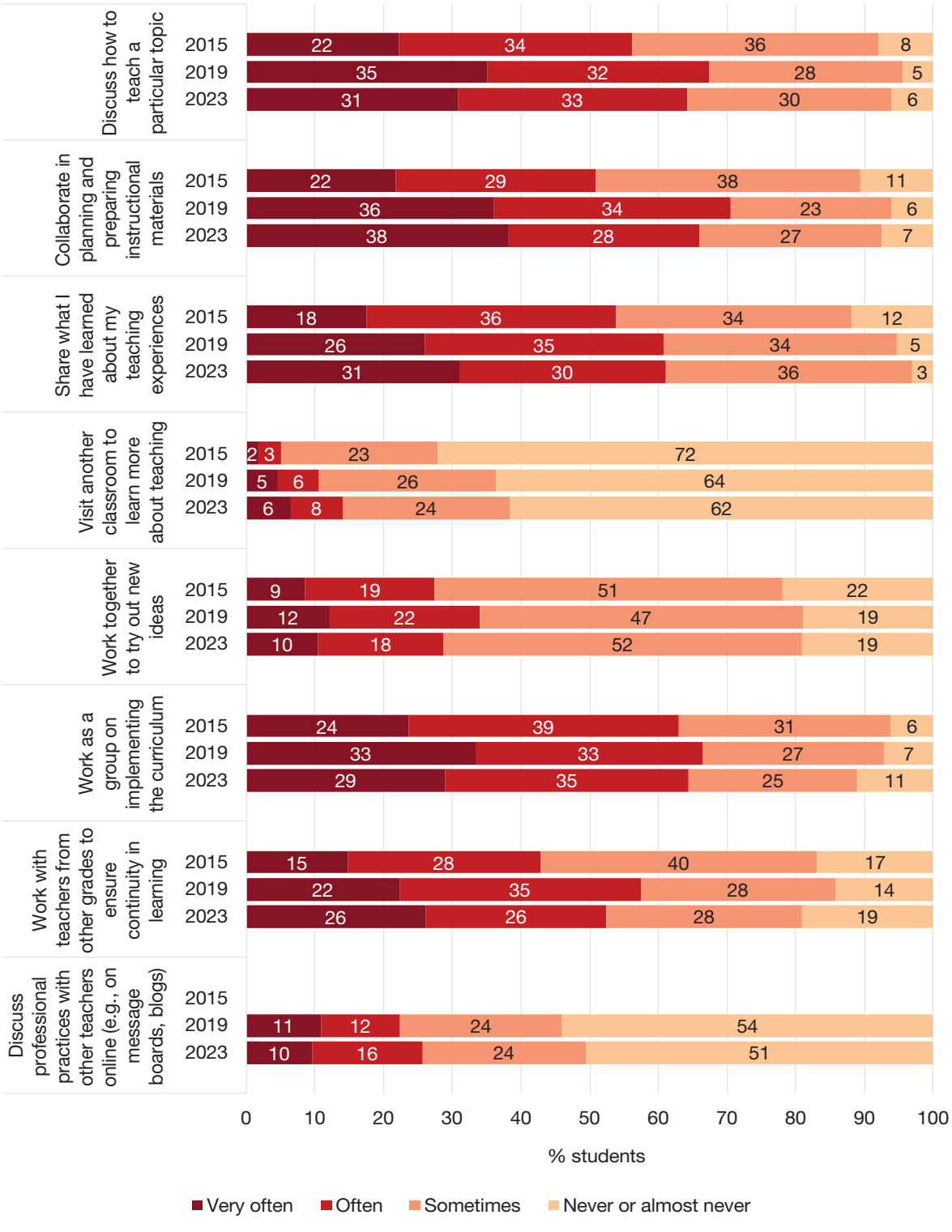
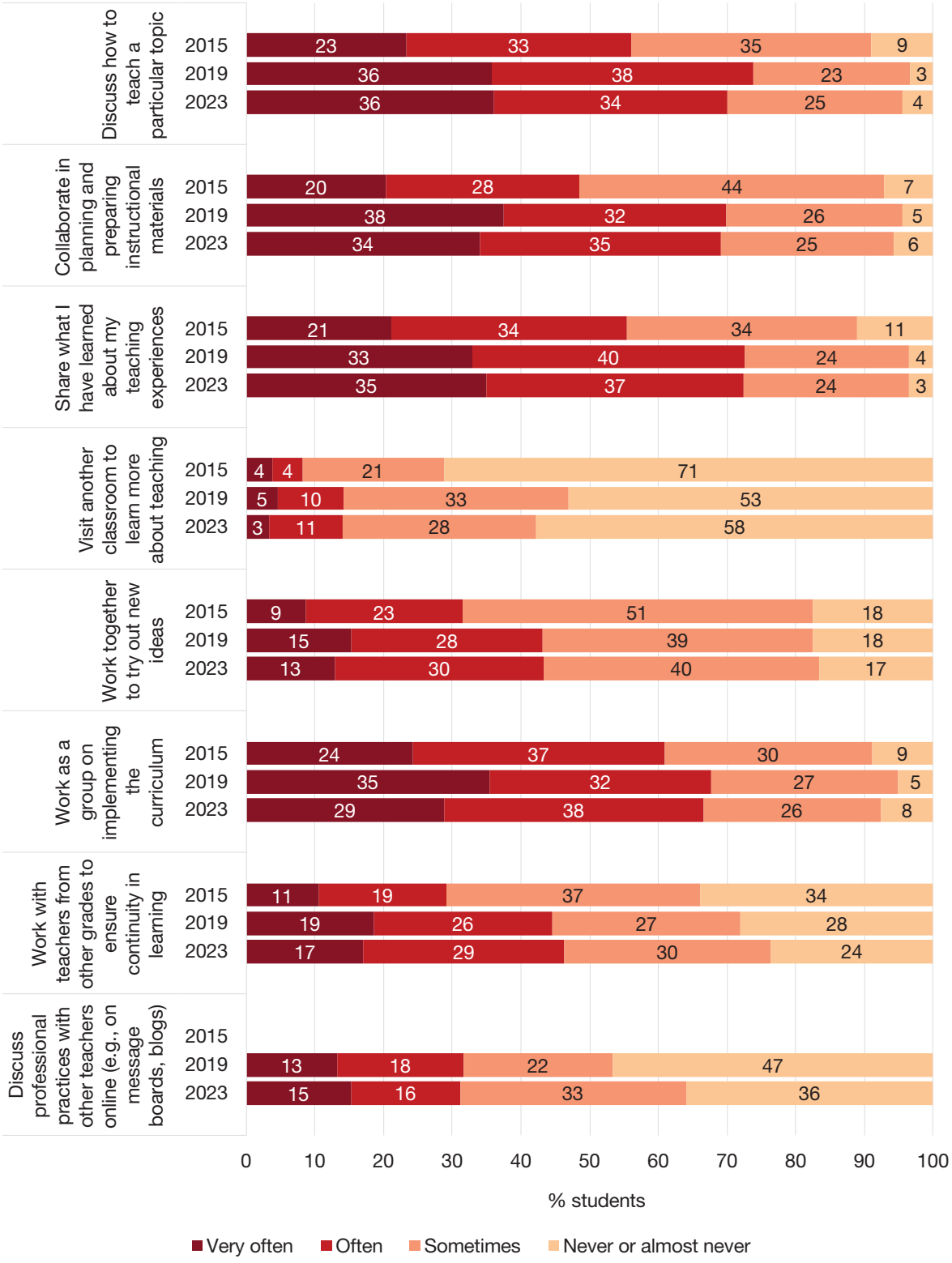


Figure 4.12 presents details of the various types of interactions of science teachers between 2015 and 2023. The four most common interactions among science teachers in 2023 were discussing how to teach a particular topic, collaborating in planning and preparing instructional materials, sharing what they have learned about their teaching experiences, and working as a group on implementing the curriculum. Similar proportions of students were taught by science teachers who reported that they very often or often interacted in these ways in 2019 and 2015. Similar to mathematics teachers (see Figure 4.11), a majority of Second Year students had science teachers who never or almost never visited another classroom to learn more about teaching across the three cycles (2015: 71%; 2019: 53%; 2023: 58%), though this proportion decreased over time.

The frequency with which students' science teachers engaged in various types of professional interactions with other teachers did not vary substantially by school gender and DEIS status in 2023 (Appendix Table A4.16). Slightly higher proportions of students in mixed-gender schools were taught by science teachers who very often engaged in most types of interactions (25% on average) and, accordingly, lower proportions of students in mixed-gender schools were taught by science teachers who never or almost never engaged in most types of interactions (17% on average) than in boys' (20% and 25%, on average, respectively) and girls' schools (19% and 22%, on average, respectively). In terms of DEIS status, DEIS schools had slightly higher proportions of students taught by science teachers who very often engaged in most types of interactions (26% on average) compared to non-DEIS schools (22% on average), and slightly higher proportions of students taught by science teachers who never or almost never engaged in most types of interactions (21% on average) compared to non-DEIS schools (19% on average).

Figure 4.12: Science teachers' professional collaboration, Second Year (2015, 2019, 2023)



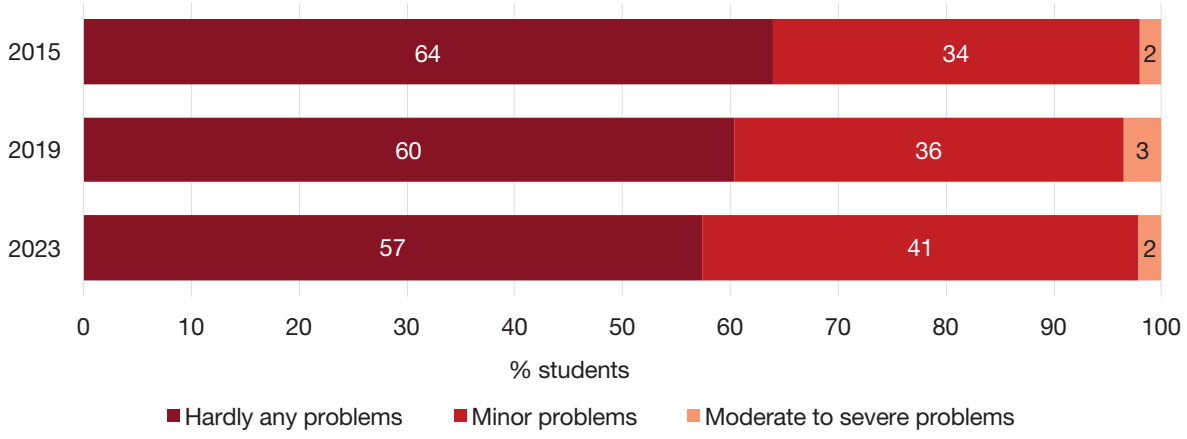
School discipline

Across all TIMSS cycles, school principals were asked to report the extent to which 10 discipline-related behaviours among Second Year students were a problem in their school. These behaviours were: *Arriving late at school*; *Absenteeism (i.e., unjustified absences)*; *Classroom disturbance*; *Cheating*; *Profanity*; *Vandalism*; *Theft*; *Intimidation or verbal abuse among students (including texting, emailing, etc.)*; *Physical injury to students*; *Intimidation or verbal abuse of teachers or staff (including texting, emailing, etc.)*; *Physical injury to teachers or staff*. The response options provided were *not a problem*, *minor problem*, *moderate problem*, and *serious problem*, and for each of the participating countries, including Ireland, school principals' responses were used by the IEA and the TIMSS & PIRLS International Study Center at Boston College to create the TIMSS *School Discipline* scale, on the basis of which students were described as attending schools with *hardly any problems*, *minor problems*, and *moderate to severe problems*.

In 2023, 57% of Second Year students attended schools where the principal reported hardly any problems, representing a slight drop from 60% in 2019 and 64% in 2015 (Figure 4.13). Very small proportions of students, ranging between 2% and 3% across the three TIMSS cycles, attended schools with moderate to severe problems.

In 2023, 91% of students in girls' schools attended schools where there were hardly any problems, a substantially higher proportion compared to those in boys' (66%) and mixed-gender schools (47%). When comparing DEIS and non-DEIS schools, a substantially higher proportion of students in non-DEIS schools attended schools with hardly any problems (67%) than in DEIS schools (34%) (Appendix Table A4.17). Analysis of the individual items of the *School Discipline* scale suggested that much of this gap may be driven by principals' reports of two specific issues, students arriving late to school and student absenteeism (i.e., unjustified absences), which were identified as serious problems for 13% and 14% of students in DEIS schools compared with 1% and 4% in non-DEIS schools, respectively.

Figure 4.13: School discipline, Second Year (2015, 2019, 2023)



School safety and order

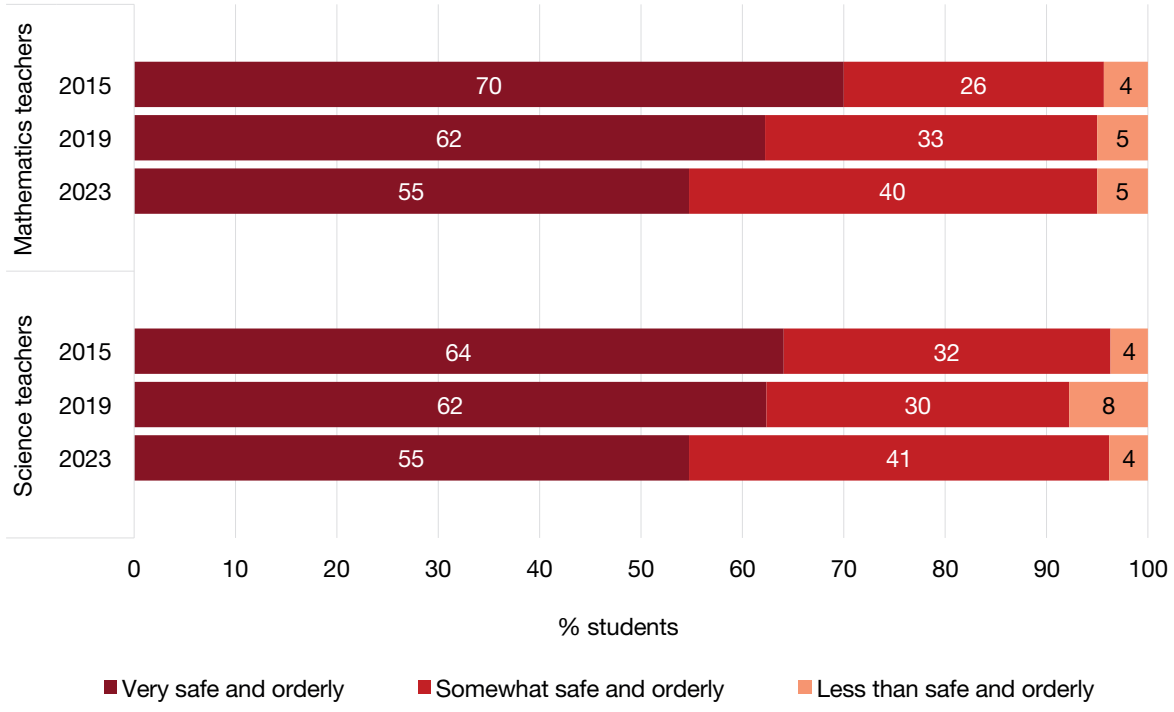
Across all TIMSS cycles, mathematics and science teachers of Second Year students were asked about the degree to which they agreed or disagreed with statements regarding safety and order within their school. The 2023 mathematics and science teacher questionnaires included the following seven items: *I feel safe at this school*; *This school's security policies and practices are sufficient*; *The students behave in an orderly manner*; *The students are respectful of the teachers*; *The students respect school property*; *This school has clear rules about*

student conduct; *This school's rules are enforced in a fair and consistent manner*.[14] For each of the participating countries, including Ireland, teachers' responses were used by the IEA and the TIMSS & PIRLS International Study Center at Boston College to create the TIMSS *Safe and Orderly School* scale, on the basis of which students were described as attending schools judged by their teachers to be *very safe and orderly*, *somewhat safe and orderly*, and *less than safe and orderly*.

Figure 4.14 presents the percentages of students attending very safe and orderly, somewhat safe and orderly, or less than safe and orderly schools based on their teachers' reports. In 2023, 55% of Second Year students were taught by mathematics teachers who reported that they were in very safe and orderly schools. This is lower than the corresponding 62% in 2019 and 70% in 2015. Similar proportions of students were taught by science teachers who reported that they were in very safe and orderly schools (2015: 64%; 2019: 62%; 2023: 55%). Proportions of students attending less than safe and orderly schools have remained relatively low over time (between 4% and 8%).

In 2023, a higher proportion of students in girls' schools (80%) were taught by mathematics teachers who reported that they were in very safe and orderly schools compared to boys' schools (63%) and mixed-gender schools (46%). The same pattern was observed among science teachers (Appendix Table A4.18). When comparing DEIS and non-DEIS schools, higher proportions of students in non-DEIS schools (60% and 57%, respectively) than in DEIS schools (42% and 49%, respectively) were taught by mathematics and science teachers who reported their school was very safe and orderly (Appendix Table A4.18).

Figure 4.14: School safety and order, Second Year (2015, 2019, 2023)



Note. In 2015, the *Somewhat safe and orderly* category was phrased *Safe and orderly*.

14 In 2015 and 2019, the *Safe and Orderly School* scale was based on the same seven items from the 2023 scale plus one additional item: *This school is located in a safe neighbourhood*.

