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Embracing teachers' role in promoting equity in the classroom: Global patterns and evidence of academic resilience from 58 countries

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ABSTRACT

Children living in poverty often just have one chance in life to reach their full potential; that is, through a good school that provides them with the opportunity to succeed. This study examines the academic resilience of disadvantaged students from low-income families who succeed in mathematics and science classrooms despite the odds against them.

The study draws on multilevel data from students and teachers across 58 education systems, including in America, Europe, Africa, Asia, and the Middle East, to achieve the following objectives (1) to examine the share of academically resilient students in mathematics and science across and within the 58 education systems, and (2) to identify the characteristics of teacher quality and teaching quality that distinguish resilient and non-resilient students. This study analysed assessment and survey data from the Trends in Mathematics and Science Study (TIMSS) 2015 in Grade 4.

The findings indicate that the share of resilient students varies across education systems and subjects, as well as when different performance thresholds are used. The characteristics of teacher and teaching quality also differ across education systems. However, the study found that some characteristics of teacher quality, especially teacher specialization in mathematics or science and hours of professional development, did not differ between resilient and non-resilient students. In contrast, the characteristics of teaching quality, including disorderly behaviour, cognitive activation, teacher support and instructional clarity, showed significant differences between resilient and non-resilient students.

These findings have direct implications for educational policy and practice aimed at enhancing equity and quality in education. They highlights the crucial role that teacher and teaching quality play in mitigating educational inequality. By creating a supportive learning environment, teachers can help disadvantaged students overcome the challenges they face and succeed in mathematics and science classrooms. Reducing achievement gaps between students from high- and low-income families benefits not only individuals but also advances equity, sustainability, and social justice in the larger society. Given the right support, any country can provide all children with a fair chance to succeed in life, regardless of their background.

TABLE OF CONTENT

1.Introduction

The true measure of any society can be found in how it treats its most vulnerable members.

— Mahatma Gandhi

Inequality in education has increased globally, especially during the COVID-19 pandemic (European Commission, 2020; United Nations, 2020). Students from low-income families are at exceptional risk of underachieving and dropping out (Kim et al., 2019; Sirin, 2005). Three out of four socioeconomically disadvantaged students across OECD countries lacked mathematics and science proficiency (OECD, 2016). Nonetheless, despite having limited educational resources and disadvantaged home backgrounds, some students manage to succeed against the odds. These students are considered to be academically resilient. They excel academically, despite experiencing adversity that puts them at heightened risk of school failure (Martin & Marsh, 2006; Masten, 2015). Resilient students show what is possible, and their academic success provides insights into supporting other vulnerable students. Studies revealed that resilient students believe they can achieve at high levels and have the determination to do what it takes to reach their goals (Martin & Marsh, 2006; Masten, 2015). However, it is yet unclear what makes some disadvantaged students perform better than their background predicts. This knowledge is crucial for informing educational policy and practice to support all students in realizing their full potential, thus contributing to equity and social justice initiatives. Closing the educational gap will benefit not only disadvantaged students but also the larger society by increasing economic growth and ensuring sustainable development (Akmal & Pritchett, 2021; Lynch & Oakford, 2014).

Teacher matters in mitigating inequality in education. Studies make a distinction between what teachers *bring* into the classroom (e.g., education level) and what teachers *do* or their actions in the classroom, such as instructional practices (Senden et al., 2022). This differentiation is reflected in the concepts of teacher quality and teaching quality. Even though researchers have linked teacher and teaching quality to student outcomes (e.g., Goe, 2007; Kyriakides et al., 2013; Qin & Bowen, 2019; Wang et al., 2020), few studies have examined the extent to which these aspects are related to students' capacity to be resilient, especially in mathematics and science learning. Research on **academic resilience in mathematics and science (ARISE)** is currently fragmented. No coherent understanding of teacher and teaching quality factors contributing to ARISE exists, especially in primary education. Primary school is a critical period for children to develop resilience and interest in mathematics and science (Charlesworth, 2015). Few attempts have also been made to

understand how ARISE may manifest differently across different contexts of education systems (hereafter referred to as “countries”) around the world. Policymakers and other stakeholders have an urgent need to understand how teacher and teaching quality factors may support academic resilience in their countries and what policies are appropriate for addressing these factors in their unique national contexts.

To address these knowledge gaps in education worldwide, this current study draws upon unique data from the Trends in International Mathematics and Science Study (TIMSS), an international large-scale assessment with representative student samples that compares student performance in mathematics and science across participating countries. This study utilizes multilevel data from students and teachers across 58 countries, including in America, Europe, Africa, Asia, and the Middle East to address the following research questions (RQs):

1. How prevalent are academically resilient students in mathematics and science across and within the 58 countries?
2. What are the characteristics of teacher quality that differentiate resilient and non-resilient disadvantaged students?
3. What are the characteristics of teaching quality that differentiate resilient and non-resilient disadvantaged students?

This study makes significant contributions to the field of education in three ways. Firstly, it examines academic resilience using **subject-specific** teacher and student data situated in mathematics and science in primary school rather than broadly applicable to all subjects and educational stages. Secondly, it focuses on the role of **teacher and teaching quality**, which has been shown to have a significant impact on student learning. Thirdly, it investigates ARISE **cross-nationally** in 58 countries representing a diverse range of geographical, cultural, and economic contexts.

Rather than taking a one-size-fits-all approach, this study recognizes the importance of considering the national context of each education system in identifying classroom factors that support and undermine academic resilience. The findings from this study have important implications for educational policy and practice, offering insights into how to close achievement gaps among disadvantaged students and enhance equity and quality in education.

2. Review of relevant literature

2.1. Academic resilience in mathematics and science

Academic resilience is crucial, particularly in the subjects of mathematics and science, where many students lack confidence in their abilities and experience anxiety (OECD, 2016). These challenges can prevent them from succeeding and pursuing mathematics and science courses beyond compulsory schooling (Henschel, 2021; Wang & Degol, 2013). Unfortunately, less than one in four students across OECD countries reported that they anticipate a career in STEM fields, with even lower for students from disadvantaged backgrounds (OECD, 2016). Many students experience various challenges in the process of learning mathematics and science that may lead to anxiety and unpleasant pressures (Ashcraft, 2002; Henschel, 2021). These challenges may even be greater for disadvantaged students who have limited access to educational resources.

Academically resilient students are those who are willing to struggle through mistakes and able to overcome negative emotions and challenging situations to achieve better learning outcomes despite their unfavourable circumstances (Cefai, 2021; Fullerton et al., 2021; Masten, 2015). Understanding what makes disadvantaged students rise to the challenge and succeed is beneficial in guiding intervention efforts to reduce the performance gap among different groups of students.

Resilience, as a broad concept, has been studied in various disciplines, including psychology, sociology, medicine, and engineering. In general, resilience refers to the capacity to bounce back or recover from adverse circumstances (Luthar, 2006; Masten, 2015). In education, academic resilience is concerned primarily with the increased likelihood of success in school despite experiencing adversity (Rudd et al., 2021; Wang et al., 1994; Ye et al., 2021). It refers to students' capacity to accomplish successful educational outcomes despite conditions that put them at risk of failure (Martin & Marsh, 2006; Rudd et al., 2021). They have the capacity to deal with adversity and succeed, while others who experience similar conditions demonstrate poor academic outcomes and fail.

Resilience is a dynamic and context-specific phenomenon that involves two core concepts: **adversity** and **positive adaptation** (Luthar et al., 2000; Ungar, 2021). *Adversity* refers to the individual or social factors associated with a high risk for poor academic outcomes, such as poverty, while *adaptation* represents student success in meeting academic challenges in the face of adversity (Rudd et al., 2021; Tudor & Spray, 2017). The likelihood that adversity will lead to positive adaptation or negative outcomes depends on individuals' *vulnerability* in overcoming their adverse circumstances (Luthar, 2006; Masten, 2015). *Risk and*

protective factors include individual characteristics like motivation and aspiration as well as environmental characteristics (e.g., home, classroom, and school) that influence vulnerability.

This study focuses specifically on teacher and teaching quality factors, as risk and protective factors that play a crucial role in moderating students' capacity to overcome adversity. Tailored to the ARISE framework, this project investigates students' unique capacity to beat the odds and overcome disadvantaged backgrounds by leveraging assets and resources within and around themselves. Figure 1 illustrates the key elements that characterise ARISE and how they relate to each other.

Figure 1. Key elements of ARISE and their relationships in this study (adapted from OECD, 2018).