Chapter 5:
The post-primary mathematics classroom

As part of TIMSS 2023, mathematics teachers of Second Year students were asked to complete a mathematics teacher questionnaire. This chapter focuses mainly on the findings from this questionnaire to provide an insight into post-primary mathematics classrooms. Three main areas are explored: (i) organisation of mathematics instruction, teaching, and assessment, (ii) challenges in mathematics instruction, and (iii) digital devices in mathematics lessons. This chapter also includes reports from principals of participating schools on the extent to which instruction in their schools was affected by shortages in mathematics resources.

Ireland's 2023 data for all students are compared to those from the previous two cycles of TIMSS (2015 and 2019). Subgroup differences by school gender and school DEIS status are also referenced in text, while all subgroup analysis outputs can be found in the Chapter 5 Appendix of this report.

Organisation of mathematics instruction, teaching, and assessment

This section focuses on time spent on mathematics instruction, strategies and activities used in mathematics lessons, use of calculators during mathematics lessons, mathematics homework, and assessment strategies in mathematics.

Time spent on mathematics instruction

Mathematics teachers were asked to indicate how much time per week they spent on teaching mathematics to the Second Year class that participated in TIMSS. The average time spent teaching mathematics to the sampled class was approximately three hours per week (183 minutes), with a standard deviation of 26 minutes. The most common responses were three hours (180 minutes) (reported by 32% of students' mathematics teachers) and three hours and 20 minutes (200 minutes) (reported by 29% of students' mathematics teachers). Broadly similar average times were reported in the previous two cycles of TIMSS; approximately three hours and 10 minutes in 2015, and three hours and five minutes in 2019. The average times were similar across the three school gender types and across the two DEIS status categories (Appendix Table A5.1).

Strategies and activities used in mathematics lessons

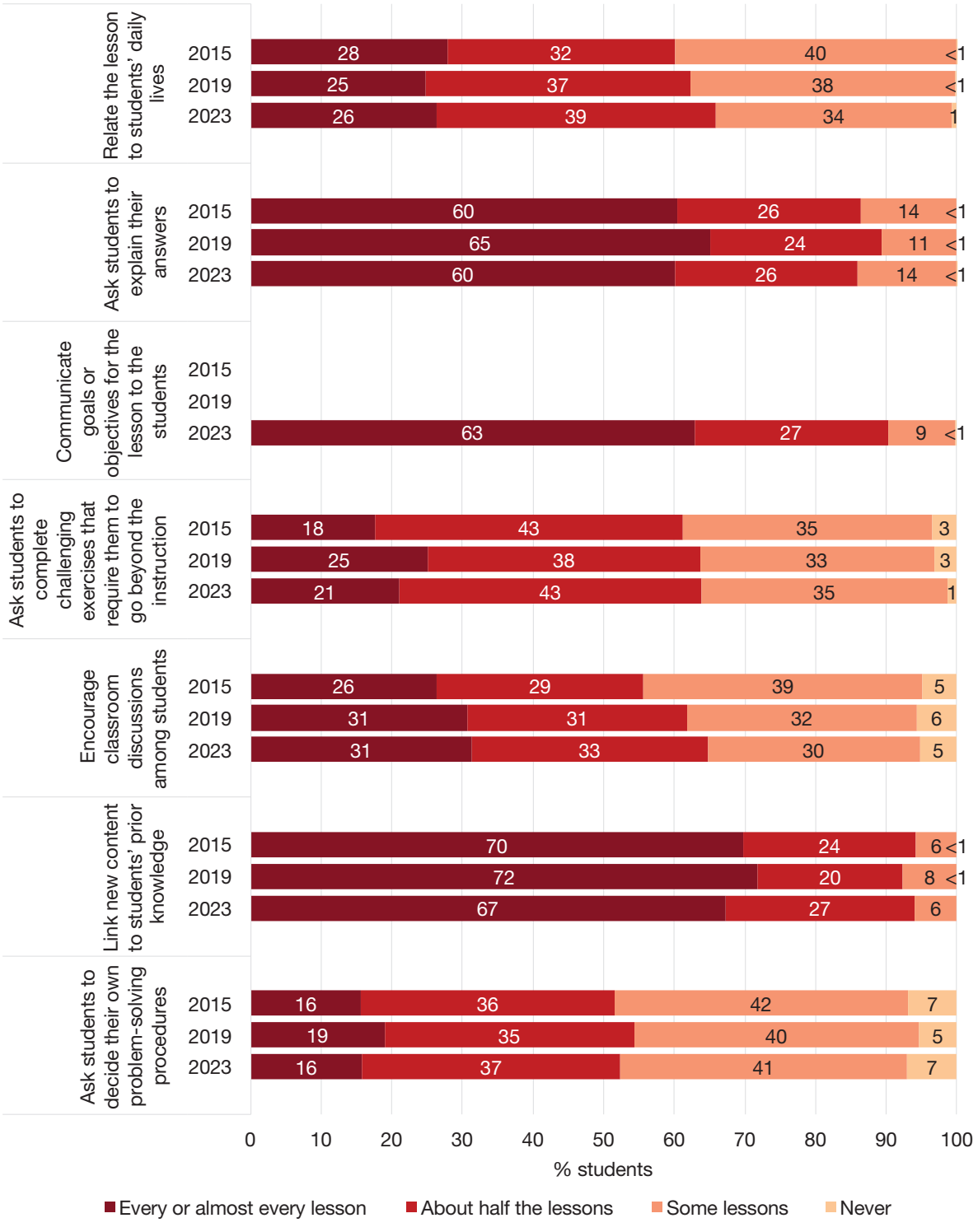
The strategies and activities used in mathematics lessons were captured through two questions in the TIMSS 2023 mathematics teacher questionnaire at Second Year. Teachers were asked to indicate the frequency with which they used specific strategies and activities in their lessons with response options ranging from *every or almost every lesson* to *never*.

The first question related to specific teaching and learning strategies. Responses for 2015, 2019, and 2023, where available, are presented in Figure 5.1. In 2023, more than three-fifths of students had teachers who reported that, in every or almost every lesson, they linked new content to students' prior knowledge (67%), communicated goals or objectives for the lesson to the students (63%), and asked students to explain their answers (60%). Approximately one-third of students were taught by teachers who encouraged classroom discussions among students (31%) and one-quarter (26%) by teachers who related the lesson to students' daily lives in every or almost every lesson. Small fluctuations can be observed across the various strategies

from 2015 to 2023, with gradual increases in the proportions of students whose teachers related the lesson to students' daily lives and encouraged classroom discussions among students.

In 2023, differences by school gender and DEIS status were not substantial. However, slightly higher proportions of students in DEIS schools than in non-DEIS schools, on average, were taught by teachers who reported using most of these strategies in every or almost every mathematics lesson (Appendix Table A5.2).

Figure 5.1: Teaching strategies during mathematics lessons, Second Year (2015, 2019, 2023)

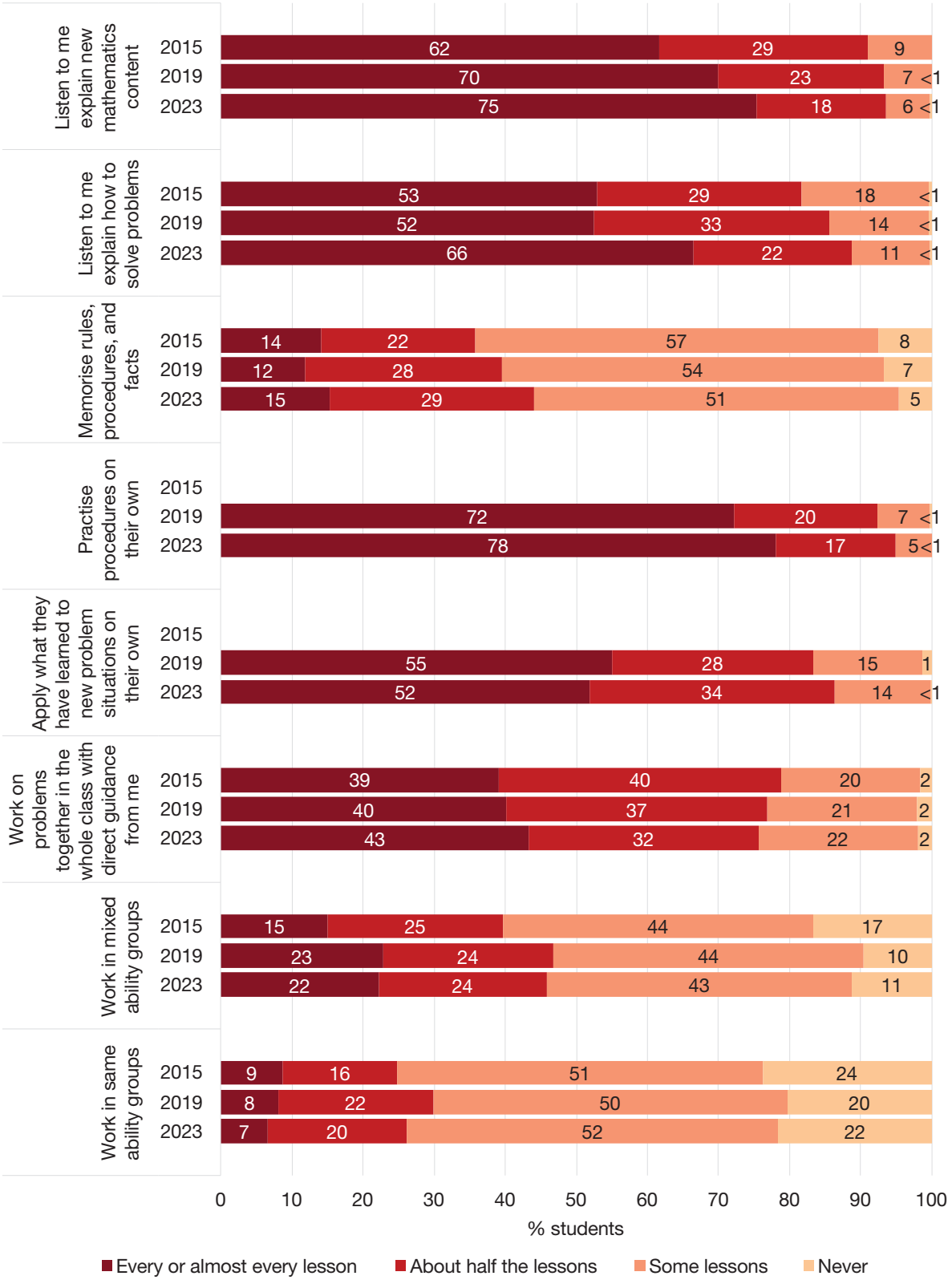


The second question related to engagement in specific activities during mathematics lessons (Figure 5.2). Approximately three-quarters of students in 2023 were taught by teachers who had students practise procedures on their own (78%) or listen to the teacher explain new mathematics content (75%), and two-thirds were taught by teachers who had students listen to them explain how to solve problems (66%) in every or almost every lesson. Fewer students were asked by their teachers to apply what they had learned to new problem situations on their own (52%) and work on problems together in the whole class with direct guidance from the teacher (43%) in every or almost every lesson. Mixed-ability groupwork was experienced in every or almost every lesson by approximately one-fifth of students (22%), while same-ability groupwork was experienced at that frequency by less than one-tenth (7%).

Looking at changes over time, the proportion of students who were asked to listen to their teacher explain new mathematics content in every or almost every lesson gradually increased from 62% in 2015 and 70% in 2019 to 75% in 2023. There has also been a marked increase in the proportion of students who were asked to listen to their teacher explain how to solve problems in every or almost every lesson from 2015 (53%) and 2019 (52%) to 2023 (66%). While the frequency with which same-ability groupwork occurred did not change considerably across the years, mixed-ability groupwork occurred more frequently in 2019 and 2023 compared to 2015.

In 2023, the frequency with which students engaged in these mathematics activities was broadly similar in DEIS and non-DEIS schools (Appendix Table A5.3). However, some differences were observed by school gender. Higher proportions of students in boys' schools were taught by teachers who had students listen to them explain new mathematics content in every or almost every lesson, while lower proportions of students in boys' schools were asked to work in either mixed- or same-ability groups in at least half the lessons than in girls' and mixed-gender schools. More students in girls' schools (20%) and mixed-gender schools (16%) were asked to memorise rules, procedures, and facts in every or almost every lesson than in boys' schools (8%). Lastly, fewer students in mixed-gender schools (75%) were taught by teachers who asked them to practise procedures on their own than in boys' and girls' schools (83%, respectively).

Figure 5.2: Students' engagement in specific mathematics activities during mathematics lessons, Second Year (2015, 2019, 2023)

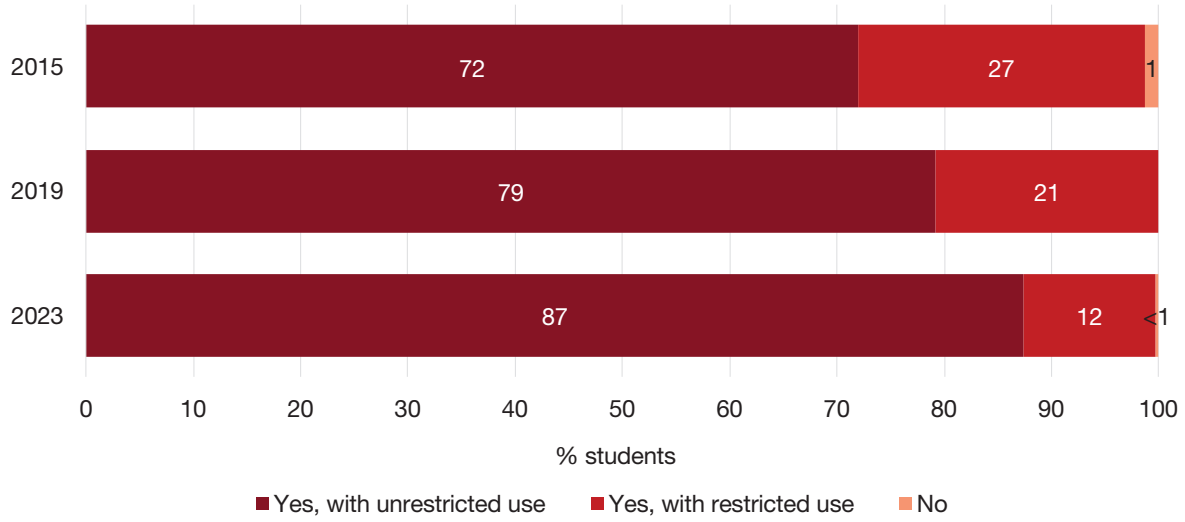


Use of calculators during mathematics lessons

As part of their questionnaire across all TIMSS cycles, mathematics teachers were asked if students were permitted to use calculators during mathematics lessons. In 2023, 87% of students had unrestricted access and a further 12% had restricted access to calculators during mathematics lessons (Figure 5.3). The proportion of students with unrestricted access to calculators increased from 72% in 2015 and 79% in 2019 to 87% in 2023, though for each of these years, nearly all students had some access to calculators during mathematics lessons.

In 2023, a higher proportion of students in girls' schools had unrestricted access to calculators (94%) than in boys' (85%) and mixed-gender schools (86%), while access to calculators was similar in DEIS and non-DEIS schools (Appendix Table A5.4).

Figure 5.3: Access to calculators during mathematics lessons, Second Year (2015, 2019, 2023)



Mathematics homework

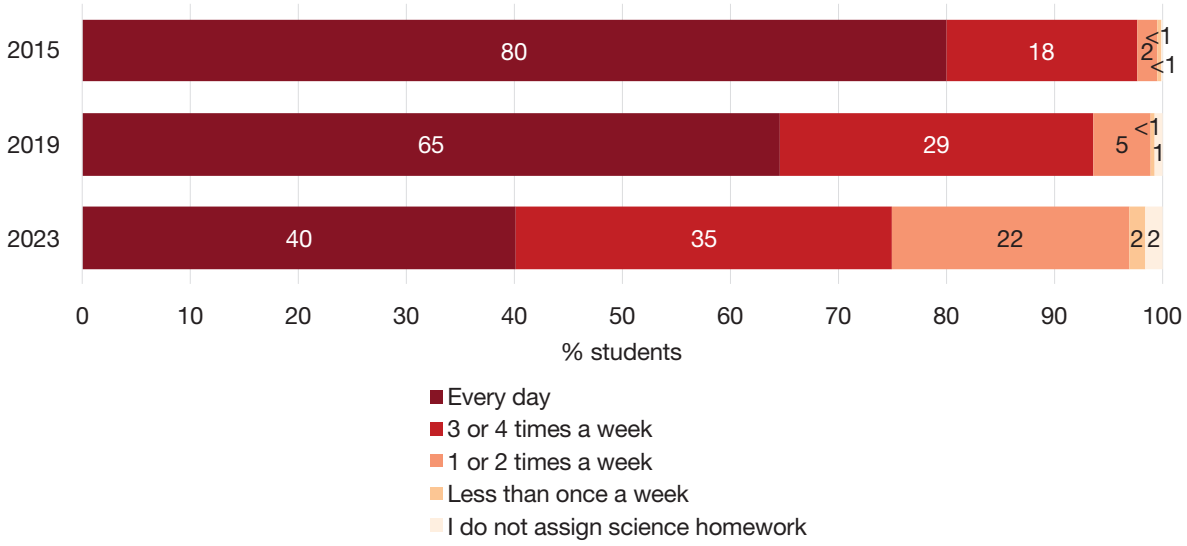
Mathematics teachers were asked two questions relating to mathematics homework. Firstly, they were asked to indicate how often they assigned mathematics homework to the class that participated in TIMSS (*every day*, *1 or 2 times a week*, *3 or 4 times a week*, *less than once a week*, or *I do not assign mathematics homework*). Secondly, they were asked to indicate how frequently (*always or almost always*, *sometimes*, or *never or almost never*) they conducted various activities with students' mathematics homework including: *Correct assignments and give feedback to students; Have students correct their own homework; Discuss the homework in class; Monitor whether or not the homework was completed; Use the homework to contribute towards students' grades or marks*.