The quality of teacher and teaching can significantly impact the academic success of disadvantaged students (e.g., Agasisti et al., 2018, 2021). When teachers lack knowledge or expertise in the subject matter, they may struggle to effectively communicate the material, resulting in student misconceptions and poor academic performance (Abell, 2013; Charalambous, 2015). Disadvantaged students are often less likely to have access to competent teachers and are disproportionately affected by this risk factor (Goldhaber et al., 2015; Qin & Bowen, 2019). Poor teacher and teaching quality can be particularly detrimental for disadvantaged students who may already face other barriers to learning, such as limited access to resources, family instability, language barriers, and lack of positive role models (Charalambous, 2015). Since these students may have limited access to high-quality instruction outside of school, their in-school instruction is crucial to their academic success. If their teachers are not competent at engaging students and fostering a supportive learning environment, disadvantaged students may be more likely to disengage from the subject, leading to lower academic achievement and lack of interest in pursuing STEM-related careers. Teachers who do not provide adequate support or resources for these students may exacerbate these challenges and create additional barriers to academic success (Goldhaber et al., 2022). For example, students who lack access to technology or a quiet study space at home may struggle to keep up with homework assignments or participate in virtual learning activities.

Furthermore, poor teaching quality can also result in missed opportunities for disadvantaged students (Goldhaber et al., 2015). Teachers who are not skilled at recognising and nurturing talent in mathematics and science may overlook students who have the potential to excel in these fields (Banerjee, 2016). This can result in missed opportunities for these students and may perpetuate disparities in academic achievement and career opportunities (Goldhaber et al., 2022). However, teachers who are aware of these barriers and actively work to address them can create a more inclusive and equitable learning environment that promotes academic resilience and success for all students (Konstantopoulos & Chung, 2011; Mincu, 2015).

2.2. Teacher quality

Teacher quality is a broad concept and conceptualised somewhat differently across studies. Researchers have also used the concepts of teacher quality and teaching quality interchangeably. This study separates the two concepts and refers to teacher quality as the skills, beliefs, and abilities the teachers bring into the classroom, whereas teaching quality or instructional quality, refers to the teachers' behaviour in the classroom and the quality of their instruction.

Blömeke, Olsen, and Suhl (2016) suggested that teacher quality includes teacher qualifications (e.g., educational background, experience in teaching, participation in professional development) and personal characteristics, such as teachers' self-efficacy or beliefs. Klingebiel and Klieme (2016) proposed a conceptual framework of teacher quality that consists of: (a) teacher qualifications, including education and professional development, and (b) teacher competence involving teacher professional knowledge, beliefs, and non-cognitive or motivational factors. Despite using different terms to indicate some aspects of teacher quality, both studies share a similar conceptual framework of teacher quality, which comprises teacher qualifications and competence or characteristics.

The study focuses specifically on *teacher qualifications* rather than teacher competence and personal characteristics for the following reasons. First, previous research has shown that teacher qualifications are related to educational equity (Darling-Hammond, 2015; Nilsen et al., 2020). For example, high-income schools may have more qualified teachers than low-income schools have. Second, teacher qualifications—such as their educational level, major area of study, and professional development—are important malleable factors that can be influenced through educational policy (e.g., through teacher education and training). Even though educational policy may influence teacher characteristics, such as increased self-efficacy through teacher education, this mechanism is difficult to establish or measure. Due to the above-mentioned reasons, this study concentrates on the

qualification aspect of teacher quality, more specifically on their educational level, major or area of study (specialisation), and participation in professional development (Figure 2).

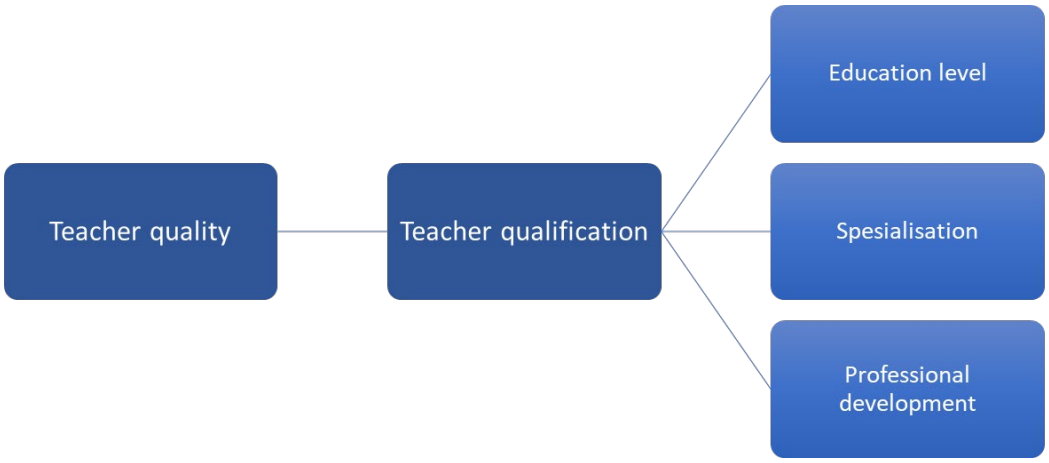

Figure 2. Different aspects of teacher quality examined in the present study.

Teacher education level and specialisation. Research indicates that the quality of teacher education is associated with teachers' educational outcomes, including their knowledge and skills (Blömeke et al., 2016). These outcomes, in turn, have a significant impact on the quality of instruction and student achievement (Abell, 2013; Klingebiel & Klieme, 2016). Teacher educational level and major area of study or specialisation may provide a rough estimate of the quality of teachers' education and their opportunities to learn (Blömeke et al., 2016). For instance, teachers with a bachelor's degree in science had the opportunity to acquire relevant scientific knowledge during their education and thus, they are more likely to present the content in a meaningful way compared to teachers without science degree. While subject matter knowledge is important, it is not enough for effective teaching (Abell, 2013; Shulman, 1986). Teachers also need pedagogical content knowledge to design instruction and assessment that meet the needs of all students, including those with diverse learning styles and backgrounds (Shulman, 1986). They are also able to break down complex concepts into smaller parts, diagnose and address student misconceptions, and provide feedback that helps students to improve their understanding of the subject. Additionally, teachers with strong pedagogical content knowledge are better able to create engaging and challenging learning environments that promote student resilience (Abell, 2013; Even & Tirosh, 2002). These teachers are able to help students develop a deep understanding of the subject matter and to develop the skills needed to apply their knowledge in real-world situations. This can help to build students' confidence, persistence, and sense of mastery, which are important components in developing student resilience. Hence, the present study examines the characteristics of teachers' education level and whether their education focuses on subject-specific area (i.e., mathematics, science,

mathematics and/or science education) between resilient and non-resilient students in 58 countries.

Professional development. In addition to teachers' formal education, their participation in professional development plays a vital role in enhancing teacher knowledge and skills, which in turn can contribute to promoting academic resilience among disadvantaged students. Several research syntheses have indicated that teacher professional development could have a considerable impact on student achievement (Kraft et al., 2018; Timperley et al., 2007). However, for such training to be effective in improving student learning outcomes, it is crucial that it is of adequate *length* and *quality* (Nilsen et al., 2020). Effective professional development also focuses on specific content, incorporates active learning, supports collaboration, uses models of effective instruction, and offers feedback and reflection for the teachers, such as through coaching and expert support (Darling-Hammond et al., 2017).

Providing effective professional development opportunities for teachers can help narrow the achievement gap between diverse groups of students (Darling-Hammond, 2015; Nilsen et al., 2020). Mathematics and science teachers who receive sustained and quality professional development are better equipped to implement evidence-based instructional practices that can support the learning needs of all students, including those who are struggling (Loucks-Horsley et al., 2009; Wilson, 2011). Evidence-based instructional practices, like inquiry-based learning and project-based learning, can help students to develop a deeper understanding of the content, encourage critical thinking and problem-solving skills, and promote student engagement (Teig et al., 2018; Teig et al., 2022). Through professional development, teachers can learn how to implement evidence-based instructional practices in their classrooms effectively and to differentiate the instruction for students with varying levels of understanding. By learning how to support and encourage students to persevere through challenging tasks, mathematics and science teachers can help students to develop a more positive attitude towards these subjects (Teig & Nilsen, 2022). This can lead to enhancing student learning and greater confidence in their academic abilities, which is a critical component of academic resilience. Therefore, the present study also examines the characteristics of teachers' participation in professional development between resilient and non-resilient students in 58 countries.

2.3. Teaching quality

Similar to teacher quality, teaching quality is a broad concept operationalised differently across countries and studies (e.g., Blömeke et al., 2016; Senden et al., 2022). Despite these differences, researchers around the world have extensively used three basic dimensions of instructional quality from Klieme et al. (2009). According to this framework, instructional quality includes three main aspects: classroom management, cognitive activation, and teacher support. However, a fourth dimension—namely, clarity of instruction—has also received increasing attention and approval in the field (Bergem et al., 2016).

Classroom management. This is the most generic aspect of instructional quality that is often considered to be independent of the subject domain (Klieme et al., 2009). All subjects would require effective classroom management, including clear rules and procedures about the time spent on tasks and disciplinary situations. Teachers can set clear expectations for student behaviour by establishing classroom rules and procedures and communicating these expectations to students. This approach helps to promote a positive learning environment where students understand what is expected of them and are held accountable for their actions (Klieme et al., 2009; Marder et al., 2023). Good classroom management helps to reduce disorderly behaviour during lesson and create a conducive environment for learning (Marder et al., 2023). As a generic aspect of teaching quality, classroom management is present in any lesson and could be similar across classrooms.

Cognitive activation. In contrast with classroom management, cognitive activation is the aspect of instructional quality that is most dependent on the subject domain (Klieme et al., 2009; Kuger et al., 2016). In mathematics classrooms, cognitive activation may involve students independently applying what they have learned to new problem situations, relating their mathematical learning to daily life, and expressing their ideas or explaining their answers to challenging exercises (Schlesinger et al., 2018). In science classrooms, cognitive activation typically engages students in scientific inquiry practices, such as formulating research questions, designing and conducting investigations, and analysing and interpreting data (Teig et al., 2019; Teig et al., 2022). In general, cognitive activation comprises instructional activities that challenge students cognitively and engage them with high-level thinking, for example, through evaluating, integrating, and applying knowledge in the context of problem solving (Baumert et al., 2010).

By engaging students in cognitively challenging tasks that require deep thinking and problem-solving, students can learn to identify their own strengths and weaknesses, set goals for their own learning, and monitor their progress towards these goals (Baumert et al., 2010; Minner et al., 2010). This can help students to develop self-regulation skills they

need to manage their own learning and to persist in the face of difficulties (Charlesworth, 2015). Students may experience the satisfaction of mastering difficult material and develop a sense of pride and accomplishment in their own abilities, which are crucial for building their confidence and resilience.

Teacher support. This aspect of teaching quality refers to "teacher sensitivity for individual needs" (Praetorius et al., 2018, p. 408). It includes socio-emotional support, such as listening to students and paying attention to every student's needs, and professional support in the subject domain, including helping students struggling with their conceptual misunderstandings, varying the instruction, and letting students know what is expected of them (Fauth et al., 2014; Neumann et al., 2012; Praetorius et al., 2018). In mathematics and science education, the latter subject-specific component of teacher support is often referred to as *structuredness*, which represents a systematic approach in the design of instruction (Brophy & Good, 1986; Neumann et al., 2012). Furthermore, supporting student learning also entails engaging teaching practice, such as providing tasks that interest students (Neumann et al., 2012). As such, the three aspects of teacher support (i.e., socio-emotional support, subject-specific support, and engaging teaching) are critical components of teacher support (Teig & Nilsen, 2022).

Teachers who promote a sense of belonging and supportive climate in their classrooms can help to foster a positive learning environment where all students feel valued and supported (Nilsen & Teig, 2022; Wang et al., 2020). Supportive teachers take the time to get to know their students, understand their strengths and weaknesses, and provide personalized feedback and guidance that can help students to improve their learning and academic performance (Teig & Nilsen, 2022; Wang et al., 2020). This can be especially important for students from diverse backgrounds who struggle academically and feel marginalized or excluded in traditional classroom settings.

Clarity of instruction. This aspect refers to clear and understandable teaching and clear learning goals (Praetorius et al., 2018). It is crucial that teachers are good at explaining concepts, as conceptual understanding is one of the main aspects of mathematics and science competence (Duit, 2009; Duit et al., 2008). Clarity of instruction also refers to teacher clarity in providing straightforward questions and answering their students (Neumann et al., 2012).

When teachers are clear in their instructions, they provide students with a clear understanding of what is expected of them, how they will be assessed, and what they need to do to achieve their academic goals (Brophy & Good, 1986; Duit et al., 2008). This can be very beneficial for disadvantaged students who have limited educational resources and

support, as it can provide them with a sense of structure and predictability that can help to reduce stress and anxiety (Ashcraft, 2002; Henschel, 2021). When students have a clear roadmap for success, they are more likely to engage in the subjects, to ask questions and seek clarification when needed. This can help to promote a deeper understanding of the content and to improve students' ability to apply what they have learned to real-world situations.

A great number of studies have highlighted the importance of teaching quality for enhancing student cognitive and non-cognitive outcomes (Fauth et al., 2014; Kyriakides et al., 2013; Senden et al., 2022). Effective teaching can also promote equity by reducing the achievement gap between students from high and low socioeconomic backgrounds (Atlay et al., 2019; Rjosk et al., 2014). While high-SES students may receive more support from their parents, competent teachers can compensate for the lack of such support among low-SES students (Rjosk et al., 2014). Hence, the present study examines the characteristics of teaching quality that differentiate resilient and non-resilient disadvantaged students (Figure 2).

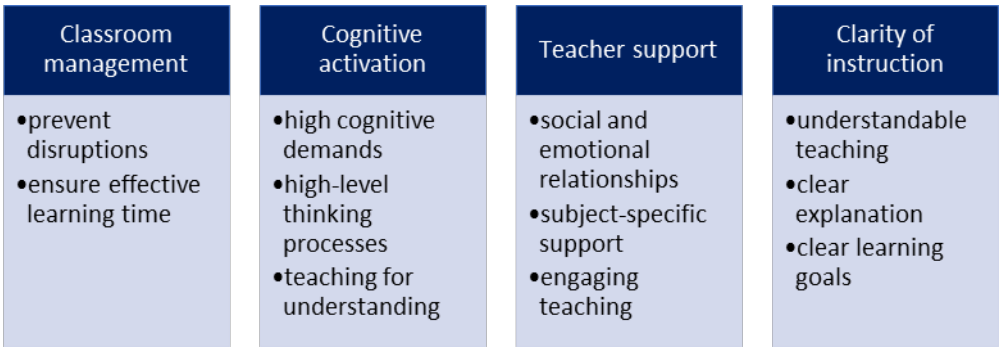

Figure 2. Different aspects of teaching quality examined in the present study.

3.Methodology

3.1. Data and sample

This study uses large-scale data from TIMSS, the only study with representative samples at the national level that collects data from students and teachers in mathematics and science from Grades 4 and 8. Furthermore, TIMSS is the only large-scale assessment that samples entire classrooms within schools, enabling investigations of factors explaining variance between classrooms. These classrooms are sampled instead of individual students across certain age groups or grade levels since TIMSS focuses on students' curricular and instructional experiences, which typically occur in classrooms. Additionally, TIMSS collects data from teachers, school leaders, students, and parents, focusing on contextual variables related to student learning, such students' early literacy and numeracy activities, home resources for learning, as school discipline and safety, school emphasis on academic success, curriculum and instruction, technology and instruction, and teacher education and professional development. Further details on the assessment design can be found on the TIMSS 2019 Technical Report (Martin et al., 2020).

This present study examines the data from student and teacher background questionnaires in addition to student achievement in mathematics and science by focusing on Grade 4. Specifically, it examines TIMSS 2019 data from 58 countries, in which a total of 303 518 fourth grade students participated in the study. Student gender is generally balanced in the TIMSS sample. In 2019, the proportion of boys was 50.7%, and the proportion of girls was 49.3%. About 12.9% of students born in the country of assessment. The proportion of students who never and sometimes speak the language of TIMSS test at home was 5.8% and 23.1%, respectively. See Appendix A1 for the list of the 58 countries participated in TIMSS 2019 and description of the students who participated in the study within each country, including the proportion across gender, country of birth, and student confidence in mathematics and science. Detailed information on the data, assessment frameworks, methods, and procedures of TIMSS 2019 are available at https://timssandpirls.bc.edu/timss2019/.

3.2. Measures

This section describes five important measures in this study: (1) mathematics and science achievement, (2) socio-economic status, (3) academic resilience, (4) teacher quality, and (5) teaching quality.

Mathematics and science achievement in TIMSS. Students answered a standardised test that covered a wide range of domain-specific knowledge and difficulty levels (Mullis &

Martin, 2017). The test was based on a comprehensive assessment framework developed collaboratively with the TIMSS participating countries to reflect their curricular goals.

Student achievement was assessed with a standardized test that covers cognitive domains in mathematics and science (i.e., knowing, applying, and reasoning). The fourth-grade mathematics assessment included three content areas—number, including prealgebra (50%); measurement and geometry (30%); and data (20%). The fourth-grade science assessment included three content areas—life science (45%), physical science (35%), and Earth science (20%). In accordance with the assessment framework, the majority of TIMSS 2019 mathematics and science items assessed fourth grade students' applying and reasoning skills. TIMSS 2019 content areas were highly overlapped with the curricula in the participating countries (see also the test-curriculum matching analysis for further details; Mullis & Martin, 2017).

During the test, each student completes one student achievement booklet or block combination consisting of two parts, followed by a student questionnaire. The testing time was 72 minutes for the mathematics and science assessment and 30 minutes for the questionnaire at the fourth grade.