In 2023, two-fifths of students had teachers who assigned mathematics homework every day, approximately one-third (35%) had teachers who assigned mathematics homework once or twice a week, while 4% had teachers who assigned mathematics homework less than once a week or did not assign mathematics homework (Figure 5.4). Of those students who were assigned mathematics homework, most had teachers who reported that they, always or almost always, discussed the homework in class (81%) and monitored whether or not homework was completed (71%). Approximately two-fifths of those who were assigned homework had teachers who reported that they, always or almost always, corrected assignments and gave feedback to students or had students correct their own homework, respectively. Using homework to contribute towards students' grades or marks was never or almost never used for three-quarters of the students who were assigned mathematics homework.

There has been a decline in the proportion of students whose teachers assigned mathematics homework on a daily basis over time, from 80% in 2015 and 65% in 2019 to 40% in 2023 (Figure 5.4). The proportion of students whose teachers assigned mathematics homework three or four times as week has increased from 2% in 2015 and 5% in 2019 to 22% in 2023. Across all years, all students (97% or more) were assigned mathematics homework at least once or twice a week.

More students in girls' schools were assigned homework on a daily basis (48%) than in boys' (44%) and mixed-gender schools (37%), although the proportions who received homework less frequently (less than once a week or never) were similar across school gender types. The frequency of mathematics homework assigned to students was generally similar in DEIS and non-DEIS schools. However, a slightly higher proportion of students in non-DEIS schools were assigned homework once or twice a week, while a slightly lower proportion were assigned homework three or four times a week compared to students in DEIS schools (Appendix Table A5.5).

Figure 5.4: Assignment of mathematics homework, Second Year (2015, 2019, 2023)



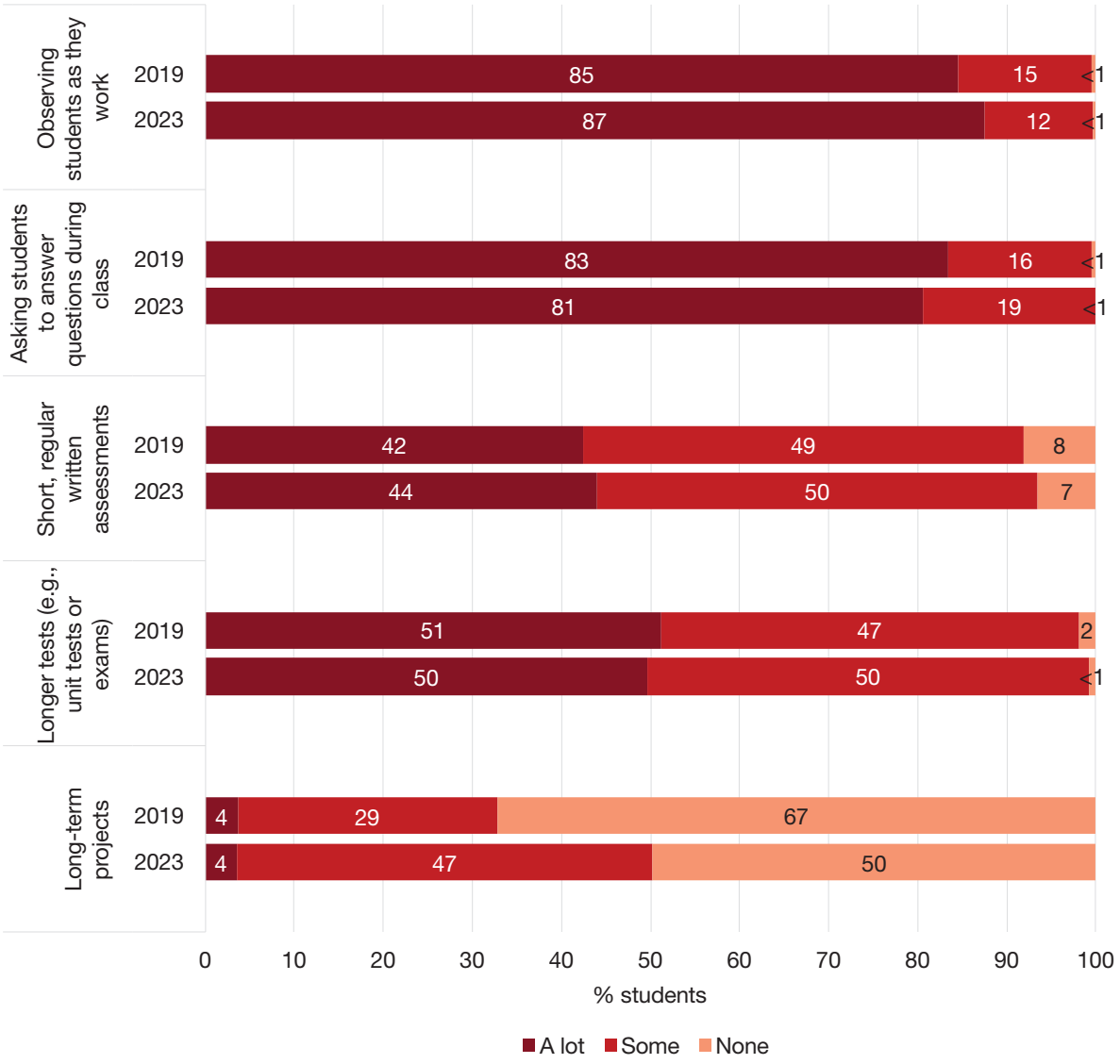
Assessment strategies in mathematics

One question in the mathematics teacher questionnaire asked teachers about the importance they placed on various assessment strategies in mathematics. Figure 5.5 presents the percentages of students based on their mathematics teachers' reports of the importance placed on assessment strategies. This question was redeveloped for TIMSS 2019 so comparisons to 2015 data are not possible.

In 2023, very high proportions of students had teachers who placed a lot of importance on observing students as they work (87%) and asking students to answer questions during class (81%) in mathematics lessons. Approximately half of students had teachers who placed a lot of importance on longer tests (e.g., unit tests or exams) (50%) and short, regular written assessments (44%). Very few students had teachers who placed a lot of importance on long-term projects (4%). There was little variation in the proportions reported in 2019 and 2023. However, the proportion of students whose teachers placed some importance on long-term projects has increased from 29% in 2019 to 47% in 2023.

In 2023, mostly minor differences were observed in the importance placed on the various assessment strategies by mathematics teachers across school gender types and DEIS categories, with no clear patterns emerging (Appendix Table A5.6).

Figure 5.5: Importance placed on assessment strategies in mathematics lessons, Second Year (2019, 2023)



Challenges in mathematics instruction

This section focuses on two key challenges faced by mathematics teachers. The first challenge, instruction affected by mathematics resource shortages, is based on data collected from school principals. The second challenge, teaching limited by students not ready for instruction, is based on data collected from mathematics teachers.

Instruction affected by mathematics resource shortages

The extent to which instruction at the school level was affected by mathematics resource shortages was captured through a question in the school questionnaire. School principals were asked to indicate how much (*not at all*, *a little*, *some*, or *a lot*) their school's capacity to provide mathematics instruction was affected by a shortage or inadequacy of resources in two areas: general school resources and resources for mathematics

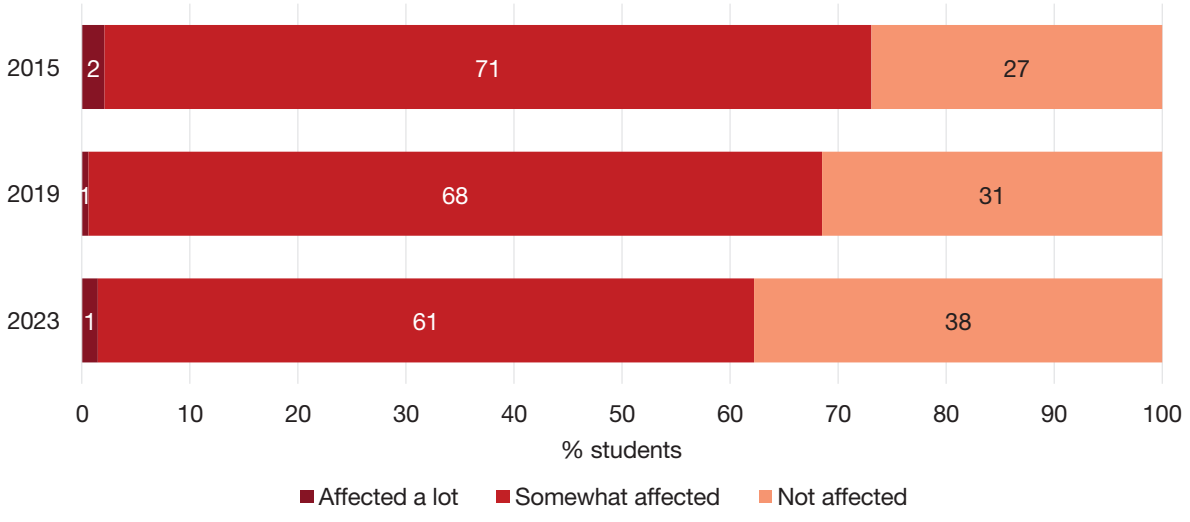
instruction. General school resources covered areas like instructional materials (e.g., textbooks), school buildings and grounds, instructional space (e.g., classroom), digital resources (e.g., interactive whiteboards), as well as resources for students with disabilities. Resources for mathematics instruction covered areas like teachers with a specialisation in mathematics, calculators for mathematics instruction, and concrete objects or materials to help students understand quantities or procedures. For each of the participating countries, including Ireland, responses to these items (about the shortage of both general and mathematics-specific resources) were used by the IEA and the TIMSS & PIRLS International Study Center at Boston College to create the TIMSS *Instruction Affected by Mathematics Resource Shortages* scale, on the basis of which schools were grouped into three categories: *affected a lot*, *somewhat affected*, and *not affected*.

Figure 5.6 presents the percentages of students in each category of the TIMSS *Instruction Affected by Mathematics Resource Shortages* scale for 2015, 2019, and 2023. In 2023, the majority of students (61%) were in schools that were somewhat affected, while almost two-fifths (38%) were in schools that were not affected. A very small proportion, approximately 1%, were in schools that were affected a lot by mathematics resource shortages. Looking at the individual component items of this scale, the proportion of students whose school principals reported that their schools were affected a lot by a shortage of each resource type was 10% or lower for most of the items. Exceptions included school buildings and grounds (19%), instructional space (e.g., classrooms) (22%), and library resources relevant to mathematics instruction (13%).

The proportion of students attending schools that were not affected by mathematics resource shortages has gradually increased over the past three cycles of TIMSS, from 27% in 2015 to 38% in 2023 (Figure 5.6). Accordingly, the proportion attending schools that were somewhat affected has decreased, from 71% in 2015 to 61% in 2023. In all three cycles, very small proportions of students (2% or less) attended schools that were affected a lot by mathematics resource shortages.

In 2023, higher proportions of students in girls' schools were in the *not affected* category (44%) compared to boys' schools (36%) and mixed-gender schools (37%) (Appendix Table A5.7). There were also differences observed by school DEIS status. Non-DEIS schools had a higher proportion of students in schools that were not affected (42%) and a lower proportion in schools that were somewhat affected (56%) by mathematics resource shortages compared to DEIS schools (27% and 73%, respectively) (Appendix Table A5.7).

Figure 5.6: Instruction affected by mathematics resource shortages, Second Year (2015, 2019, 2023)



Note. In 2015, the *Somewhat affected* category was phrased *Affected*.

Teaching limited by students not ready for instruction

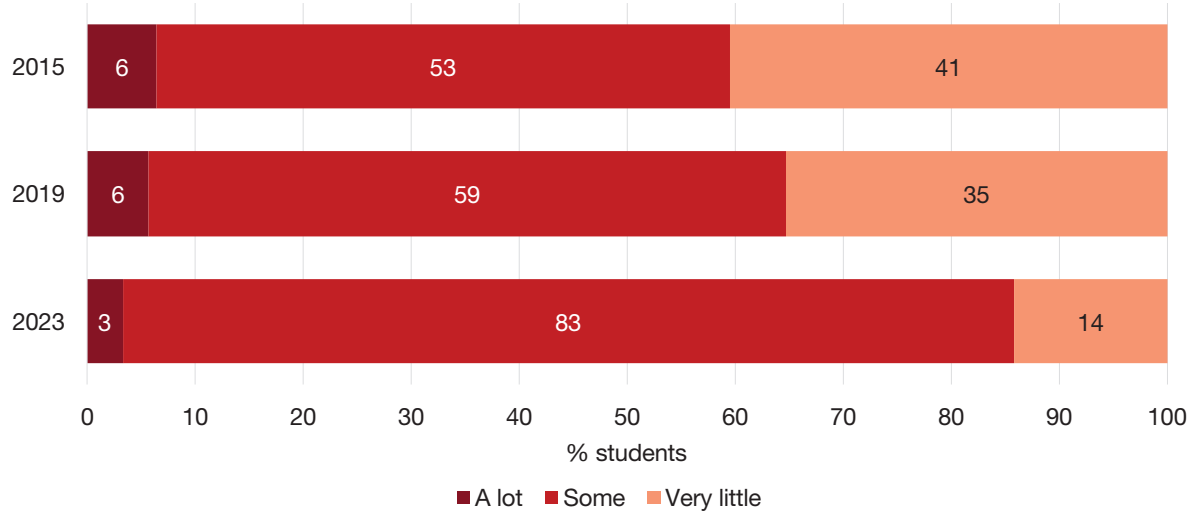
The mathematics teacher questionnaire included a question asking teachers to what extent (*not at all*, *some*, or *a lot*) various factors limited how they taught the TIMSS class. These factors included: *Students lacking prerequisite knowledge or skills*; *Students suffering from lack of basic nutrition*; *Students suffering from not enough sleep*; *Students absent from class*; *Disruptive students*; *Uninterested students*; *Distracted students*; *Students with mental, emotional, or psychological impairment*; *Students with difficulties understanding the language of instruction*; *Students with physical disabilities*. For each of the participating countries, including Ireland, responses from mathematics teachers were used by the IEA and the TIMSS & PIRLS International Study Center at Boston College to create the TIMSS *Teaching Limited by Students not Ready for Instruction* scale, on the basis of which students were described as receiving teaching that, according to their teachers, was limited by students not being ready for instruction *a lot, some,* and *very little*.

Figure 5.7 presents the percentages of students in each category of the TIMSS *Teaching Limited by Students not Ready for Instruction* scale for 2015, 2019, and 2023. In 2023, teachers of most students (83%) reported that their mathematics teaching was limited to some extent by students not being ready for instruction. Smaller proportions of students had teachers who reported that their mathematics teaching was limited very little (14%) or a lot (3%). Looking at the individual component items of this scale, approximately one-third of students were taught by teachers who reported that students being absent from class (33%) and students lacking prerequisite knowledge or skills (30%) limited their teaching a lot. Mathematics teachers of approximately one-tenth of students reported that their teaching was limited a lot by students suffering from not enough sleep (15%), uninterested students (14%), and distracted students (11%).

The proportions of students whose teachers reported that their mathematics teaching was limited very little by students not being ready for instruction have decreased over the past three cycles of TIMSS, but a particularly marked decrease was observed from 2019 (35%) to 2023 (14%) (Figure 5.7). Accordingly, the proportion of students taught by teachers whose mathematics teaching was somewhat limited has increased from 53% in 2015 and 59% in 2019 to 83% in 2023.

Looking at differences by school gender and DEIS status, more students in mixed-gender schools (87%) had teachers whose mathematics teaching was somewhat limited by students not being ready for instruction than in boys' (77%) and girls' schools (71%). Accordingly, fewer students in mixed-gender schools had teachers whose mathematics teaching was limited very little (9%) than in the other two school types (23% in boys' schools; 27% in girls' schools). Also, higher proportions of students in DEIS schools had teachers who reported that their instruction was somewhat limited (89%) and lower proportions had teachers whose teaching was limited very little (6%) than in non-DEIS schools (80% and 17%, respectively) (Appendix Table A5.8).

Figure 5.7: Teaching limited by students not ready for instruction, Second Year (2015, 2019, 2023)



Note. In 2015, the three categories were phrased: *Very limited, Somewhat limited,* and *Not limited*.

Digital devices in mathematics lessons

The mathematics teacher questionnaire included questions regarding Second Year students' access to digital devices during mathematics lessons. This section focuses on the availability and use of digital devices during mathematics lessons, and obstacles to using digital devices, a new question introduced in 2023.

Availability and use of digital devices

In 2023, mathematics teachers were asked if their students had digital devices (including computers, tablets, or smartphones) available to use during mathematics lessons. Those who had digital devices available were asked three follow-up questions relating to the access students had to these digital devices, how often they used these digital devices during mathematics lessons, and how often they completed various activities using digital devices.

Three-fifths of students (62%) had digital devices available to use during mathematics lessons in 2023. Of these students who had digital devices available to them, three-fifths (62%) were in schools that had digital devices that the class could use sometimes, one-third (34%) were in a class that had digital devices for each student to use, and 17% were in classes that had digital devices that students could share. More than half of those who had digital devices (58%) were in schools that allowed students to bring their own digital devices.

According to teachers' reports, two-fifths of students (42%) who had devices used them at least once a week, a further one-quarter (25%) used them once or twice a month, while one-tenth (10%) never or almost never used these devices during mathematics lessons. Among students who had digital devices available during mathematics lessons, the most frequent activities included reading the textbook or watching instructional videos and practising problems and procedures, with 38% and 24% of students completing these activities at least once a week, respectively. More than half (54%) of those who had digital devices available during mathematics lessons never or almost never used them to take a test.