To interpret the results from the assessment, TIMSS describe achievement at four points International Benchmarks[1]: Low International Benchmark (400), Intermediate International Benchmark (475), High International Benchmark (550), and Advanced International Benchmark (625). This study uses the Intermediate International Benchmark (475) as the achievement cut off point or threshold to identify academically resilient students (see Measure of academic resilience for further details).

Students who reached at least 475 points in mathematics indicate that they can apply basic mathematical knowledge in simple situations. This includes that students can (1) compute with three- and four-digit whole numbers in a variety of situations, (2) understand decimals and fractions, (3) identify and draw shapes with simple properties, and (4) read, label, and interpret information in graphs and tables. In science, students who are at the Intermediate International Benchmark indicate that they are able to show knowledge and understanding of some aspects of science. It indicates that students can (1) demonstrate some basic knowledge of plants and animals, (2) demonstrate knowledge about some properties of matter and some facts related to electricity, (3) can apply elementary

[1] The full description of student achievement at the International Benchmarks can be found at https://timss2019.org/reports/achievement/

knowledge of forces and motion, and (4) show some understanding of Earth's physical characteristics. Appendix 1 shows the average achievement in mathematics and science from each country and the percentage of students who reached the Intermediate International Benchmark.

Socioeconomic status (SES). TIMSS 2019 had a Home Resources for Learning (HRL) scale that measure students' home resources related to education. The HRL scale was based on student questionnaire about the number of books at home and the number of home study supports student owns (e.g., internet connection and own room) as well as parent questionnaire on the highest level of a parent's education and the number of children's books in the home. The HRL scale had a high missing rate (24.8%), particularly on the parent questionnaire. Therefore, it was not used to represent SES as it is commonly done in previous studies. Instead, to have a meaningful comparison on student SES, this study adopted six items about home educational resources rated by students, with missing values ranged from 2.6% and 3.8% (Table 1). The number of books at home was a five-point Likert scaled item and treated as continuous variable. The other five items were binary-coded, Yes as 1 and No as 0. The alignment method was used to calculate SES scores and is discussed in the next section.

Table 1. The percentages of student home educational resources across the 58 countries.

Questions about home educational resources	**Percentage of students**				
	0–10 books	**11–25 books**	**26–100 books**	**101–200 books**	**More than 200 books**
About how many books are there in your home? (Do not count magazines, newspapers, or your school books)	21	26	27	12	10
Do you have any of these things at your home?	**Yes**	**No**			
1) A computer or tablet	83.8	13.5			
2) Study desk/table for your use	75.5	21.6			
3) Own room	61.9	35.3			
4) Internet connection	80.9	15.9			
5) Own mobile phone	59.9	37.1			

Academic resilience. Academic resilience is defined as an increased likelihood of adjustment or success despite experiencing adversity (Wang et al., 1994). As shown on Figure 1, adversity and adjustment are two main factors in defining academic resilience. This study uses student achievement in mathematics or science as an indicator of adaptation or success and student home resources or SES as an indicator of adversity.

Figure 3 summarises analytical approach to measure academic resilience. First, a full sample of fourth-grade students participated in TIMSS 2019 across the 58 participating countries is examined. Second, disadvantaged students were identified using the SES or home resources measure. Specifically, students who were placed at the bottom of 1/3 of

the SES distribution in their countries were selected and comprise the sample of this study. The next step focuses on identifying resilient and non-resilient students based on the sample of disadvantaged students. Different performance thresholds were used to identify resilient students (high performance) and non-resilient students (low performance).

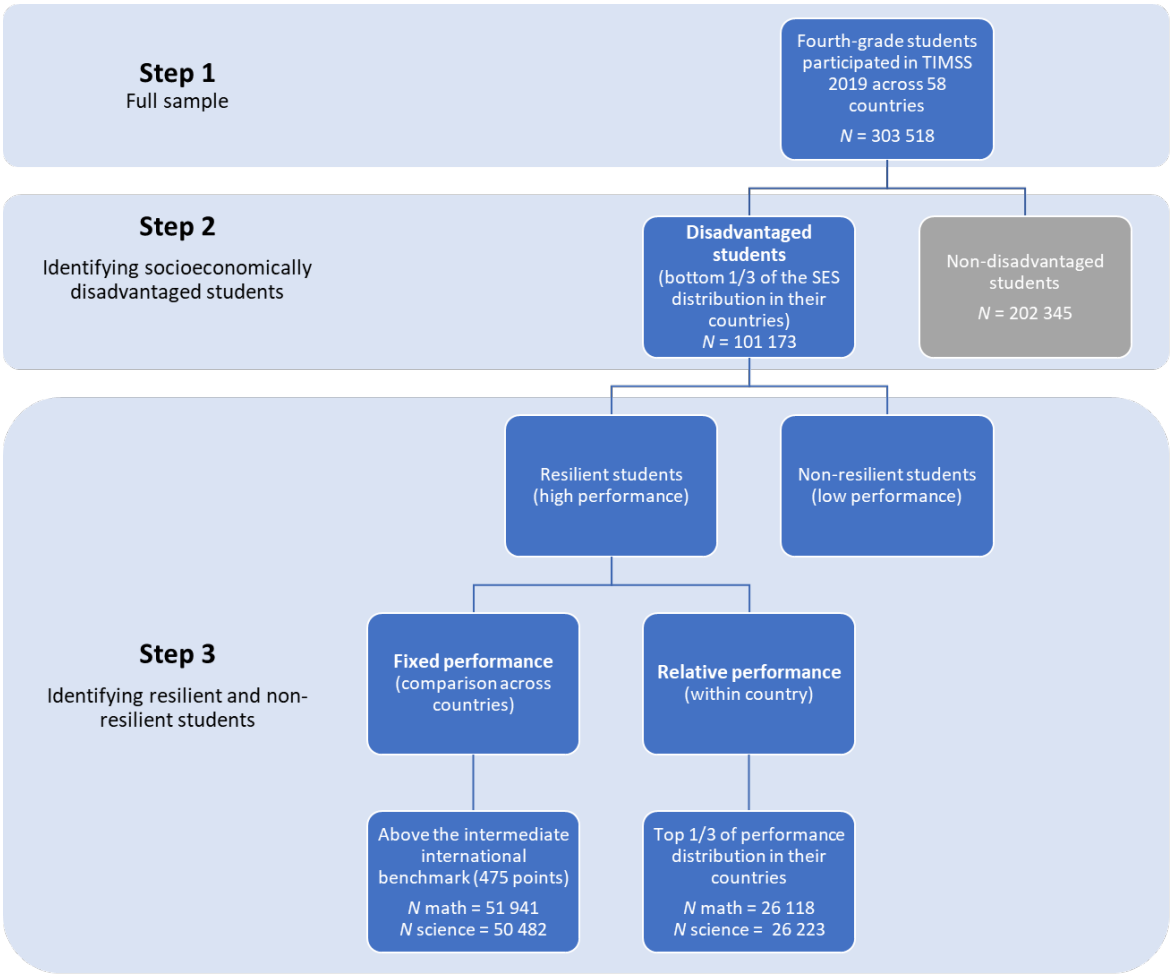

Figure 3. A graphical representation to summarize the conceptualization of academic resilience using fixed and relative performance thresholds.

To define high performance, fixed and relative performance thresholds are applied. In a *fixed performance threshold*, students are academically resilient if they are among the bottom 1/3 of the SES distribution in their countries but demonstrate mathematics or science performance above the TIMSS Intermediate International Benchmark (i.e., above 475 points). This fixed threshold stresses an international perspective in which a direct cross-country comparison is the focus of the study.

In a *relative performance threshold*, students are academically resilient if they are among the bottom 1/3 of the SES distribution but achieve the top 1/3 of the performance distribution in their countries. Since resilience is a dynamic process that varies across

contexts (Luthar et al., 2000), the relative within-country SES and performance thresholds are best suited for operationalising academic resilience within countries.

Teacher quality. Teacher qualifications were used to measure teacher quality through the following categorical variables: (1) *educational level* from ISCED level 3 to 8; (2) *main area of study or specialisation* in mathematics or science education; (3) *participation in professional development* as determined by the number of hours teachers spent in formal professional development in the last two years (Table 2).

Table 2. The percentage of students who were taught by teachers with different aspects of teacher qualification.

Questions about teacher quality	Percentage
1. ***Educational level**: What is the highest level of formal education you have completed?*	
Did not complete <Upper secondary education—ISCED Level 3>	0.6
Upper secondary education—ISCED Level 3	3.8
Post-secondary, non-tertiary education—ISCED Level 4	3.0
Short-cycle tertiary education—ISCED Level 5	6.3
Bachelor's or equivalent level—ISCED Level 6	58.7
Master's or equivalent level—ISCED Level 7	27.0
Doctor or equivalent level—ISCED Level 8	0.6
2. ***Major or main area of study in mathematics**: During your education, what was your major or main area(s) of study?*	
Major in Education and Mathematics	28.3
Major in Education but not Mathematics	40.1
Major in Mathematics but not Education	11.4
All Other Majors	15.4
No Formal Education Beyond Upper Secondary	4.8
3. ***Major or main area of study in science**: During your education, what was your major or main area(s) of study?*	
Major in Education and Science	26.1
Major in Education but not Science	41.8
Major in Mathematics but not Education	14.2
All Other Majors	13.1
No Formal Education Beyond Upper Secondary	4.7
4. ***Professional development in mathematics**: In the past two years, how many hours in total have you spent in formal (e.g., workshops, seminars, etc.) for mathematics?*	
None	21.7
Less than 6 hours	21.1
6–15 hours	25.4
16–35 hours	15.4
More than 35 hours	16.4
5. ***Professional development in science**: In the past two years, how many hours in total have you spent in formal (e.g., workshops, seminars, etc.) for mathematics?*	
None	33.8

Less than 6 hours	21.1
6–15 hours	20.5
16–35 hours	12.2
More than 35 hours	12.4

Teaching quality. The measure of teaching quality is based on student and teacher questionnaires. Teaching quality is divided into three aspects: classroom management, cognitive activation, and teacher support and instructional clarity.

Classroom management. This study uses the TIMSS scale of *disorderly behaviour during mathematics lessons*[2], which was created based on students' responses to the question "How often do these things happen in your mathematics lessons?" with a four-point Likert scale: never, some lessons, about half the lessons, and every or almost every lesson. The scale includes six items, including "Students don't listen to what the teacher says", "There is disruptive noise", and "It is too disorderly for 18rofessts to work well". These six items were combined into the scale of disorderly behaviour using item response theory (IRT) scaling methods, specifically the Rasch partial credit model (see Martin et al., 2020 for further details). The scale has a mean score of 9.9 and standard deviation of 2. Students were scored according to their responses to the six items. The scale used specific cut-off values to divide students' scores into three categories representing the frequency of disorderly behaviour: (1) *few or no lessons* category corresponds to the score at or above 11.6, (2) *some lessons* category corresponds to the score between 11.6 and 8, and (3) *most lessons* category corresponds to the score at or below 8.

On average across the 58 countries, 18% of the students reported few or no lessons with disorderly behaviour during mathematics lessons, whereas 68% and 14% of the students reported various disorderly behaviours occurred in some and most lessons, respectively.

Cognitive activation. This study uses cognitive activation specific to mathematics and science lessons (Table 4). Cognitive activation is measured using teachers' ratings of how often they would do certain practices in the classrooms using a four-point Likert scale: never, some lessons, about half the lessons, and every or almost every lesson.

Three items are used to represent cognitive activation in mathematics. Due to the lack of commonality across the items, a scale of cognitive activation in mathematics was not created. Instead, teachers' responses to the three items were used individually in the

[2] The full description of the scale in mathematics can be found at https://timss2019.org/reports/disorderly-behavior-during-mathematics-lessons/

analyses to represent teachers' practices. Teachers' responses on the four-point Likert scale were recoded into two categories to simplify the presentation of the results and align the responses with cognitive activation in science. Responses that correspond to conducting cognitive activation in mathematics in "some lessons" or "never" were coded into "less than half of the lessons", whereas those that correspond to "about half the lessons" or "every or almost every lesson" were coded into "about half of the lessons or more".

Table 4. The percentage response pattern of cognitive activation in mathematics and science instruction.

Cognitive activation	Less than half of the lessons	About half of the lessons or more
Mathematics		
1) Practice procedures on their own	13	87
2) Apply what they have learned to new problem situations on their own	14.8	85.2
3) Work problems together in the whole class with direct guidance from the teacher	25.4	74.6
Science		
Teacher emphasis on science investigation scale	69	31

For cognitive activation related to science lessons, the TIMSS scale of *teacher emphasis on science investigation*[3] was used. The scale was based on teachers' reports regarding how often they asked students to do eight instructional activities that emphasizes science investigation, including observe natural phenomena and describe what they see, design or plan experiments or investigations, conduct experiments or investigations, interpret data from experiments or investigations, present data from experiments or investigations, use evidence from experiments or investigations to support conclusions, and do field work outside the class.

Teacher support and instructional clarity. The TIMSS *Instructional Clarity in Mathematics Lessons* and *Instructional Clarity in Science Lessons* scales[4] are used as an indicator of teacher support and instructional clarity. The scales were created from student responses to the question *«How much do you agree with these statements about your <subject> lessons?*" with a four-point Likert scale (agree a lot, agree a little, disagree a little, and disagree a lot). Each scale includes seven items, which asked students about aspects of teachers' instruction during their mathematics or science lessons, such as whether

[3] The full description of the scale can be found at https://timss2019.org/reports/teachers-emphasis-on-science-investigation/
[4] The full description of the scale in mathematics can be found at https://timss2019.org/reports/instructional-clarity-in-mathematics-lessons/ and in science at https://timss2019.org/reports/instructional-clarity-in-science-lessons/

students know what their teacher expects them to do, whether their teacher is easy to understand, has clear answers to their questions, is good at explaining mathematics or science, does a variety of things to help the students learn, and explains a topic again when the students do not understand. These responses were combined into the TIMSS Instructional Clarity scales for mathematics and science separately. Both scales were constructed using item IRT scaling methods, specifically the Rasch partial credit model (see Martin et al., 2020 for further details).

Both instructional clarity in mathematics and science scales have a mean score of 9.9 and standard deviation of 2. Students were scored according to their responses to the six items. The scale used specific cut-off values to divide students' scores into three categories representing their agreements about instructional clarity in mathematics and science lessons: (1) *high clarity* category corresponds to the score at or above 8.7 in mathematics and 8.8 in science, (2) *moderate clarity* category corresponds to the score between 8.7 and 6.8 in mathematics and between 8.8 and 6.9 in science, and (3) *low clarity* category corresponds to the score at or below 6.8 in mathematics and 6.9 in science.

On average across the 58 countries, about three-quarters (74%) of fourth grade students reported that their mathematics instruction had "high clarity," 21% reported "moderate clarity," and just 5% characterized their instruction as having "low clarity." The percentages were slightly lower for science lessons with 72% of fourth-grade students reported "high clarity", whereas 22% and 6% reported "moderate clarity" and "low clarity", respectively.

3.3. Data analysis

IEA IDB Analyzer version 3 was used to merge and prepare the datasets, whereas IBM SPSS Statistics version 28 and Mplus version 8.7 (Muthén & Muthén, 1998-2021) was used for the data analyses. These analyses were aimed at identifying the proportion of academically resilient students in mathematics and science using fixed and relative thresholds (RQ1), examining the characteristics of teacher quality—i.e., educational level, specialisation, and the number of p20rofessional development In the last two years—between resilient and non-resilient students (RQ2), and examining the characteristics of teaching quality—i.e., classroom management, instructional clarity, and cognitive activation—between resilient and non-resilient students (RQ3).

To address RQ1, the measure of student SES and achievement were used to estimate the proportion of resilient students in mathematics and science separately (see analytical approach in Figure 4). Since this study uses data from 58 countries, a comparable SES and achievement measures are needed to compare the findings across the countries. To create a comparable SES construct, the alignment method is applied to estimate the means and

intercepts of many groups/countries by allowing some flexibility in measurement invariance (Asparouhov & Muthén, 2014). The alignment method is a better option compared to confirmatory factor analysis (CFA) in handling large datasets with many groups as it is more flexible and less restrictive than CFA (Asparouhov & Muthén, 2014). First, a configural model of SES consisting of 6 items was estimated using CFA. Loadings and intercepts were estimated freely, whereas factor means were fixed to zero and factor variances were fixed to one. Next, the alignment approach was applied by taking the configural model as its point of departure to estimates the most optimal pattern of measurement invariance across the 58 countries using a free alignment approach. The result from the alignment method shows a high degree of invariance (16.9%) and indicates that the SES construct is comparable across these countries.

One of the major goals of TIMSS is to provide valid comparisons across student populations based on broad coverage of the achievement domain. TIMSS also provide comparable mathematics and science achievement data since its first cycle in 1995. A further information on the scaling methodology and linking of achievement data across cycles is described in the TIMSS 2019 Technical Report (Martin et al., 2020).

The share of academically resilient students is estimated using fixed and relative thresholds using student achievement and SES (see 3.2.1 Measures and Figure 4). Mathematics and science achievement were estimated via a measurement model that produced a set of five plausible values for each student to represent the range of student performance. Note that only the first plausible value is presented in this study to identify academically resilient students. Although additional analyses using other plausible values were conducted, the results were comparable and hence were not presented in this report to avoid overlap.

To address RQ2, the characteristics of teacher quality (i.e., educational level, major or main area of study, and hours of professional development) between resilient and non-resilient students in mathematics and science were compared. This comparison was based on pooled data across the 58 countries as well as within each education system. The same analytical approach was conducted to address RQ3 by focusing on the characteristics of teaching quality (i.e., classroom management, instructional clarity, and cognitive activation) between resilient and non-resilient students. Furthermore, several extreme cases from RQ1—that is, some countries with unique pattern of the proportion of resilient students—were selected to provide a more in-depth comparison of resilient and non-resilient students in relation to their teacher and teaching quality characteristics.