In 2015 and 2019, teachers were also asked a similar question about whether computers (including tablets) were available to use during mathematics lessons. In 2023, however, the question was expanded to include

smartphones. The inclusion of smartphones means that trend comparisons should be interpreted cautiously. One-quarter of students (25%) in 2015 and approximately one-third of students (31%) in 2019 had computers (including tablets) available to use during mathematics lessons, while three-fifths of students (62%) in 2023 had digital devices (including computers, tablets, and smartphones) available to use during mathematics lessons.

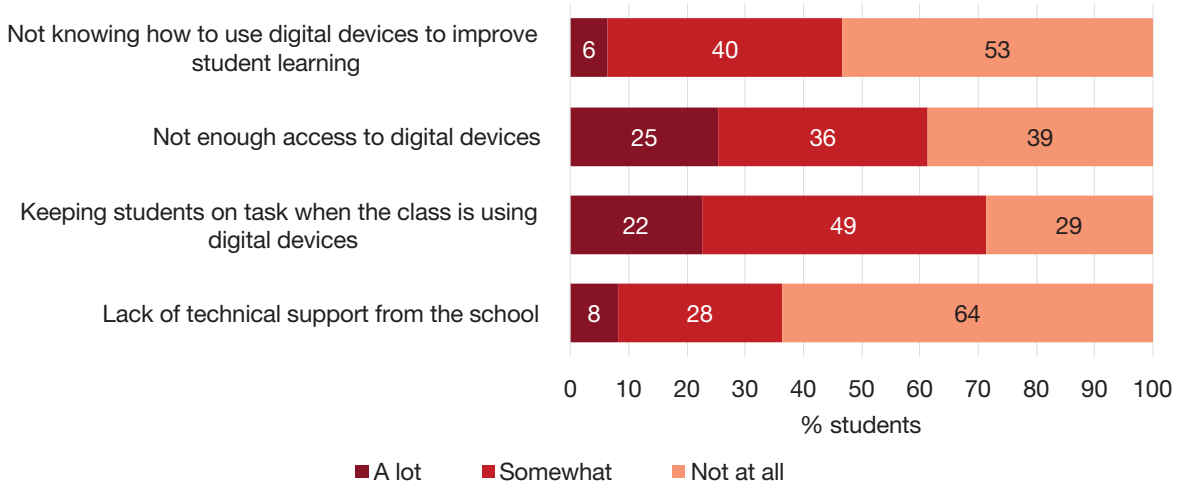
The proportions of students who had digital devices available during mathematics lessons were relatively similar in DEIS and non-DEIS schools. However, some differences were observed across the three school gender types. Lower proportions of students in boys' schools (48%) had digital devices available to use during mathematics lessons than in girls' (63%) and mixed-gender schools (66%) (Appendix Table A5.9).

Obstacles to using digital devices

A new question was added to the teacher questionnaire in 2023 asking teachers about the extent (*not at all*, *somewhat*, or *a lot*) to which they faced various obstacles in incorporating digital devices into mathematics lessons. The obstacles included: *Not knowing how to use digital devices to improve student learning*; *Not enough access to digital devices*; *Keeping students on task when the class is using digital devices*; *Lack of technical support from the school*. Figure 5.8 presents the percentages of students taught by teachers facing these obstacles in incorporating digital devices into their mathematics lessons. Approximately one-quarter of students were taught by teachers who reported that not enough access to digital devices (25%) and keeping students on task when the class is using digital devices (22%) kept them a lot from using digital devices in mathematics lessons. The majority of students had teachers who reported that a lack of technical support from the school (64%) and not knowing how to use digital devices to improve student learning (53%) were not obstacles to incorporating digital devices into their mathematics lessons.

Broadly similar proportions of students, or some differences without clear patterns, were observed for each of these obstacles across the different school gender and DEIS status categories (Appendix Table A5.10).

Figure 5.8: Obstacles to incorporating digital devices into mathematics lessons, Second Year (2023)



Chapter 6:
The post-primary science classroom

As part of TIMSS 2023, science teachers of Second Year students were asked to complete a science teacher questionnaire. This chapter focuses mainly on the findings from this questionnaire to provide an insight into post-primary science classrooms. Three main areas are explored: (i) organisation of science instruction, teaching, and assessment, (ii) challenges in science instruction, and (iii) digital devices in science lessons. This chapter also includes reports from participating students on the frequency with which they conducted science experiments and from principals of participating schools on the extent to which instruction in their schools was affected by shortages in science resources.

Ireland's 2023 data for all students are compared to those from the previous two cycles of TIMSS (2015 and 2019). Subgroup differences by school gender and school DEIS status are also referenced in text, while all subgroup analysis outputs can be found in the Chapter 6 Appendix of this report.

Organisation of science instruction, teaching, and assessment

This section focuses on time spent on science instruction, strategies and activities used in science lessons, frequency of conducting science experiments, science homework, and assessment strategies in science.

Time spent on science instruction

Science teachers were asked to indicate how much time per week they spent on teaching science to the Second Year class that participated in TIMSS. The average time spent on teaching science to the sampled class was approximately two hours and 25 minutes (145 minutes), with a standard deviation of 30 minutes. The most common responses were two hours (120 minutes) (reported by 40% of students' science teachers) and two hours and 40 minutes (160 minutes) (reported by 25% of students' science teachers). Broadly similar average times were reported in the previous two cycles of TIMSS; approximately two hours and 40 minutes in 2015, and two hours and 30 minutes in 2019. The average times were broadly similar across the three school gender types and across the two DEIS status categories (Appendix Table A6.1).

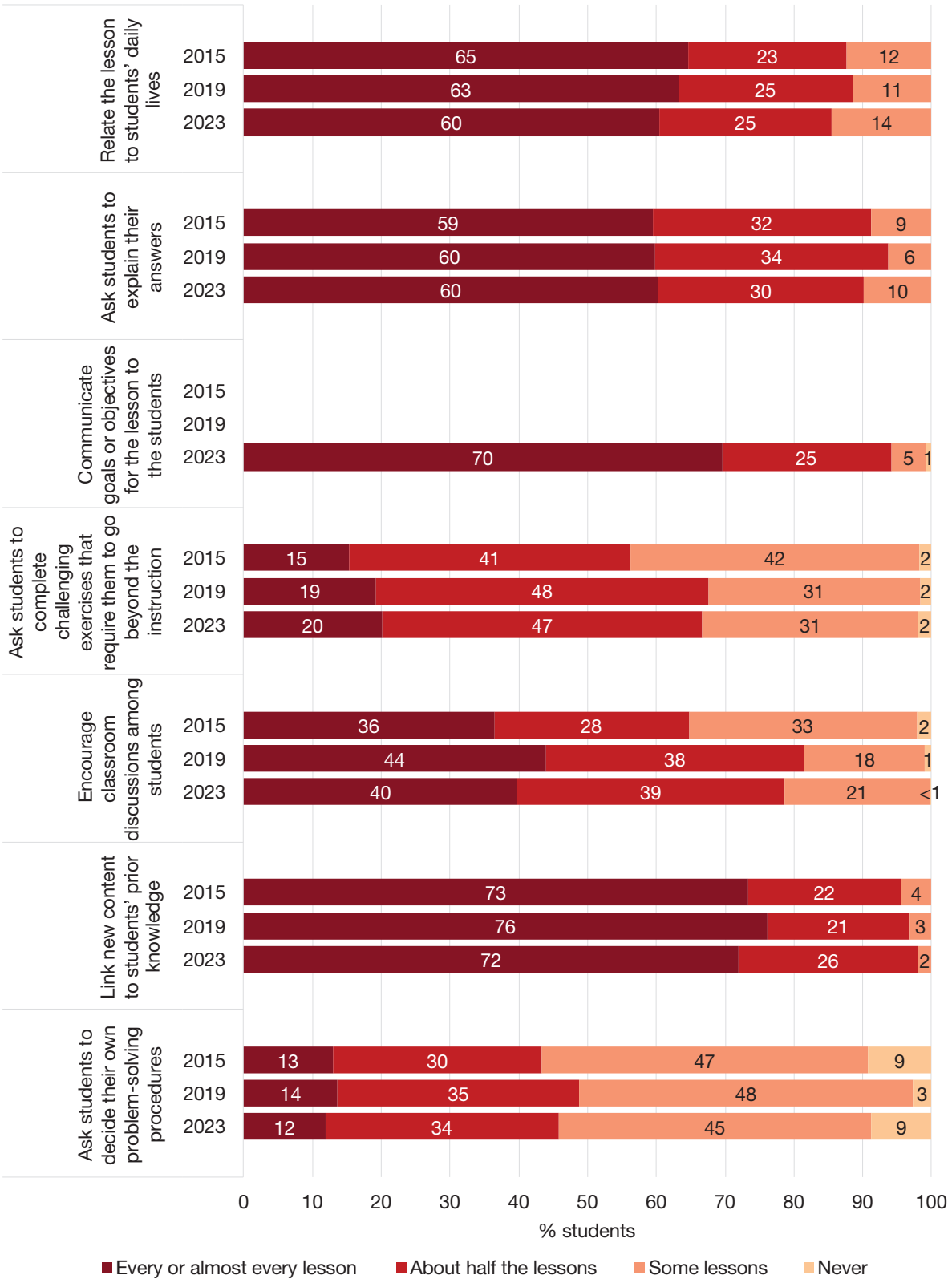
Strategies and activities used in science lessons

The strategies and activities used in science lessons were captured through two questions in the TIMSS 2023 science teacher questionnaire at Second Year. Teachers were asked to indicate the frequency with which they used specific strategies and activities in their lessons with response options ranging from *every or almost every lesson* to *never*.

The first question related to specific teaching and learning strategies, and responses for 2015, 2019, and 2023, where available, are presented in Figure 6.1. In 2023, more than three-fifths of students had teachers who reported that, in every or almost every lesson, linked new content to students' prior knowledge (72%), communicated goals or objectives for the lesson to the students (70%), asked students to explain their answers (60%), and related the lesson to students' daily lives (60%). Approximately two-fifths of students were taught by teachers who encouraged classroom discussions among students (40%) and one-fifth (20%) by teachers who asked students to complete challenging exercises that required them to go beyond the instruction (20%) in every or almost every lesson. Slightly over one-tenth of students (12%) had teachers who asked them to decide their own problem-solving procedures in every or almost every lesson. Small fluctuations can be observed across the various strategies from 2015 to 2023, with a gradual increase in the proportions of students whose teachers asked them to complete challenging exercises that required them to go beyond the instruction and encouraged classroom discussions.

Looking at the differences by school gender and school DEIS status in 2023, four-fifths of students in boys' schools (80%) had teachers who asked students to explain their answers in every or almost every science lesson compared to approximately two-fifths in girls' schools (44%) and three-fifths in mixed-gender schools (59%). Higher proportions of students in boys' schools (82%) and DEIS schools (79%) had teachers who linked new content to students' prior knowledge in every or almost every science lesson compared to the proportions in girls' schools (73%), mixed-gender schools (69%), and non-DEIS schools (69%) (Appendix Table A6.2).

Figure 6.1: Teaching strategies during science lessons, Second Year (2015, 2019, 2023)

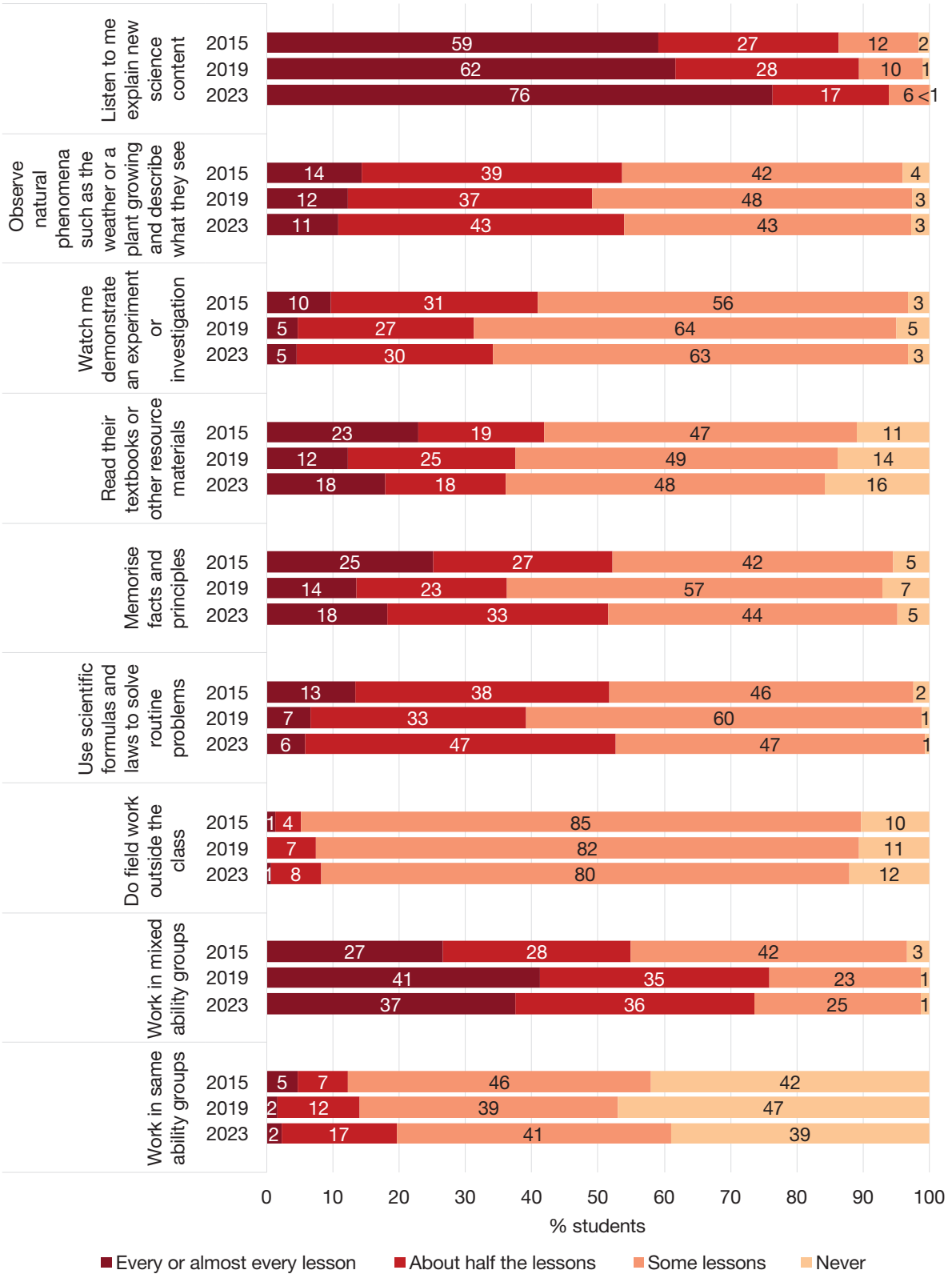


The second question related to engagement in specific activities during science lessons (Figure 6.2). Approximately three-quarters of students in 2023 were taught by teachers who had students listen to them explain new science content (76%), and approximately two-fifths were taught by teachers who had students work in mixed-ability groups (37%) in every or almost every lesson. Fewer students were asked by their teachers to read their textbooks or other resource materials (18%), memorise facts and principles (18%), and observe and describe natural phenomena such as the weather or a plant growing (11%) in every or almost every lesson. Doing fieldwork outside the class and same-ability groupwork were experienced in every or almost every lesson by very small proportions of students, though most students were taught by teachers who reported doing this in at least some lessons.

Looking at changes over time, the proportion of students who were asked to listen to their teacher explain new science content in every or almost every lesson gradually increased from 59% in 2015 and 62% in 2019 to 76% in 2023. While the frequency with which same-ability groupwork was used did not change considerably across the years, mixed-ability groupwork was used more frequently in 2019 (76%) and 2023 (73%) than in 2015 (55%).

In 2023, students in DEIS and non-DEIS schools took part in these science activities at broadly similar rates, except for listening to the teacher explain new science content, which occurred in almost every lesson for more students in DEIS schools (87%) than in non-DEIS schools (72%). Some differences were also observed by school gender. Higher proportions of students in boys' schools (14%) were taught by teachers who had students watch the teacher demonstrate an experiment or investigation in every or almost every lesson compared to the proportions in girls' (1%) or mixed-gender schools (3%). The activity of observing and describing natural phenomena such as the weather or a plant growing was experienced regularly (every or almost every lesson) more often in boys' schools (14%) and mixed-gender schools (12%) than in girls' schools (4%). This pattern was also observed in activities like reading textbooks or other resource materials, as well as memorising facts and principles (Appendix Table A6.3).

Figure 6.2: Students' engagement in specific science activities during science lessons, Second Year (2015, 2019, 2023)



Conducting experiments during science lessons

As part of their questionnaire, students were asked how often their teacher asked them to conduct science experiments, with response options ranging from *at least once a week* to *never*. In 2023, one-fifth of students (22%) conducted experiments at least once a week, half of students (49%) conducted experiments once or twice a month, and a very small proportion of students (4%) never conducted science experiments. This question was also asked in 2019, and more than one-third of students at that point (35%) reported that their teacher asked them to conduct science experiments at least weekly. Similar proportions in 2019 as in 2023 reported never (5%) conducting science experiments. There were no marked differences in the frequency with which students conducted experiments by school gender or school DEIS status (Appendix Table A6.4).