4. Findings

4.1. The characteristics of disadvantaged students

A total of 303 518 fourth-grade students participated in TIMSS 2019 across 58 countries. Appendix 2 shows the number of students participated from each country, the country average achievement, and the percentage of students who reached the score of 475 points or above in mathematics and science (the TIMSS Intermediate International benchmark).

From a total of 303 518 fourth-grade students who participated in TIMSS 2019, 101 173 students were considered socioeconomically disadvantaged as they place among the bottom 1/3 of the SES distribution in their countries. Figure 4 summarizes the proportion of gender and immigration backgrounds of these students.

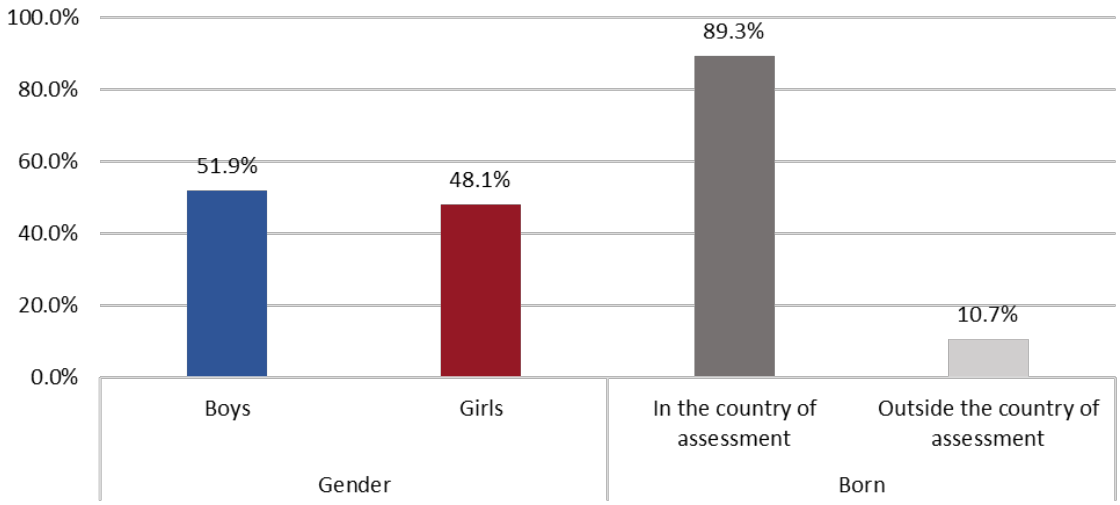

Figure 4. The proportion of gender and immigration backgrounds among disadvantaged students.

In general, the proportion of girls (48.1%) from disadvantaged backgrounds were about the same as boys (51.9%). Pakistan had the lowest proportion of girls from disadvantaged background (39.8%), followed by Saudi Arabia (40.2%) and Republic of Korea (40.1%). South Africa had the lowest proportion boys from disadvantaged background (41.3%), followed by Morocco (44.2%), and Turkey (45.6%).

The proportion of disadvantaged students who born in the country where the TIMSS assessment took placed also varied. Only 10.7% of the fourth-grade disadvantaged students who participated in TIMSS 2019 did not born in the country of assessment. Using students' country of birth to indicate their immigration background, this study shows that the proportion of immigration background was the highest for the United Arab Emirates

(38%), Qatar (30.8%), and Sweden (25.1%) but the lowest proportion was in Japan (0.4%), Croatia (1.4%), and Republic of Korea (1.9%).

4.2. The share of academically resilient students (RQ1)

4.2.1. Across countries, performance thresholds, and subjects

The share of academically resilient students varied across countries, performance thresholds, and subjects (Table 5).

Table 5. The proportion of academically resilient students across 58 countries using fixed and relative performance thresholds.

Country	Number of		Percentage of disadvantaged students who reached the TIMSS Intermediate International Benchmark (score 475): *Fixed threshold*		Percentage of disadvantaged students who reached the top 1/3 performance distribution in their countries: *Relative threshold*	
	students	disadvantaged students	Math	Science	Math	Science
Albania	4426	1471	52.3	52.1	25.6	25.2
Armenia	5399	1794	57.9	37.6	25.6	25.0
Australia	5890	1932	57.8	69.3	25.0	25.3
Austria	4464	1483	76.5	63.0	22.9	21.4
Azerbaijan	5245	1716	69.9	28.1	29.1	29.2
Bahrain	5762	1916	51.3	53.0	31.0	27.7
Belgium (Flemish)	4655	1545	70.9	52.6	24.0	21.8
Bosnia and Herzegovina	5617	1868	33.6	37.2	28.4	27.9
Bulgaria	4268	1420	67.6	65.6	29.2	30.3
Canada	13653	4146	54.4	65.8	23.2	25.4
Chile	4174	1379	24.6	37.2	24.9	24.1
Chinese Taipei	3765	1253	94.0	86.8	27.5	26.5
Croatia	3785	1260	63.1	75.5	28.8	30.3
Cyprus	4062	1349	70.8	61.6	25.4	25.8
Czech Republic	4692	1498	70.1	72.2	24.0	25.4
Denmark	3227	1067	62.3	61.4	23.0	25.1
England	3396	1040	76.6	73.9	23.4	23.6
Finland	4730	1565	68.3	79.3	24.3	25.6
France	4186	1339	42.5	42.5	19.8	20.6
Georgia	3787	1182	46.7	34.1	26.6	26.9
Germany	3437	992	63.4	59.4	21.6	20.4
Hong Kong SAR	2968	982	93.6	70.7	21.0	21.5
Hungary	4571	1497	64.5	67.1	25.1	22.4
Iran	6010	2000	27.1	28.6	22.3	23.0
Ireland	4582	1509	77.6	72.2	26.7	29.7
Italy	3741	1244	67.0	65.7	28.9	28.2
Japan	4196	1396	92.0	86.4	26.8	29.4
Kazakhstan	4791	1590	63.8	48.2	25.2	22.9
Korea	3893	1294	91.8	92.2	24.0	26.0

Country	Number of		Percentage of disadvantaged students who reached the TIMSS Intermediate International Benchmark (score 475): *Fixed threshold*		Percentage of disadvantaged students who reached the top 1/3 performance distribution in their countries: *Relative threshold*	
	students	disadvantaged students	Math	Science	Math	Science
Kosovo	4496	1488	30.8	21.6	27.4	29.7
Kuwait	4437	1455	19.0	23.8	29.0	30.4
Latvia	4481	1480	82.0	85.0	32.5	32.2
Lithuania	3741	1202	72.0	69.2	23.4	22.4
Malta	3630	1206	62.0	56.0	27.9	30.0
Montenegro	5076	1683	37.6	37.3	29.0	28.1
Morocco	7723	2568	11.1	14.0	23.5	27.5
Netherlands	3355	1108	78.9	68.8	25.2	23.9
New Zealand	5019	1656	42.8	49.2	22.2	22.2
North Macedonia	3270	1082	38.7	23.0	23.6	23.0
Northern Ireland	3497	1161	79.7	68.0	26.3	26.0
Norway	3951	1259	74.6	73.2	24.9	24.8
Oman	6814	2260	26.4	30.4	27.5	25.9
Pakistan	3980	1251	9.0	10.3	32.4	35.2
Philippines	5515	1831	2.3	1.0	27.0	24.7
Poland	4882	1618	65.0	70.5	26.8	24.9
Portugal	4300	1430	65.5	58.7	24.8	26.2
Qatar	4933	1634	26.1	29.7	21.4	22.6
Russian	4022	1340	89.1	91.5	31.9	33.6
Saudi Arabia	5453	1807	15.9	19.5	25.2	24.5
Serbia	4380	1458	59.3	65.1	26.3	25.5
Singapore	5986	1992	91.5	86.4	23.3	20.8
Slovak Republic	4247	1408	61.0	67.1	26.1	25.7
South Africa	11891	3953	8.4	5.9	25.3	25.2
Spain	9555	3157	64.6	68.9	32.8	32.6
Sweden	3965	1303	58.2	64.5	18.9	17.5
Turkey	4028	1337	53.0	59.4	18.1	18.6
United Arab Emirates	25834	8472	45.7	45.4	27.8	27.8
United States	8776	2847	65.5	68.9	21.7	22.1

Note. The findings suggest that there are three distinct patterns in the proportion of academically resilient students in mathematics and science across different countries: (1) **Philippines** represents countries with a low proportion of resilient students when fixed threshold is applied but a high proportion of resilient students when the relative threshold is used; (2) **Singapore** represents countries with a high proportion of resilient students when fixed threshold is applied but low proportion of resilient students when the relative threshold is used; and (3) **Norway** represents countries with medium proportion of resilient students either using fixed or relative and in both subjects.