Science homework

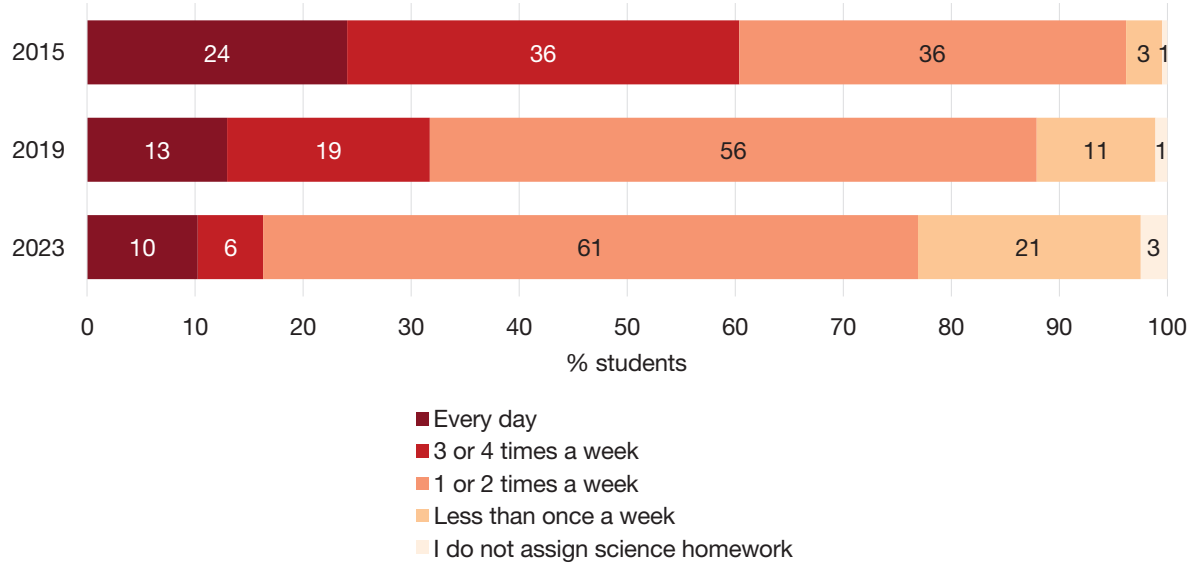
Science teachers were asked two questions relating to science homework. Firstly, they were asked to indicate how often they assigned science homework to the class that participated in TIMSS (*every day*, *1 or 2 times a week*, *3 or 4 times a week*, *less than once a week*, or *I do not assign science homework*). Secondly, they were asked to indicate how frequently (*always or almost always*, *sometimes*, or *never or almost never*) they conducted various activities with students' science homework including: *Correct assignments and give feedback to students; Have students correct their own homework; Discuss the homework in class; Monitor whether or not the homework was completed; Use the homework to contribute towards students' grades or marks*.

In 2023, one-tenth of students had teachers who assigned science homework every day, while 6% of students were assigned science homework three or four times a week (Figure 6.3). The majority of students (61%) received science homework once or twice a week. Only 3% of students had teachers who did not assign science homework. Of those students who were assigned science homework, most had teachers who reported that they, always or almost always, monitored whether or not homework was completed (80%) or discussed the homework in class (75%). Approximately two-fifths of those who received science homework had teachers who reported that they, always or almost always, corrected assignments and gave feedback to students (44%) and one-third of students (32%) had teachers who always or almost always had students correct their own homework. Using homework to contribute towards students' grades or marks was never or almost never used for the majority (60%) of the students who were assigned science homework.

There has been a decline in the number of students whose teachers assigned science homework on a daily basis from 24% in 2015 and 13% in 2019 to 10% in 2023 (Figure 6.3). In 2015, most students were assigned science homework at least three or four times a week but, in 2019 and 2023, most students were assigned science homework once or twice a week or less frequently. Accordingly, the proportion of students who were assigned science homework less than once a week has increased from 3% in 2015 and 11% in 2019 to 21% in 2023.

More students in girls' schools were assigned science homework at least once or twice a week (24%) than in boys' schools (14%) or mixed-gender schools (16%). The frequency with which students were assigned science homework was broadly similar in DEIS and non-DEIS schools in 2023, though more students in DEIS schools (67%) were assigned science homework three or four times a week than in non-DEIS schools (58%). Accordingly, fewer students were assigned science homework less than once a week in DEIS schools than in non-DEIS schools (Appendix Table A6.5).

Figure 6.3: Assignment of science homework, Second Year (2015, 2019, 2023)



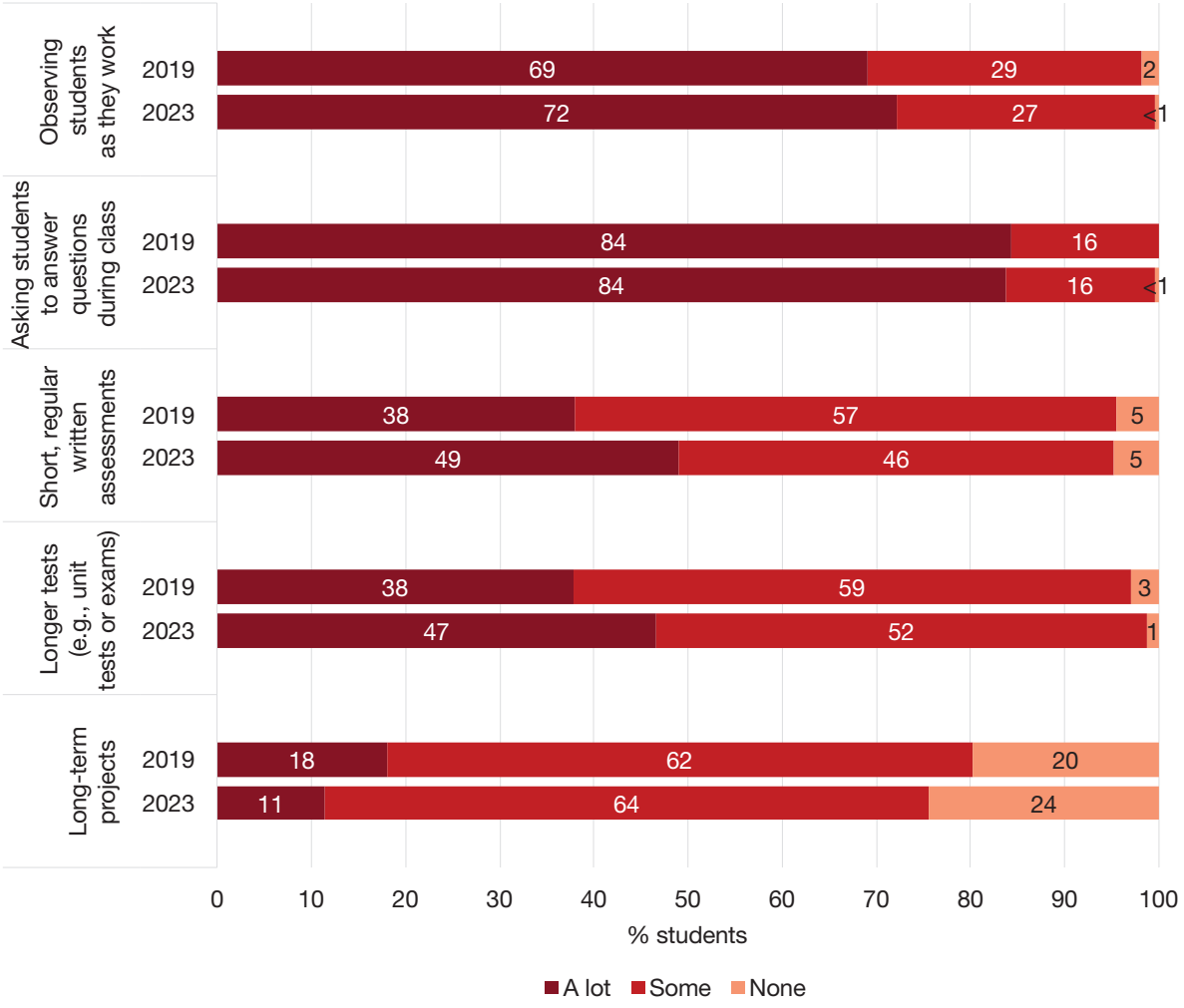
Assessment strategies in science

One question in the science teacher questionnaire asked teachers about the importance they placed on various assessment strategies in science. Figure 6.4 presents the percentages of students based on their science teachers' reports of the importance placed on assessment strategies. This question was redeveloped for TIMSS 2019 so comparisons to 2015 data are not possible.

In 2023, very high proportions of students had teachers who placed a lot of importance on asking students to answer questions during class (84%) and observing students as they work (72%) in science lessons. Approximately half of students had teachers who placed a lot of importance on short, regular written assessments (49%) and longer tests (e.g., unit tests or exams) (47%). A smaller proportion of students (11%) had teachers who placed a lot of importance on long-term projects. There was little variation in the proportions reported in 2019 and 2023 for observing students as they work or asking students to answer questions during class. More students had teachers who placed a lot of importance on short, regular written assessments and longer tests (e.g., unit tests or exams) in 2023 compared to 2019. Conversely, fewer students had teachers who placed a lot of importance on long-term projects in 2023 compared to 2019.

In 2023, mostly minor differences were observed in the importance placed on the various assessment strategies by science teachers between the school DEIS categories. However, some more notable differences were observed by school gender. Higher proportions of students in boys' schools than in girls' or mixed-gender schools had teachers who placed a lot of importance on each of the assessment strategies, with the exceptions of observing students as they work and long-term projects. For the former, a lower proportion of students in boys' schools were taught by teachers who emphasised this strategy, while for the latter, similar proportions of students were observed across all three school gender categories (Appendix Table A6.6).

Figure 6.4: Importance placed on assessment strategies in science lessons, Second Year (2019, 2023)



Challenges in science instruction

This section focuses on two key challenges faced by science teachers. The first challenge, instruction affected by science resource shortages, is based on data collected from school principals. The second challenge, teaching limited by students not ready for instruction, is based on data collected from science teachers.

Instruction affected by science resource shortages

The extent to which instruction at the school level was affected by science resource shortages was captured through a question in the school questionnaire. School principals were asked to indicate how much (*not at all, a little, some*, or *a lot*) their school's capacity to provide science instruction was affected by a shortage or inadequacy of resources in two areas: general school resources and resources for science instruction. General school resources covered areas like instructional materials (e.g., textbooks), school buildings and grounds, instructional space (e.g., classroom), digital resources (e.g., interactive whiteboards), as well as resources for students with disabilities. Resources for science instruction covered areas like teachers with a specialisation in science, calculators for science instruction, and science equipment and materials for experiments. For each of

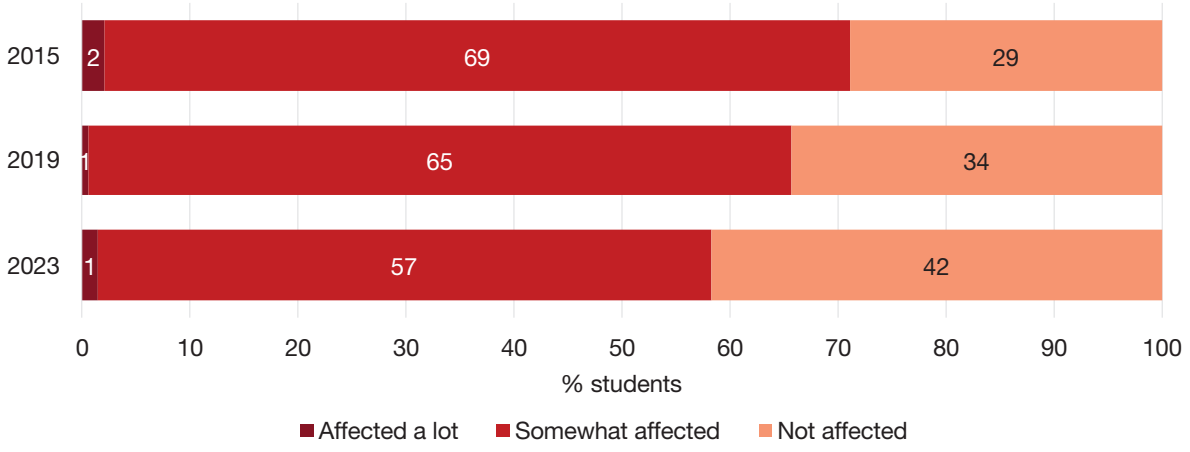
the participating countries, including Ireland, responses to these items (about the shortage of both general and science-specific resources) were used by the IEA and the TIMSS & PIRLS International Study Center at Boston College to create the TIMSS *Instruction Affected by Science Resource Shortages* scale, on the basis of which schools were grouped into three categories: *affected a lot, somewhat affected*, and *not affected*.

Figure 6.5 presents the percentages of students in each category of the TIMSS *Instruction Affected by Science Resource Shortages* scale for 2015, 2019, and 2023. In 2023, most students (57%) were in schools that were somewhat affected by science resource shortages, while approximately two-fifths (42%) were in schools that were not affected. A very small proportion, approximately 1%, were in schools that were affected a lot. Looking at the individual component items of this scale, the proportion of students whose school principals reported that their schools were affected a lot by a shortage of each resource type was 10% or lower for most of the items. Exceptions included school buildings and grounds (19%), instructional space (e.g., classrooms) (22%), and library resources relevant to science instruction (12%).

The proportion of students attending schools that were not affected by science resource shortages has gradually increased over the past three cycles of TIMSS, from 29% in 2015 to 42% in 2023 (Figure 6.5). Accordingly, the proportion attending schools that were somewhat affected has decreased, from 69% in 2015 to 57% in 2023. In all three cycles, very small proportions of students (2% or less) attended schools that were affected a lot by science resource shortages.

In 2023, higher proportions of students in girls' schools were in the *not affected* category (46%) than in boys' schools (36%) and mixed-gender schools (42%) (Appendix Table A6.7). There were also clear differences observed by school DEIS status. Non-DEIS schools had a higher proportion of students in schools that were not affected (47%) and a lower proportion in schools that were somewhat affected (51%) by science resource shortages compared to DEIS schools (29% and 71%, respectively) (Appendix Table A6.7).

Figure 6.5: Instruction affected by science resource shortages, Second Year (2015, 2019, 2023)



Note. In 2015, the *Somewhat affected* category was phrased *Affected*.

Teaching limited by students not ready for instruction

The science teacher questionnaire included a question asking teachers to what extent (*not at all, some,* or *a lot*) various factors limited how they taught the TIMSS class. These factors included: *Students lacking prerequisite knowledge or skills*; *Students suffering from lack of basic nutrition*; *Students suffering from not enough sleep*; *Students absent from class*; *Disruptive students*; *Uninterested students*; *Distracted students*; *Students with mental, emotional, or psychological impairment*; *Students with difficulties understanding the language of instruction*; *Students with physical disabilities*. For each of the participating countries, including Ireland, responses from science teachers

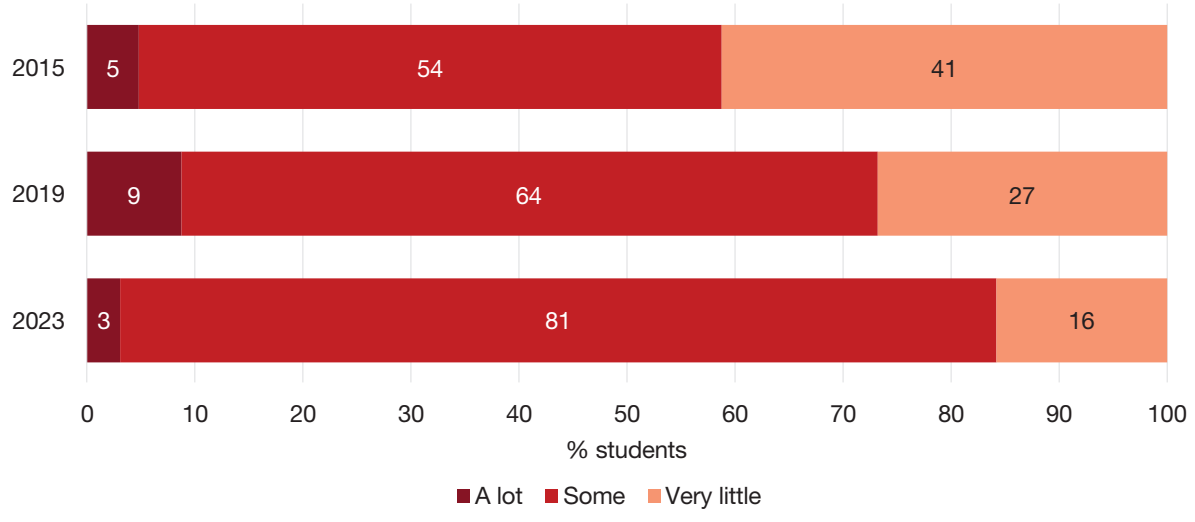
were used by the IEA and the TIMSS & PIRLS International Study Center at Boston College to create the TIMSS *Teaching Limited by Students not Ready for Instruction* scale, on the basis of which students were described as receiving teaching that, according to their teachers, was limited by students not being ready for instruction *a lot, some,* and *very little*.

Figure 6.6 presents the percentages of students in each category of the TIMSS *Teaching Limited by Students not Ready for Instruction* scale for 2015, 2019, and 2023. In 2023, teachers of most students (81%) reported that their science teaching was limited to some extent by students not being ready for instruction. Smaller proportions of students had teachers who reported that their science teaching was limited very little (16%) or a lot (3%). Looking at the individual component items of this scale, approximately one-third of students were taught by teachers who reported that students being absent from class (29%) limited their teaching a lot. Science teachers of between one-tenth and one-fifth of students reported that their teaching was limited a lot by students suffering from not enough sleep (18%), uninterested students (15%), distracted students (13%), disruptive students (12%), and students lacking prerequisite knowledge or skills (11%).

The proportion of students whose teachers reported that their science teaching was limited very little by students not being ready for instruction has decreased over the past three cycles of TIMSS, from 41% in 2015 to 16% in 2023 (Figure 6.6). Accordingly, the proportion of students taught by teachers whose science teaching was somewhat limited has increased from 54% in 2015 and 64% in 2019 to 81% in 2023.

Looking at differences by school gender and DEIS status in 2023, more students in mixed-gender schools (83%) and boys' schools (80%) had teachers whose science teaching was somewhat limited by students not being ready for instruction compared to girls' schools (75%) (Appendix Table A6.8). Higher proportions of students in DEIS schools (6%) had teachers who reported that their science teaching was limited a lot by students not being ready for instruction than in non-DEIS schools (2%). In addition, fewer students in DEIS schools (6%) had teachers who reported that their science teaching was limited very little than in non-DEIS schools (20%) (Appendix Table A6.8).

Figure 6.6: Teaching limited by students not ready for instruction, Second Year (2015, 2019, 2023)



Note. In 2015, the three categories were phrased: *Very limited, Somewhat limited,* and *Not limited*.

Digital devices in science lessons

The science teacher questionnaire included questions regarding Second Year students' access to and use of digital devices during science lessons. This section focuses on the availability and use of digital devices during science lessons, and obstacles to using digital devices, a new question introduced in 2023.

Availability and use of digital devices

In 2023, science teachers were asked if their students had digital devices (including computers, tablets, or smartphones) available to use during science lessons. Those who had digital devices available were asked three follow-up questions relating to the access students had to these digital devices, how often they used these digital devices during science lessons, and how often they completed various activities using digital devices.

More than four-fifths of students (83%) had digital devices available to use during science lessons in 2023. Of these students who had digital devices available to them, almost three-quarters (70%) were in schools that had digital devices that the class could use sometimes, two-fifths (39%) were in classes that had a digital device for each student to use, and 25% were in classes that had digital devices that students could share. More than half of those who had digital devices (60%) were in schools that allowed students to bring their own digital devices.

According to teachers' reports, two-fifths of students (37%) who had digital devices used them at least once a week, a further two-fifths (41%) used them once or twice a month, one-fifth of students (21%) used them a few times a year, while 1% never or almost never used them during science lessons. Among students who had digital devices available during science lessons, the most frequent activities included reading the textbook or watching instructional videos and solving extended or contextualised problems, with 19% and 16% of students completing these activities at least once a week, respectively. Approximately one-third of those who had digital devices available during science lessons never or almost never used them to take a test (37%) or create graphs, tables, or other data displays (31%).

In 2015 and 2019, teachers were also asked a similar question about whether computers (including tablets) were available to use during science lessons. In 2023, however, the question was expanded to include smartphones. The inclusion of smartphones means that trend comparisons should be interpreted cautiously. One-quarter of students in 2015 (26%) and approximately two-fifths of students in 2019 (45%) had computers (including tablets) available to use during science lessons, while more than four-fifths of students (83%) in 2023 had digital devices (including computers, tablets, and smartphones) available to use during science lessons.

The proportions of students who had digital devices available during science lessons were similar by school gender and DEIS status (Appendix Table A6.9).

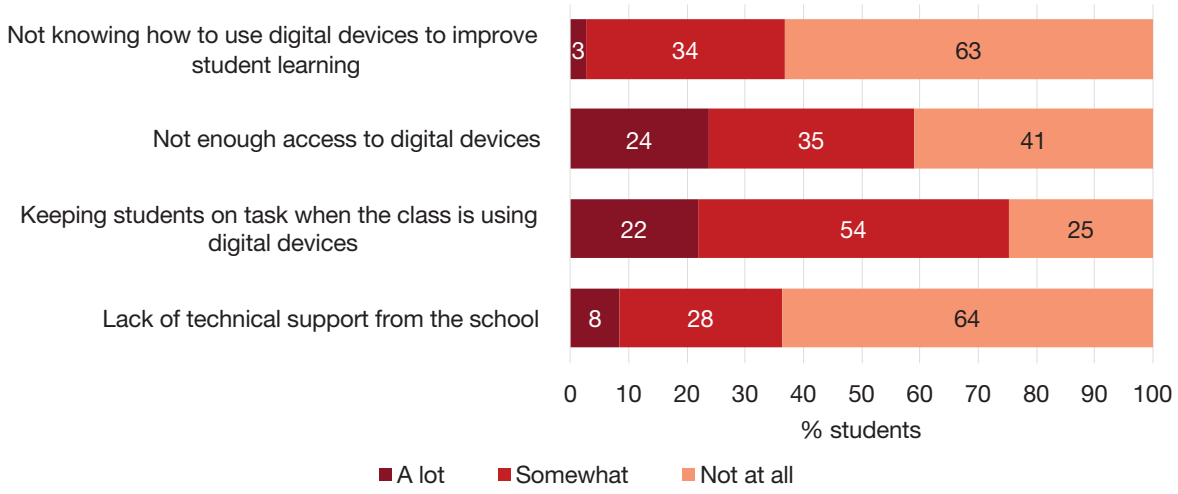
Obstacles to using digital devices

A new question was added to the teacher questionnaire in 2023 asking teachers about the extent (*not at all, somewhat,* or *a lot*) to which they faced various obstacles in incorporating digital devices into science lessons. The obstacles included: *Not knowing how to use digital devices to improve student learning*; *Not enough access to digital devices*; *Keeping students on task when the class is using digital devices*; *Lack of technical support from the school*. Figure 6.7 presents the percentages of students taught by teachers facing these obstacles in incorporating digital devices into science lessons. Approximately one-quarter of students were taught by teachers who reported that insufficient access to digital devices (24%) and keeping students on task during digital device use (22%) were significant obstacles to using digital devices in science lessons. For most students,

their teachers reported that a lack of technical support (64%) or limited knowledge of how to use digital devices to improve learning (63%) did not prevent them from incorporating digital devices into science lessons.

Looking at differences by school gender and DEIS status, higher proportions of students in girls' schools (44%) than in mixed-gender (34%) and boys' schools (26%) had teachers who reported that not knowing how to use digital devices to improve students learning was somewhat of an obstacle to incorporating digital devices into science lessons. More students in boys' schools (34%) than in girls' (22%) and mixed-gender schools (21%) had teachers who reported that insufficient access to digital devices was a major obstacle to using digital devices in science lessons, while keeping students on task during digital device use was a greater obstacle in boys' schools, with 87% of students falling into the *a lot* or *somewhat* categories, compared to 62% in girls' schools and 75% in mixed-gender schools. Lower proportions of students in DEIS schools than in non-DEIS schools had teachers who reported that keeping students on task when the class is using digital devices and lack of technical support from the school limited them to at least some extent from incorporating digital devices into science lessons (Appendix Table A6.10).

Figure 6.7: Obstacles to incorporating digital devices into science lessons, Second Year (2023)



Chapter 7:
Summary and discussion of key findings

This report draws on data from the 2023 cycle of TIMSS, alongside earlier cycles – 2011 (Fourth Class only), 2015, and 2019 – to examine trends in Ireland's primary and post-primary schools, as well as in mathematics and science classrooms. The analysis spans a period shaped by curriculum reform, introduction of new policies, and the COVID-19 pandemic. Subgroup analyses by school gender and school DEIS status, provided in each chapter's appendix, offer a more nuanced understanding of the data. This final chapter synthesises the main findings, considers their relevance within the national policy context, and outlines possible directions for future policy and practice.

Summary of findings

Primary and post-primary schools

This section summarises findings related to various aspects of the school context, including school composition, teacher characteristics, school-level resources, and school environment.

School composition

- **Linguistic composition:** The proportions of students attending primary and post-primary schools where most students speak English or Irish as their native language have decreased over time, reflecting increased linguistic diversity in Ireland over recent years. Mixed-gender and DEIS schools at both levels tended to have greater linguistic diversity than other school types.
- **Socioeconomic composition:** Trends in schools' socioeconomic composition, as reported by school principals, were different between the two levels. In primary schools, the proportion of pupils in schools with more affluent student bodies decreased from 2019 to 2023 (though remaining above 2015 levels), while the share in schools with more disadvantaged student bodies has steadily increased. At post-primary level, the reverse trend was observed; more students attended schools with more affluent student bodies and fewer attended ones with more disadvantaged student bodies over time. The socioeconomic composition of mixed-gender schools at both levels mirrored those of the overall samples. Girls' primary schools had more pupils from affluent backgrounds and fewer from disadvantaged backgrounds than boys' schools, whereas at post-primary level, single-sex schools had similar socioeconomic compositions (both more affluent than mixed-gender schools). DEIS schools at both levels had the highest concentrations of students from disadvantaged backgrounds compared to non-DEIS schools.
- **Pupils' literacy and numeracy readiness:** Across the years, the majority of primary pupils (≥80%) attended schools where over 75% of pupils could perform a range of literacy and numeracy tasks at the start of First Class. However, in 2023, there was a decline in the proportion of pupils attending schools where over 75% of pupils were literacy- and numeracy-ready compared to 2019. Girls' and non-DEIS schools had the highest proportions of literacy- and numeracy-ready pupils, while DEIS Urban Band 1 schools had the lowest.

Teacher characteristics

- **Formal education:** The proportions of students taught by teachers with a master's degree have gradually increased over time at both primary and post-primary levels. Across school subgroups, teachers' levels of formal education were broadly similar at both levels.
- **Major or main area of study and specialisation during third-level education:** Over the years, most primary pupils (≥78%) were taught by teachers with a major in primary education but no major (or specialisation) in mathematics or science. The proportions taught by teachers with both a major in primary education and a major (or specialisation) in mathematics or science gradually decreased, while those taught by teachers with other majors or specialisations remained low over time. At post-primary level, the proportions of students taught by mathematics or science teachers with majors in both their subject and subject education have increased over time. At primary level, boys' and mixed-gender schools had similar patterns to the overall sample, while girls' schools had fewer teachers with a dual major in primary education and mathematics, and DEIS Rural schools had more such teachers. At post-primary level, fewer students in girls' schools were taught by mathematics teachers with a dual major, while DEIS schools had more students with mathematics teachers holding dual majors, and science teacher qualifications were similar across DEIS and non-DEIS schools.
- **Job satisfaction:** Although around half or more students have consistently been taught by teachers who were very satisfied with their job, teacher job satisfaction has declined at both primary and post-primary levels over time. At primary level, girls' schools had the lowest proportion of pupils taught by very satisfied teachers and the highest taught by those less than satisfied; this pattern was reversed at post-primary level. Teacher job satisfaction was broadly similar across DEIS categories at both levels, though DEIS Urban Band 2 schools at primary level had slightly fewer pupils taught by very satisfied teachers and slightly more by those less than satisfied, and DEIS post-primary schools had a slightly higher proportion of students taught by less than satisfied teachers than non-DEIS schools.
- **Participation in professional development in mathematics and science education:** In 2023, fewer students at both levels were taught by teachers who had recently completed professional development in mathematics or science education compared to previous years. This decline was more pronounced at primary level. At post-primary level, this decline was less consistent, with some areas – such as addressing individual students' needs, mathematics assessment, improving students' critical thinking or inquiry skills, and addressing students' language needs in learning science – showing stable or increased professional development participation. Overall, post-primary students were more likely than primary pupils to be taught by teachers with recent professional development in mathematics and science education. At primary level, girls' schools had lower teacher participation in mathematics professional development than boys' and mixed-gender schools. DEIS Rural primary schools had the lowest, and DEIS Urban Band 1 schools the highest participation in both subjects. At post-primary level, mathematics teachers in boys' schools had lower participation than those in girls' and mixed-gender schools. No clear-cut patterns of differences in mathematics professional development among mathematics teachers were found by school DEIS status, or by school gender and DEIS status with regards to science professional development among science teachers.
- **Future needs in professional development in mathematics and science education:** The areas in which both primary and post-primary teachers reported needing future professional development included improving students' critical thinking or problem-solving/inquiry skills, integrating technology into mathematics/science instruction, addressing students' language needs in learning mathematics, integrating science with other subjects, and addressing individual students' needs. Fewer pupils in boys' primary schools had teachers reporting future professional development needs in both subjects than in girls' and mixed-gender schools. At post-primary level, students in mixed-gender schools were

more likely to be taught by teachers reporting future professional development needs in both subjects. No clear DEIS-related differences were observed in future needs at either level.

School-level resources

- **Number of computers/tablets:** At both levels, the average number of computers/tablets per school increased over time, reaching 28 devices in primary (a 15:1 pupil-to-computer ratio) and 112 devices in post-primary schools in 2023 (an 8:1 student-to-computer ratio). Despite this growth, in 2023, over 90% of primary pupils attended schools with 50 or fewer computers/tablets, while 15% of post-primary students attended schools with 50 or fewer computers/tablets. Substantial proportions of Second Year students also attended schools with higher availability of devices, including 15% attending schools with over 200 computers/tablets. All pupils in boys' and girls' primary schools attended schools with 50 or fewer computers/tablets. At post-primary level, boys' and mixed-gender schools were better equipped than girls' schools. Among DEIS categories, DEIS Urban Band 1 primary schools were slightly better equipped than others, while at post-primary level, non-DEIS schools had more devices than DEIS schools.
- **Science laboratory:** Across all TIMSS cycles, almost no primary pupils attended schools with access to a science laboratory, whereas nearly all post-primary students attended schools with access to a science laboratory. At primary level, access did not vary by school gender or DEIS status. However, at post-primary level, slightly fewer students in mixed-gender and DEIS schools had access to a laboratory compared to other school types.
- **Online learning management system:** Between 2019 and 2023, the use of online learning management systems to support learning (e.g., Aladdin, Seesaw, Moodle) increased at both levels, with nearly all students attending schools using such systems in 2023. Minor variations were observed by school gender and DEIS status in 2023, with slightly lower usage in mixed-gender schools, at both levels, and in DEIS Rural and non-DEIS primary schools compared to DEIS Urban primary schools. Information about use of learning management systems was not available prior to 2019.
- **School library or media centre:** At primary level, access to a library in school increased between 2011 and 2023, while at post-primary level, it declined from 2015 to 2023. However, these patterns should be interpreted considering the change to the phrasing of the question (from access to "a library" between 2011 and 2019 to access to "a library or media centre" in 2023). In 2023, students in boys' schools had greater access than those in girls' and mixed-gender schools, at both levels. At primary level, access was higher in DEIS Urban schools compared to DEIS Rural and non-DEIS schools.
- **High-speed internet:** In 2023, around 90% of primary pupils attended schools with high-speed internet, while at post-primary this proportion was slightly higher, at 96%. At primary level, access was highest in boys' schools, followed by mixed-gender and girls' schools, while among DEIS categories, access was lowest in DEIS Urban Band 1 schools. At post-primary, no notable differences in access by school gender or DEIS status were observed.

School environment

- **School emphasis on academic success:** Emphasis on academic success remained relatively stable over time across both levels, with most students attending schools that placed a high emphasis, and fewer in schools with very high or medium emphasis. At primary level, girls' schools had the highest and boys' schools had the lowest proportions of pupils in schools with very high academic emphasis; while at post-primary level, boys' schools had the highest proportion of students in schools with very high emphasis. Non-DEIS schools at both levels, as well as DEIS Rural schools at primary level, had

the highest proportions of students in schools with very high emphasis. Almost no students in DEIS (Urban) schools attended schools with a very high emphasis on academic success.

- **Professional collaboration:** At both levels, common types of professional interactions among teachers included teachers discussing how to teach a particular topic, collaborating in planning and preparing instructional materials, sharing what they have learned about their teaching experiences, and working as a group on implementing the curriculum. Cross-grade collaboration to ensure continuity in learning declined over time at primary level. At post-primary level, cross-grade collaboration increased between 2015 and 2019 among both mathematics and science teachers, then declined slightly in 2023 among mathematics teachers (but remained stable among science teachers). Visiting other classrooms remained infrequent at both levels. At primary level, teachers in girls' and non-DEIS schools tended to engage less frequently in most types of interactions, while teachers in DEIS Rural schools were more likely to engage frequently in most types of interactions. At post-primary level, mathematics teachers in boys' schools were less likely to collaborate frequently than teachers in girls' and mixed-gender schools. Slightly higher proportions of students in mixed-gender schools were taught by science teachers who very often engaged in most types of interactions than in boys' and girls' schools. DEIS schools had more students taught by mathematics and science teachers who very often engaged in most types of interactions, but also slightly more students taught by science teachers who rarely or never did so compared to non-DEIS schools.
- **School discipline:** At primary level, discipline problems remained relatively stable over time, with most pupils attending schools with hardly any discipline problems. At post-primary level, there has been a slight decrease in the proportion of students attending schools with hardly any problems and an increase in students attending schools with minor discipline problems. Boys' primary schools had the highest rates of minor and moderate to severe problems, while at post-primary level, mixed-gender schools followed by boys' schools experienced the most frequent issues of this kind. DEIS schools at both levels reported higher frequencies of disciplinary problems than non-DEIS schools (and DEIS Rural schools at primary level).
- **Safe and orderly school:** The proportions of students in less than safe and orderly schools remained low (2–8%) over time at both levels. However, the proportions attending very safe and orderly schools declined between 2015 and 2023, from 83% to 76% at primary level and from about two-thirds (64% and 70% according to mathematics and science teachers, respectively) to 55% at post-primary level. Girls' schools were generally rated safer and more orderly than boys' and mixed-gender schools at both levels, as were non-DEIS schools (and DEIS Rural schools at primary level) compared to DEIS (Urban) schools.