The fixed performance threshold focuses on the disadvantaged students who demonstrate mathematics or science performance above the TIMSS Intermediate International Benchmark (i.e., above 475 points). Findings from the fixed performance threshold shows that the following countries had the lowest proportion of resilient students in

mathematics: Philippines (2.2%) South Africa (8.2%), and Pakistan (9.4%) and in science: Philippines (1%) South Africa (6.3%), and Pakistan (10.6%). In contrast, the following countries had the highest proportion of resilient students in mathematics: Chinese Taipei (91.5%), Hong Kong SAR (90.2%), and Republic of Korea (89.2%) as well as in science: Russian Federation (91.7%), Republic of Korea (90%), and Chinese Taipei (82.9%).

The relative performance threshold focuses on the disadvantaged students who achieved at the top 1/3 of the performance distribution in their countries. When the relative performance threshold was used to identify academically resilient students, the findings shows that the following countries had the lowest proportion of resilient students in mathematics: Turkey (18.1%), Sweden, 18.9%), and France (19.8%) and science: Sweden (17.5%), Turkey, 18.7%), and Germany (20.4%). In contrast, the following countries had the highest proportion of resilient students in mathematics: Pakistan (32.4%), Latvia (32.5%), and Spain (32.8%) and in science: Spain (32.6%), Russian Federation (33.7%), and Pakistan (35.2%).

Table 5 shows some countries with unique patterns on the share of academically resilience students across thresholds and subjects. At least three patterns emerged from the findings: (1) countries with a low proportion of resilient students in mathematics and science when fixed threshold is applied but a high proportion of resilient students when the relative threshold is used, including Philippines, South Africa, and Pakistan; (2) countries with a high proportion of resilient students in mathematics and science when fixed threshold is applied but low proportion of resilient students when the relative threshold is used, including Singapore and Hong Kong SAR; and (3) countries with medium proportion of resilient students either using fixed or relative and in both subjects, such as Norway, Australia, and Malta.

To present the findings, I selected three countries, one from each pattern, and compare their findings with the overall sample across the 58 countries (Figure 5). Further details on the findings from other countries are presented in Table 5.

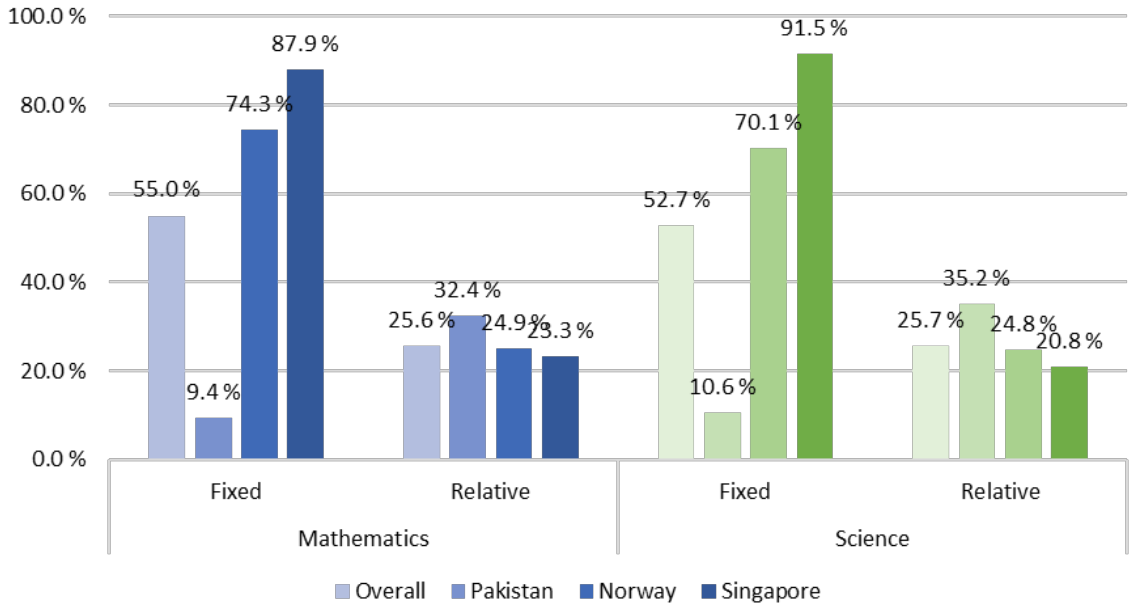

Figure 5. The proportion of academically resilient students in mathematics and science using fixed and relative performance thresholds.

4.2.2. Across students' gender

In general, the proportion of academically resilient students in mathematics was slightly higher for boys than girls (Figure 6). Similar patterns were found in Pakistan and Norway, whereas the opposite pattern was shown in Singapore. Out of 89 resilient students in Pakistan, 74% of them are boys. In Norway, 571 students were resilient, and 60% of them are boys. Iran, Canada, and Republic of Korea also had about 60% of male resilient students. In Singapore, 1012 students were resilient, and 53% of them are boys.

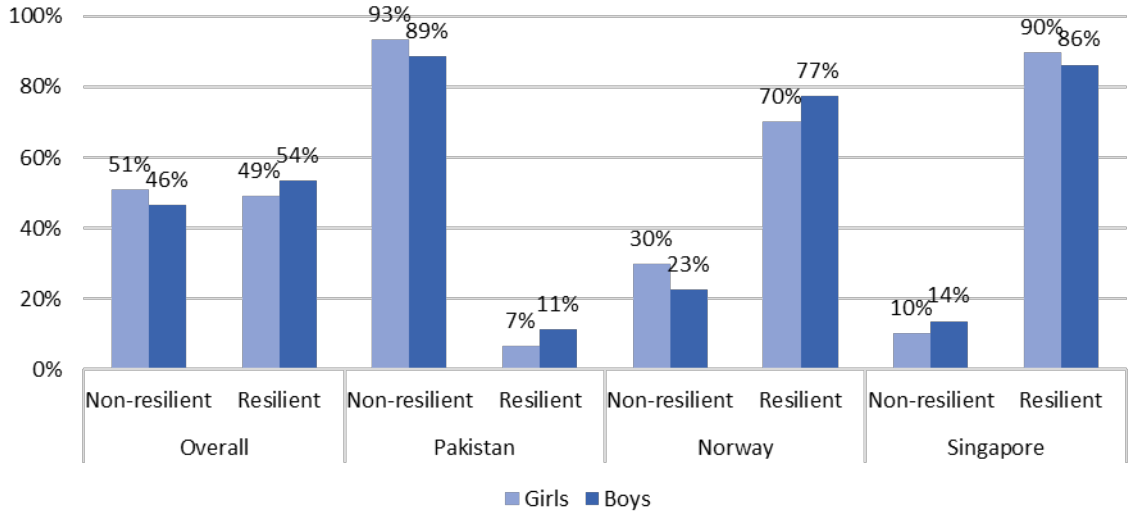

Figure 6. The proportion of resilient and non-resilient students across gender using fixed performance threshold in mathematics.

In science, the overall proportion of academically resilient students was also slightly higher for boys than girls (Figure 7). A similar pattern was only shown in Norway, whereas the opposite pattern was found in Pakistan and Singapore. In Norway, 543 students were resilient, and 60% of them are boys. Pakistan, Chile, Republic of Korea, and Poland also had about 60% of male resilient students. In Singapore, 939 students were resilient, and 54% of them are boys.

Appendix 3 shows the percentage of resilient and non-resilient students across gender in each country using relative threshold (within-country performance).

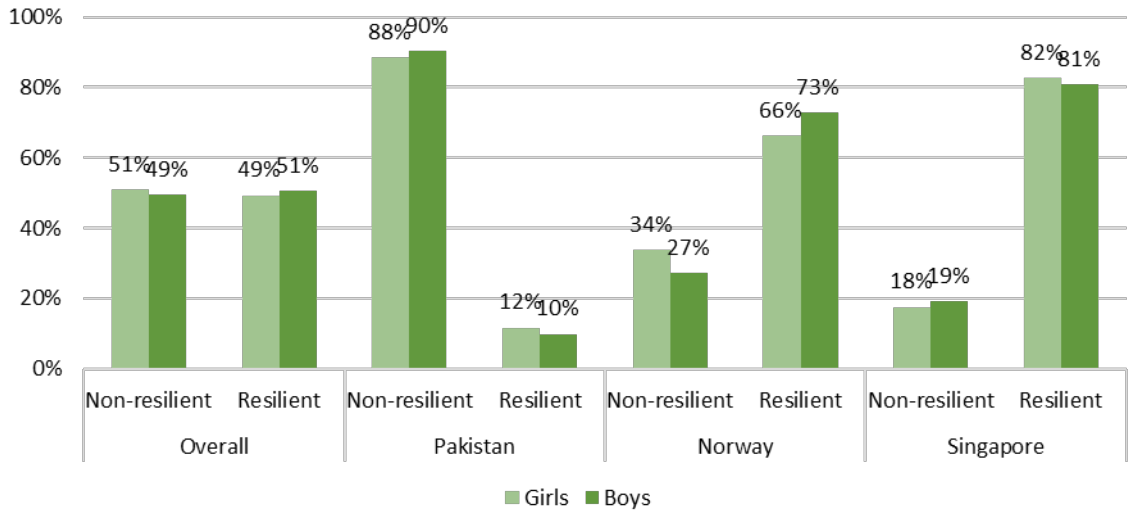

Figure 7. The proportion of resilient and non-resilient students across gender using fixed performance threshold in science.