Primary and post-primary classrooms

This section summarises findings related to classroom practices and challenges in mathematics and science, including the organisation of mathematics and science instruction, teaching, and assessment, challenges in mathematics and science instruction, and availability and use of digital devices during mathematics and science lessons.

Organisation of mathematics and science instruction, teaching, and assessment

- **Time spent on mathematics instruction:** Between 2015 and 2023, mathematics instruction at primary level averaged approximately four hours and 30 minutes per week, marking an increase from 2011. At post-primary level, the average instructional time was around three hours per week, with little variation across TIMSS cycles. Primary teachers in girls' and DEIS Urban Band 2 schools reported spending

slightly more time teaching mathematics than in the other school types. At post-primary level, reported instructional time was similar across school gender and DEIS categories.

- **Time spent on science instruction:** Between 2015 and 2023, science instruction at primary level averaged about one hour per week, marking a decrease from 2011. At post-primary level, the average instructional time was approximately two hours and 25 minutes in 2023, slightly lower than in 2015 and 2019. Instructional time in science was similar across school gender and DEIS categories at both levels.
- **Strategies used in mathematics and science lessons:** Common teaching strategies across all TIMSS cycles and levels included linking new content to students' prior knowledge, asking students to explain their answers, relating lessons to students' daily lives (more frequently in post-primary science lessons), and encouraging classroom discussions among students (more frequently at primary level). At primary level, somewhat higher proportions of pupils in boys' schools and DEIS Rural schools, on average, were taught by teachers who used these strategies in every or almost every lesson. At post-primary level, there was little variation by school gender and DEIS status in mathematics lessons in 2023. In science, however, boys' and DEIS schools had higher proportions of students taught by teachers who regularly used certain strategies, particularly asking students to explain their answers and linking new content to students' prior knowledge.
- **Activities in mathematics lessons:** Across all TIMSS cycles and levels, common activities in mathematics lessons included students listening to teachers explain new content or problem-solving methods, and teachers having students practise procedures on their own. Listening to teachers explain new content was more common in 2023 compared to previous years. Post-primary students engaged more often in memorising rules, procedures, and facts than primary pupils. At primary level, the frequency with which certain activities took place in mathematics lessons in 2023 was broadly similar across school gender types, though slightly higher in boys' schools. DEIS Urban Band 1 schools had the least frequent engagement in these mathematics activities, while DEIS Rural schools had the highest. At post-primary level, activity frequency in mathematics lessons in 2023 was broadly similar across DEIS and non-DEIS schools. However, students in boys' schools were more likely to listen to teachers' explanations but less likely to work in groups, while more students in girls' and mixed-gender schools were asked to memorise content.
- **Activities in science lessons:** Across all TIMSS cycles and levels, common activities in science lessons included students listening to teachers explain new content and working in mixed-ability groups. Listening to teachers explain new content was more common in 2023 at post-primary level compared to previous years, while working in mixed-ability groups was more frequent in 2019 and 2023 compared to 2015 at both levels. Students reading their textbooks or other resource materials occurred more frequently at primary compared to post-primary level, and, at primary level, was more frequent in 2023 than in previous years. In 2023, primary pupils in boys' and girls' schools were more likely than those in mixed-gender schools to be asked to observe natural phenomena (e.g., plant growing) and describe what they see. Same-ability groupwork was least common in boys' schools. At post-primary level, teacher-led demonstrations of experiments or investigations occurred more often in boys' schools compared to girls' or mixed-gender schools. The activities of observing natural phenomena, reading textbooks or other resource materials, and memorising facts and principles were experienced more frequently in boys' schools and mixed-gender schools than in girls' schools. While some variation by school DEIS status was noted, no consistent patterns emerged. Notably, though, pupils in DEIS Rural primary schools were more likely to engage in observing natural phenomena (e.g., plant growing) and describing what they see, as well as watching teachers demonstrate an experiment or investigation, compared to their peers in other schools.

- **Use of calculators during mathematics lessons:** At primary level, the proportion of pupils permitted to use calculators during mathematics lessons decreased from 2011 to 2023. At post-primary level, nearly all students had either restricted or unrestricted access to calculators across all TIMSS cycles, with unrestricted access increasing over time. In 2023, boys' primary schools and DEIS Urban Band 1 primary schools had the highest proportions of pupils with no access to calculators. At post-primary level, unrestricted access was more common in girls' schools, with no notable differences by school DEIS status.
- **Conducting experiments during science lessons:** In 2023, most primary pupils conducted science experiments infrequently, with a small minority doing so weekly, a pattern similar to 2019. At post-primary level, about one-fifth of students conducted experiments weekly in 2023 (a decline from over one-third in 2019), while a small proportion never did (similarly to 2019). At primary level, a higher proportion of pupils in boys' schools conducted experiments at least weekly compared to girls' and mixed-gender schools in 2023, with little variation across DEIS categories. At post-primary level, there were no marked differences in the frequency with which students conducted experiments by school gender or DEIS status.
- **Mathematics homework:** At both levels, nearly all students were assigned mathematics homework at least weekly across all TIMSS cycles. At primary level, daily assignment of homework decreased from 2011 to 2015, remained stable between 2015 and 2019, and rose slightly in 2023 to a broadly similar proportion as that in 2011. At post-primary level, there has been a considerable decline in the proportion of students assigned mathematics homework on a daily basis. Most students with homework had teachers who monitored completion, discussed it in class, and, at primary level, corrected assignments and provided feedback. Daily homework was more common in girls' schools at both levels, while the proportions who were assigned homework less frequently (once or twice a week or less) were similar across school gender types. Minor variations in frequency were observed by school DEIS status at both levels.
- **Science homework:** At post-primary level, the majority of students were assigned science homework at least once a week across all TIMSS cycles, although there has been a decline in the proportion assigned homework more frequently. At primary level, the proportion of pupils assigned science homework on a weekly basis declined over time, accompanied by an increase in the proportion of pupils not assigned science homework. Nearly three-quarters of Fourth Class pupils were not assigned science homework in 2023. When homework was assigned, most teachers monitored its completion, discussed it in class, and, at primary level, corrected assignments and provided feedback. In 2023, science homework was assigned less frequently in boys' primary schools and DEIS Urban Band 1 primary schools than in the other school types. At post-primary level, more students in girls' schools were assigned weekly science homework than in boys' schools or mixed-gender schools. The frequency with which students were assigned science homework was broadly similar in DEIS and non-DEIS post-primary schools in 2023.
- **Assessment strategies in mathematics and science:** Teachers at both levels valued observing students and asking questions during class as assessment strategies in mathematics and science. Short, regular written assessments and longer tests (e.g., unit tests or exams) were both seen as important by teachers. Short assessments were considered more important at primary level, while longer tests were prioritised at post-primary level. Long-term projects gained importance in post-primary mathematics in 2023 and were generally viewed as slightly more relevant to science than mathematics at primary level. At primary level, teachers of more pupils in boys' and girls' schools placed a lot of importance on longer tests in mathematics than in mixed-gender schools, while teachers of fewer pupils in girls' schools placed a lot of importance on asking pupils to answer questions during class than in boys' and mixed-gender schools. In science, teachers of more pupils

in boys' schools placed a lot of importance on short, regular written assessments, while teachers of more pupils in girls' schools placed a lot of importance on longer tests. Long-term projects were less emphasised in boys' and DEIS Urban schools, and in-class questioning was less emphasised in DEIS Urban Band 2 schools. At post-primary level, differences in the importance placed on assessment strategies were generally minor across DEIS categories for both subjects. However, among science teachers, some variation was observed by school gender, with higher proportions of students in boys' schools having teachers placing a lot of importance on certain assessment strategies.

Challenges in mathematics and science instruction

- **Instruction affected by mathematics and science resource shortages:** Across all cycles and both levels, very small proportions of students (≤2%) attended schools highly affected by mathematics or science resource shortages. At primary level, the proportion of pupils in schools not affected by shortages declined between 2011 and 2019, while this pattern reversed between 2019 and 2023. At post-primary level, the proportions of students attending schools not affected by shortages gradually increased over time. At both levels in 2023, higher proportions of students in girls' schools attended schools not affected by mathematics shortages, while higher proportions in girls' and mixed-gender schools attended schools not affected by science shortages. Non-DEIS schools had higher proportions of students in schools not affected by mathematics and science resource shortages than DEIS schools.
- **Teaching limited by students not ready for instruction:** Across both levels, the proportions of students taught by teachers whose instruction was minimally affected by students not being ready for instruction have gradually declined, with marked decreases between 2019 and 2023. Correspondingly, the proportions of students taught by teachers whose instruction was affected more have increased over time. At both levels, more students in girls' schools were taught by teachers reporting minimal limitations, while boys' and mixed-gender schools had higher proportions taught by teachers whose instruction was considerably affected. Teachers in DEIS Urban (primary) and DEIS (post-primary) schools reported greater limitations due to students not being ready for instruction in both mathematics and science lessons.

Availability and use of digital devices during mathematics and science lessons

- **Availability of digital devices:** According to teachers' reports, the availability of digital devices was higher in science lessons than mathematics lessons at both primary and post-primary levels. Availability of digital devices has increased over time for both subjects and levels, though caution is needed when comparing trends as the relevant question in the 2023 teacher questionnaire was expanded to include smartphones (as well as computers or tablets). At primary level, most pupils were in schools that had digital devices that the class could use sometimes, about one-third were in a class that had digital devices for each pupil to use, and more than half were in classes that had digital devices that pupils could share. A very small proportion were in schools that allowed pupils to bring their own devices. In 2023, digital device availability during mathematics lessons was relatively similar across school gender types. DEIS Urban Band 1 schools had the highest availability of devices in mathematics lessons among primary-level DEIS categories, while DEIS Rural schools had the lowest availability in science lessons. At post-primary level, approximately two-thirds of students with device access were in schools that had digital devices that the class could use sometimes, about one-third were in a class that had digital devices for each student to use, and one-fifth to one-quarter were in classes that had digital devices that students could share. Approximately two-thirds of students with access to devices were in schools that allowed them to bring their own devices. Device

availability during mathematics and science lessons was broadly similar by school gender and DEIS status at post-primary level. However, fewer students in boys' schools had devices available during mathematics lessons compared to girls' and mixed-gender schools.

- **Use of digital devices:** Despite the higher availability of digital devices in science lessons at both primary and post-primary levels, device use was slightly higher in primary mathematics lessons compared to science, while at post-primary level, use was higher in science lessons compared to mathematics lessons. At primary level, common activities for pupils with access to devices in their schools included reading textbooks and watching instructional videos, playing games involving mathematics calculations or concepts, and practising problems and procedures. About half of Fourth Class pupils with devices in mathematics lessons, and just under one-quarter in science lessons, used digital devices to take a test. At post-primary level, common activities for students with access to devices in their schools included reading textbooks or watching instructional videos, practising problems and procedures, and solving extended or contextualised problems. Between half and two-thirds of Second Year students with access to devices used them to take tests during mathematics and science lessons.
- **Obstacles to using digital devices:** Many students were taught by teachers who reported challenges integrating digital devices into mathematics and science lessons at both levels. At primary level, limited access to devices was the main barrier. At post-primary level, limited access to devices and keeping students on task were key concerns. While lack of knowledge on how to use digital devices to improve student learning and insufficient technical support from the school were also noted as challenges, they were seen as less critical. At primary level, more pupils in boys' schools had teachers reporting that keeping pupils on task when the class was using digital devices was a major obstacle in incorporating digital devices into mathematics and science lessons, while lack of access to devices was a greater barrier in girls' schools. While there was some variation by school DEIS status, no consistent patterns were observed. At post-primary level, obstacles to using digital devices in mathematics were similar across school types. For science, more students in girls' schools had teachers reporting lack of knowledge on how to use digital devices to improve student learning as a moderate obstacle, while in boys' schools, limited access to devices and keeping students on task were reported as greater barriers. More students in non-DEIS schools had teachers reporting that keeping students on task, and a lack of technical support from the school, limited them to at least some extent from incorporating digital devices into science lessons.

Discussion

The TIMSS 2023 data, considered alongside data from earlier cycles (2011, 2015, and 2019), reveal a period of both notable continuity and significant educational change in Ireland's primary and post-primary schools and classrooms. Developments during this period reflect both the effects of sustained policy initiatives and the education system's capacity to navigate external circumstances and disruptions, most notably the COVID-19 pandemic. This discussion explores the evolving landscape of Irish education across two key dimensions: (i) the structural and organisational characteristics of schools, and (ii) the pedagogical practices and classroom experiences that shape mathematics and science teaching and learning. In examining both trends and more recent shifts, this analysis offers insights into progress made and outstanding challenges.

Primary and post-primary schools

Evolving demographics and school readiness

The growing linguistic diversity in Ireland's primary and post-primary schools represents a fundamental shift in the country's educational landscape. As documented by other national research (e.g., Farrell et al., 2023), this shift reflects broader demographic changes in Ireland and presents both challenges and opportunities for teaching and learning. Linguistic diversity is especially pronounced in mixed-gender and DEIS schools, which increasingly serve complex, multilingual student cohorts. While this concentration can intensify existing challenges related to equity and resourcing, it also offers opportunities to cultivate inclusive, multilingual learning environments. Despite the growing number of students who are not native English or Irish speakers, participation in professional development focused on addressing language needs remains relatively low, further underscoring the need for targeted preparation and sustained training in multilingual pedagogies and culturally responsive teaching. These competencies are essential for ensuring that linguistically diverse students are fully supported in accessing the curriculum, given that all subjects are language-dependent and misunderstandings can easily arise from linguistic barriers. Additionally, especially in recent years, many students from other language backgrounds, particularly those arriving as refugees, may have experienced significant trauma in their lives (though TIMSS data do not capture students' socio-emotional experiences or migration histories). As such, school principals and teachers must be prepared to address not only linguistic challenges but also the emotional and psychological needs of these students in order to help them integrate successfully into the school community.

The divergent socioeconomic patterns between primary and post-primary levels warrant attention. Primary schools have seen an increased enrolment of pupils from disadvantaged backgrounds, whereas post-primary schools have experienced a rise in enrolment from more affluent student populations over time. This difference may be linked to differential school choice behaviours that emerge as students transition to post-primary education, with more affluent families exercising greater choice in school selection. DEIS schools continue to serve higher concentrations of disadvantaged students at both levels, as intended by the programme design.

A concerning trend in the 2023 data is the decline in pupils' literacy and numeracy readiness at the beginning of First Class, as reported by principals. The data suggest a return to 2015 levels, effectively reversing the improvements observed in 2019. This pattern aligns with national and international research indicating that early childhood development was negatively affected by COVID-19-related disruptions (e.g., Egan & Pope, 2025; Hadley et al., 2025). This decline in foundational skills has direct implications for pupils' later engagement with mathematics and science. It is, therefore, critical that teachers are equipped to identify early gaps and apply evidence-informed strategies to support foundational learning recovery, ensuring that students are not disadvantaged as they move through their primary education and beyond.

Teacher qualifications and professional development

There have been gradual increases in the proportions of teachers holding master's degrees at both levels, and those with dual majors in mathematics/mathematics education and science/science education at post-primary level. This may signal the success of initiatives that emphasise teacher qualifications as a lever for improving instructional quality, including the introduction of the PME in 2014 (with the first cohort graduating in 2016) and the PDMT in 2012 (with the first cohort graduating in 2014). However, the declining proportion of primary teachers with dual specialisation in primary education and mathematics/science, likely due to the removal of the academic subject component from the Bachelor of Education from 2012 onwards, raises some concerns about the potential impact on the availability of subject-specific pedagogical expertise in primary schools. While all initial teacher education programmes in Ireland are currently required to support pre-service

teachers' personal and professional knowledge for literacy and numeracy development, international research continues to stress the importance of strong content knowledge and pedagogical content knowledge for effective instruction (Copur-Gencturk & Tolar, 2022).

Although job satisfaction levels among teachers in Ireland have generally been high (Clerkin, 2013; Clerkin et al., 2017, 2018), the relative decline in satisfaction across both levels in 2023 is concerning given its potential implications for teacher retention and instructional quality. This finding may reflect the cumulative effects of educational change and reform implementation, increased accountability pressures, administrative burden, and the residual impact of COVID-19 disruptions on teaching conditions and workload. A recent synthesis of the literature on teacher workload and work intensification highlights how such increased demands and intensified work, especially the "non-teaching" aspects of it, contribute significantly to stress and dissatisfaction (Creagh et al., 2025). Additionally, broader societal challenges, such as housing costs, work-life balance pressures, and changing professional expectations may be contributing to decreased satisfaction. The variation in satisfaction levels seen here by school gender and DEIS status suggests that professional experiences differ across school contexts. Evidence from Singleton's (2025) study commissioned by the Teachers' Union of Ireland also highlights this variation. The author notes that "when given the opportunity to elaborate on their job satisfaction, some [teachers in DEIS schools] found the work rewarding, while others described aspects of working in a DEIS school as stressful or emotionally draining" (p. 23). Similarly, insights from a recent study conducted by Dublin City University's Centre for Collaborative Research Across Teacher Education (DCU CREATE) identify burnout as a critical concern for teachers in both primary and post-primary schools (DCU, 2025). Combined, these findings highlight the need for targeted supports to promote teacher wellbeing, particularly in high-need school settings. Such supports are essential for maintaining instructional quality, preventing burnout, and enhancing teacher retention. In this context, Eryilmaz et al. (2025) underscore the pivotal role of school principals in fostering a supportive environment, as revealed in their analysis of TIMSS 2019 data from 46 countries, including Ireland, while Harford and Fleming (2025) provide a useful read on the specific challenges of teacher supply in Ireland, offering valuable insights into the factors affecting teacher recruitment and retention.

Participation in professional development related to mathematics and science declined in 2023, despite ongoing policy emphasis under the *STEM Education Policy Statement* (Department of Education and Skills, 2017f) and relevant professional supports provided at a national level. This decline may reflect a combination of factors, including pandemic-related disruptions, increased workload, staff shortages, or dissatisfaction with available professional development options – with the latter issue identified in Singleton's (2025) study. Additionally, the prioritisation of the *Primary Language Curriculum* and wellbeing at primary level and the completion of the Junior Cycle rollout for subject specifications at post-primary level, alongside the fact that professional development related to the new *Primary Mathematics Curriculum* had not begun at the time of the TIMSS 2023 data collection at primary level, could have contributed to the observed drop, with this pattern potentially suggesting that subject-specific professional development tends to be prioritised when new curricula are introduced. However, there is a clear need for more sustained and ongoing professional development to ensure continuous growth in teaching practice. Towards this end, adoption and expansion of more integrated and impactful models of professional learning would be important. Initiatives such as the *Clare Small Schools Project* (Smith & Browne, 2024) illustrate the potential of sustained, school-embedded professional development to increase both teacher engagement and satisfaction. Importantly, there is broad alignment in reported professional development needs across school types. These include integrating technology into mathematics and science instruction, fostering students' critical thinking and problem-solving skills, and differentiating instruction to meet individual needs. This relative consistency presents an opportunity to design targeted capacity-building efforts that could be implemented effectively across diverse educational settings.

School-level resources and infrastructure

The substantial growth in digital device availability, particularly at post-primary level, and the near-universal adoption of online learning management systems between 2019 and 2023 likely reflect the combined influence of sustained investment through initiatives such as the *Digital Strategy for Schools* (Department of Education and Skills, 2015a; Department of Education, 2022a) and the accelerated digitalisation prompted by the COVID-19 pandemic. These developments align with findings from the evaluation of the *Digital Learning Framework* (Donohue et al., 2024), which highlight a system-wide shift towards integrating digital tools into everyday teaching and learning. However, access to digital infrastructure remains somewhat uneven. Boys' and mixed-gender post-primary schools, as well as non-DEIS schools, were found to be better equipped than girls' and DEIS schools, respectively. Also, the reduced availability of school libraries at post-primary level, though likely influenced by temporary closures during the pandemic, points to ongoing resource challenges.

Across all TIMSS cycles, very few students were in schools facing notable shortages of mathematics or science resources. However, there was a small increase in primary schools with moderate resource constraints between 2011 and 2019, before an improvement was observed in 2023. At post-primary level, resource constraints have gradually eased. Although these findings point to general progress in school resourcing for mathematics and science, DEIS schools continue to report higher rates of resource constraints. This raises important concerns about whether all students have access to the material supports necessary for effective mathematics and science teaching and learning.

School environment

Schools have maintained a relatively stable academic emphasis over time, with most students attending schools placing high emphasis on academic success. However, the variation by school type – with substantial proportions of students in DEIS Urban Band 1 schools at primary level and DEIS schools at post-primary level attending schools with only a medium emphasis on academic success – raises questions about potentially lower expectations in more disadvantaged settings and the possible consequences for student aspirations and academic, as well as non-academic, outcomes. Research shows that when teachers hold lower expectations, they tend to provide less challenging and engaging instruction, fewer opportunities for choice, and less emotionally supportive classroom environments, while high-expectation teachers foster more positive beliefs, motivation, and achievement among students over time (Rubie-Davies & Hattie, 2025).

While disciplinary climates in primary schools have generally remained positive over time, with most pupils attending schools reporting minimal problems, post-primary schools show signs of disciplinary deterioration. There has been a decline in the proportion of students attending schools with few disciplinary issues, and an increase in those attending schools facing more challenges. Notably, girls' schools consistently report more positive disciplinary climates than boys' and mixed-gender schools at both levels. This pattern may partly reflect the findings of the *Children's School Lives* study (Devine et al., 2024), which highlight how behavioural expectations in Irish schools are shaped by gender norms from an early age. According to Devine et al. (2024), girls, particularly in girls' schools, are more likely to be viewed and to view themselves as compliant and well-behaved, with teachers often reinforcing these expectations. Although teachers in Devine et al.'s (2024) study acknowledged that girls and boys engage differently with classroom expectations, it also showed that girls in junior classes were held to higher behavioural standards yet paradoxically received more critical evaluations in senior classes. Meanwhile, certain disruptive behaviours among boys appeared to become increasingly normalised, likely contributing to the less favourable climates in boys' and mixed schools. Discipline issues were also more prevalent in DEIS schools, where higher proportions of students were reported experiencing minor to severe behavioural problems at both primary and post-primary levels. These findings are supported by Fleming and Harford (2023), whose case study research involving school leaders, teachers, parents, and

students identified ongoing constraints that limit the capacity of DEIS schools to effectively manage behavioural challenges.

The decline in the proportions of schools rated as very safe and orderly, especially at post-primary level, is concerning. As with discipline, reports of school safety and order varied by school type. Girls' schools were rated as safer and more orderly than boys' and mixed-gender schools, while DEIS Urban schools reported more frequent challenges in maintaining safe and supportive environments. These disparities highlight inequalities in school climate that can potentially, in turn, shape student wellbeing and academic engagement. These are the kinds of issues that the *Bí Cineálta* procedures, introduced in 2024, are designed to address. By promoting a children's rights-based, whole-school partnership approach, the guidance aims to support schools in developing inclusive environments where safety is embedded not just in rules, but in culture, relationships, and teaching practices (Department of Education, 2024a).

Primary and post-primary classrooms

Instructional time and homework

Instructional time for mathematics and science at primary level has remained relatively stable between 2015 and 2023, following an increase in mathematics and a decrease in science between 2011 and 2015. However, consistent with the pattern observed as far back as 2015 (Clerkin et al., 2018), Ireland continues to allocate less science instructional time at primary level than almost all TIMSS countries. While Ireland's average is approximately one hour per week, the TIMSS international average is about two hours per week.[15] Some variation exists at primary level, where girls' and DEIS Urban Band 2 schools reported slightly higher mathematics instructional time, potentially reflecting the new approach to time in the *Primary Curriculum Framework*, which gives schools more autonomy over time allocation, and/or targeted support efforts. Instructional time varied little across gender and DEIS categories at post-primary level, suggesting a more uniform approach.

At post-primary level, the slight decline in science instructional time between 2019 and 2023, while mathematics allocation remained stable, may be linked to several factors, including the transition from 40-minute to one-hour class periods or relevant changes in the curriculum. This trend, combined with the fact that Ireland already allocated relatively little science instructional time compared to other TIMSS countries as far back as 2015 (Clerkin et al., 2018), alongside the shorter school year in Irish schools compared to other countries, is concerning given the emphasis on STEM education in national policy and explicit goals of increasing student engagement in science subjects (Department of Education and Skills, 2017f).

In 2023, assignment of homework on a daily basis declined for both subjects and grade levels compared to previous years. This may reflect challenges in designing age-appropriate science tasks, a reduced emphasis on science outside of classroom hours, or broader shifts in homework policies. It should also be noted that changes in lesson structures at post-primary level may partly explain why homework appears to be assigned less frequently with many schools having moved from 40-minute to one-hour lessons, which reduces the number of contact days per week. Nevertheless, when homework was assigned, teachers typically monitored its completion and provided feedback, an essential practice for supporting learning (e.g., Cunha et al., 2018). Ensuring this feedback loop is maintained, particularly in subjects receiving less instructional time, is vital for supporting student progression and maintaining engagement in mathematics, science, and other subjects.

15 Authors' calculations using the TIMSS 2023 international database, which can be accessed at https://timss2023.org.

Teaching strategies, activities, and challenges in mathematics and science lessons

Irish classrooms have seen both continuity and subtle shifts in instructional practices in mathematics and science across the TIMSS cycles. Core teaching strategies such as linking new content to prior knowledge, encouraging students to explain their answers, and relating lessons to daily life have remained central, underscoring a sustained commitment to active learning and conceptual understanding. However, the increased frequency of teacher-led explanations in 2023, particularly at post-primary level, may indicate a shift towards more teacher-directed instruction. This could be interpreted within the context of COVID-19 disruptions during the data collection period, when schools may have relied on more direct instructional approaches to address learning gaps or compensate for interrupted educational experiences following the extended school closures. While teacher-directed instruction offers essential structure, guidance, and alignment with curricular standards, student-directed approaches have been shown to better promote autonomy, mastery-oriented goals, and deep-learning strategies (e.g., Schweder et al., 2025).

Changes in classroom activities reveal interesting patterns of pedagogical change, including an increased frequency of textbook reading at primary level in 2023 and a greater emphasis on mixed-ability groupwork in science lessons. However, the continued emphasis on traditional activities, such as practising procedures and memorising content, indicates that innovative pedagogical approaches promoted through various policy initiatives and relevant training may not yet be widespread in everyday classroom practice. A key feature of the *Primary Mathematics Curriculum* is the recognition that *how* teachers teach is as important as *what* they teach, with specific pedagogical practices designed to support this principle (Department of Education, 2023b). While TIMSS data included in this report pre-date the enactment of the *Primary Mathematics Curriculum*, it will be important to consider in future cycles whether its implementation – and, on a different timeline, the *Science, Technology and Engineering Education* specification – shapes classroom practice in ways that reflect these priorities.

A key concern emerging from the 2023 data is the increasing proportions of teachers reporting that their ability to teach effectively is limited by students not being ready for instruction. The increasing frequency of this challenge, across both levels and subjects, likely reflects the lingering impact of COVID-19 disruptions on student preparedness, behaviour, emotional wellbeing, and absenteeism, and is consistent with the observed declining student attitudes towards mathematics, science, and school in 2023 compared to previous TIMSS cycles (Denner, Clerkin, et al., 2025). Together, these patterns highlight the need for renewed attention to student engagement, motivation, and classroom climate, areas that are crucial not only for learning recovery but also for sustaining long-term educational progress (see also Denner, Clerkin, et al., 2025).

Assessment practices

Assessment practices in Irish classrooms at both primary and post-primary levels reflect the formative principles promoted in policy as well as the practical realities of summative demands. The reported widespread use of classroom observations and teacher questioning, for example, echoes the emphasis on formative approaches in the assessment guidelines for the *Primary School Curriculum* (National Council for Curriculum and Assessment, 2007) and the *Framework for Junior Cycle* (Department of Education and Skills, 2015b). At post-primary level, the increased importance attached to long-term projects in mathematics in 2023 likely reflects the influence of the revised Junior Cycle mathematics specification (Department of Education and Skills, 2017d), which explicitly prioritises problem-solving and authentic learning experiences, and includes project work as part of assessment. This shift marks an important development, especially in light of the introduction of CBAs, and indicates that recent curricular reforms are beginning to shape classroom assessment in meaningful ways, encouraging deeper engagement and more process-oriented evaluation. It should be noted, though, that many teachers reported needing additional professional development in problem-solving, highlighting that sustained support will be essential if curricular reforms are to translate into consistent changes in classroom assessment.

At the same time, the continued prioritisation of longer summative tests, particularly at post-primary level, suggests that assessment cultures continue to be shaped by summative demands. This tension between policy aspirations for more formative forms of assessment and institutional pressures for traditional evaluation methods (e.g., terminal summative assessments) represents an ongoing challenge for educational reform. As one school principal noted in McGarr, O'Reilly, et al.'s (2024) study: "I feel like the assessment has fallen behind us… I still think that that's the next area of focus for teachers … we need to start looking at how we assess and what we value in assessment" (p. 66).

Digital device integration

Despite notable investments and infrastructure improvements, challenges persist in integrating technology into mathematics and science instruction. Although digital devices were more widely available for science than mathematics lessons at both levels, actual usage varied. At primary level, devices were used slightly more often in mathematics lessons, while at post-primary level, they were used more frequently in science lessons. The main barriers of limited access (particularly at primary level) and difficulty keeping students on task (particularly at post-primary level), combined with the widespread demand for professional development on the integration of technology into mathematics and science instruction, suggest that infrastructure alone may not be sufficient. In fact, systematic reviews on the relationship between technology use and student achievement, as well as on digital distractions in education, highlight that greater availability of technology does not automatically translate into improved academic or non-academic outcomes for students. The impact of digital devices depends heavily on how they are used; studies point to risks of distraction and wellbeing concerns alongside potential benefits when integration is purposeful (e.g., Martin et al., 2025; Valverde-Berrocoso et al., 2022).

As the digital transformation of education continues to evolve, accelerated by pandemic-related necessities, there is an increasing need for sustained attention to pedagogical innovation. This includes not only the integration of existing technologies but also the growing role of artificial intelligence (AI) in education. Teachers will need focused professional development to effectively and ethically incorporate AI tools into teaching, learning, and assessment. Future professional development efforts could emphasise pedagogical applications of technology, including AI, rather than just focusing on technical skills alone. Notably, the redevelopment of the *Primary School Curriculum* in Ireland reflects this prioritisation, placing a stronger emphasis on STEM education and explicitly recognising *Technology* as a core component. This renewed focus aims to integrate digital literacy and computational thinking alongside science and mathematics, ensuring that students are equipped with the skills needed to engage fully in a digitally rich learning environment.

The relatively low usage of digital devices for assessment purposes, with few students ever using them for testing, may indicate missed opportunities for leveraging technology to support assessment. The common activities reported – reading textbooks, watching videos, and practising procedures – suggest that technology is often used to replicate traditional activities rather than to enable new forms of learning and assessment, a pattern also identified by Feerick et al. (2022) as part of the longitudinal evaluation of the *Digital Learning Framework* and Clerkin (2013) as part of the PIRLS and TIMSS 2011 findings. Realising the full potential of digital devices will require a shift from substitution towards more transformative, student-centred practices that align with contemporary goals for mathematics and science education.

In this context, the Department of Education and Youth's publication of *Circular 0044/2025* in June 2025, which mandates primary schools to ban the use of personal mobile phones during school hours, underscores the ongoing efforts to manage appropriate technology use in educational settings. The policy allows specific exemptions for medical, wellbeing, or practical purposes, as well as for students with special educational needs (Department of Education and Youth, 2025). This policy reflects growing concerns about the role of mobile phones in schools, recognising both their potential to distract and the need for clear guidelines on their

appropriate use. Additionally, it highlights the evolving nature of digital policies, as schools continue to navigate the complexities of integrating technology in ways that balance both the benefits and challenges it presents.

Conclusion

Over the past decade and continuing into the present, Ireland's mathematics and science education has been shaped by a robust and evolving policy framework aimed at strengthening students' mathematical and scientific proficiency, enhancing teacher capacity, and integrating new literacies, particularly digital literacy, into the learning environment.

Trends in school and classroom environments between 2011 and 2023 presented in this report reflect a period of sustained policy intervention, educational change, and significant external disruption. While notable progress is evident across many areas, several emerging challenges require attention. The decline in teacher satisfaction and professional development participation, coupled with increasing reports of students not being ready for instruction, signals potential systemic stress that could undermine educational quality if left unaddressed. The persistent disparities between DEIS and non-DEIS schools, as well as differences by school gender composition, highlight ongoing equity concerns that require targeted intervention. Particularly concerning is the declining foundational readiness of First Class pupils, which has implications for long-term educational trajectories and achievement gaps.

Three priority areas emerge from this report. First, teachers need strong, ongoing support, including meaningful and feasible professional development opportunities and wellbeing measures, particularly in schools facing greater challenges, given the significant period of curriculum redevelopment currently underway in Ireland. Second, efforts to promote equity should focus on reducing gaps in resources and ensuring high academic expectations for all students, regardless of individual and school characteristics. Third, learning recovery efforts should prioritise foundational skill development, while maintaining student engagement through creative and effective teaching practices. As Ireland continues its curriculum renewal efforts and refines strategies for teaching and learning in mathematics and science, sustained attention to these priority areas will be essential. Future policy initiatives should recognise the interconnected nature of school-level factors and classroom practices, ensuring that structural improvements translate into enhanced learning experiences for all students. In keeping with the *Primary Mathematics Curriculum's* rationale, recognising mathematics as worthwhile, a human and social phenomenon, and important to study in its own right, policy and practice should foster curiosity, creativity, and reasoning alongside proficiency. Only through such comprehensive and contextually responsive approaches can Ireland ensure that all students have access to a high-quality education that prepares them for future academic and career success in an increasingly complex world.

Although the comprehensive data presented in this report provide a strong foundation for this work and for evidence-informed policy development, further research exploring the relationships between selected school- and classroom-level characteristics and mathematics and science achievement would be valuable, ideally through multivariate analyses that account for the interplay of multiple factors. In addition, qualitative studies investigating what happens within classrooms, for example, the nature of instructional practices and the challenges faced by teachers, would yield additional insights into the mechanisms underlying the patterns presented in this report.

TIMSS 2023 national reporting

This report is the fourth in a series of national reports describing findings for Ireland from TIMSS. Previous reports have focused on the mathematics and science achievement of students in Ireland (McHugh et al., 2024), students' environmental knowledge and attitudes (Clerkin et al., 2025), and students' school experiences and attitudes towards mathematics and science (Denner, Clerkin, et al., 2025). A forthcoming report (Piccio et al., in press) will describe in detail the home environments of Fourth Class and Second Year students and will be made available on erc.ie in late 2025.

Simultaneously, work is underway for the next cycle of TIMSS, the main data collection of which is scheduled in 2027. The findings of the current set of reports can be compared against the data that arise from the 2027 cycle to monitor how schools and classrooms evolve over the coming years.

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