4.2.3. Across students' immigration backgrounds

Overall, 10.7% of the fourth-grade disadvantaged students who participated in TIMSS 2019 did not born in the country of assessment. Figure 8 shows that about half of these students were considered academically resilient in mathematics. The proportion of resilient students who did not born in the country of assessment was higher in Norway and Singapore. In contrast none of disadvantaged students with immigration background was identified as resilient in Pakistan. Note that only 2.7% of the disadvantaged students did born in the country of assessment in Pakistan compared 14.4% in Norway and 16.2% in Singapore.

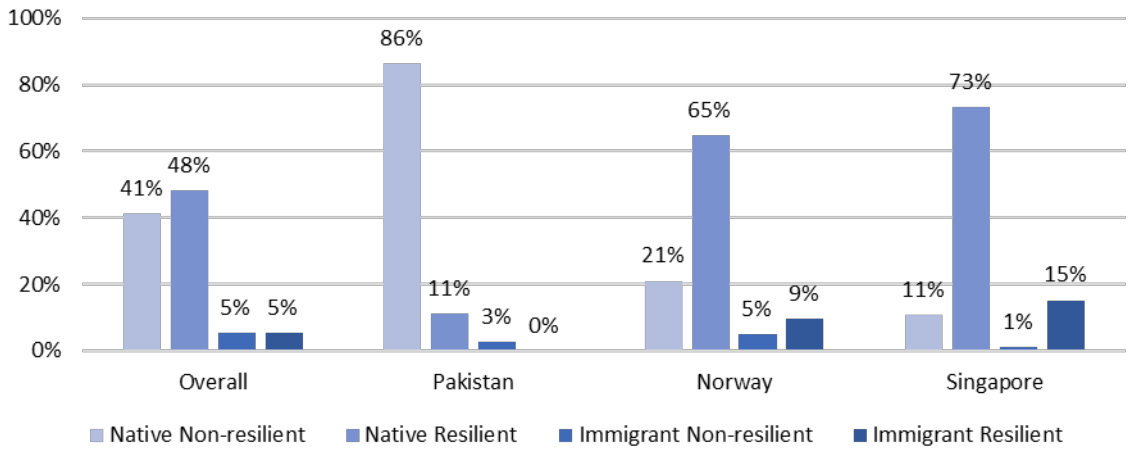

Figure 8. The proportion of resilient and non-resilient students between those who born and did not born in the country of assessment using fixed performance threshold in mathematics.

The proportion of immigrant students who were considered academically resilient were about the same between mathematics and science (Figure 9). Similar to mathematics, the proportion of resilient students who did not born in the country of assessment was higher in Norway and Singapore but no immigrant students with disadvantaged background was identified as academically resilient in science.

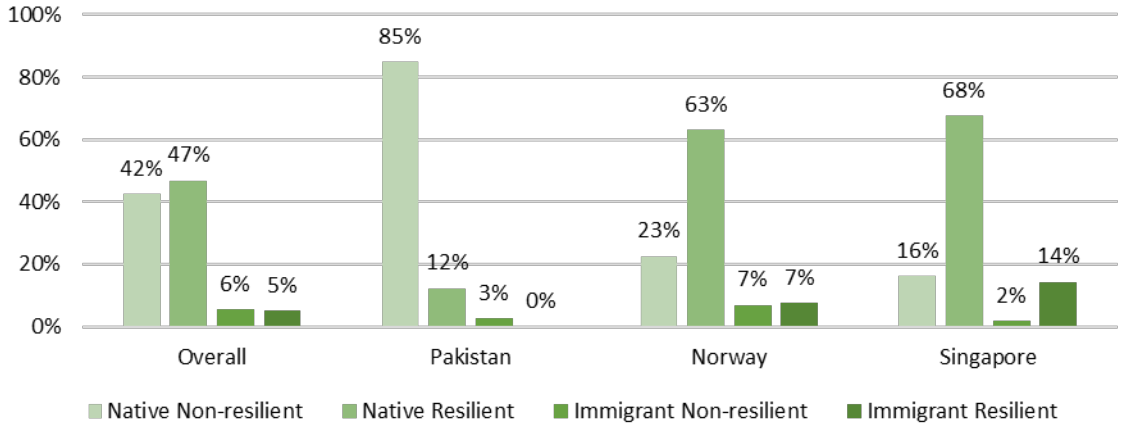

Figure 9. The proportion of resilient and non-resilient students between those who born and did not born in the country of assessment using fixed performance threshold in science.

4.3. The characteristics of teacher quality between resilient and non-resilient students (RQ2)

4.3.1. Teacher educational level

The proportion of resilient and non-resilient students varies across teacher education levels (Figure 10). The proportion in mathematics and science were higher for students whose

teachers have master's degrees. In science, there was no difference in the proportion of resilient and non-resilient students whose teachers have bachelor's degrees, whereas the proportion was higher in mathematics. The proportion of non-resilient students whose teachers only have short-cycle tertiary education, post-secondary non-tertiary education, and upper secondary education were slightly higher compared to resilient students. A very small number of disadvantaged students have teachers who did not complete upper secondary. There was no difference between the proportion of resilient and non-resilient students in this category. Similar findings were also found for the students who have teachers with doctoral or equivalent educational level.

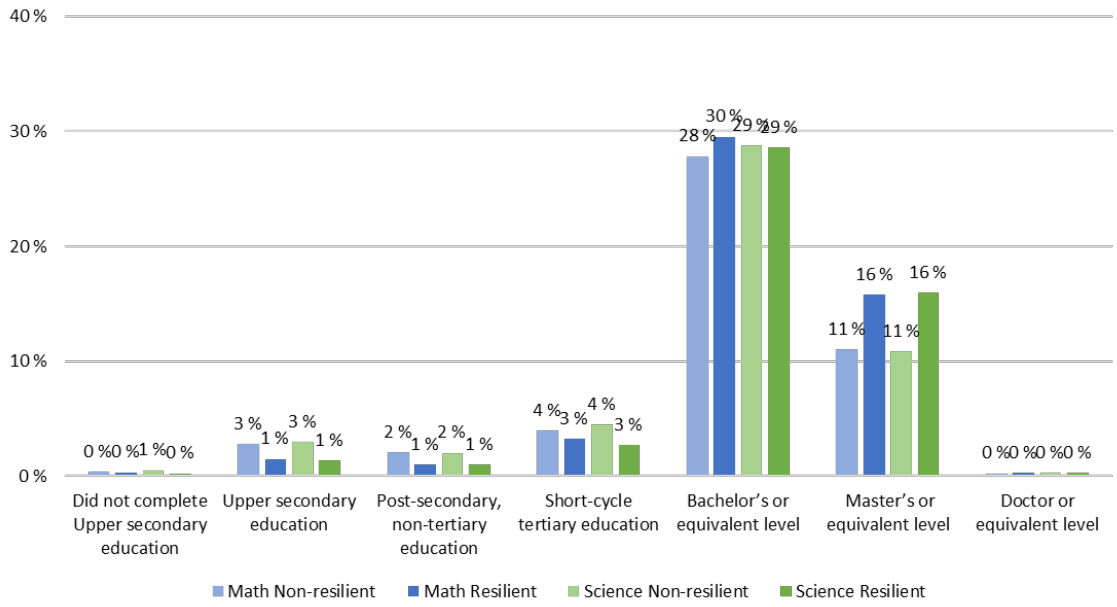

Figure 10. The proportion of resilient and non-resilient students across teacher education levels using fixed performance threshold in mathematics and science.

As shown in Appendix 4-5, less than 500 disadvantaged students were taught by teachers who have education below bachelor's degrees, except in Italy (767 disadvantaged students and 65% of them are resilient students who were taught by teachers with upper secondary education) and Saudi Arabia (639 disadvantaged students and 11% of them are resilient students who were taught by teachers with post-secondary, non-tertiary education), and South Africa (741 disadvantaged students and 7.6% of them are resilient students who were taught by teachers with short-cycle tertiary education).

4.3.2. Teacher main area of study or specialisation

The share of resilient and non-resilient students also varies across teacher major or main are of study (Figures 11 and 12). The proportion of resilient students who were taught by teachers who had major in primary education and specialization in mathematics or science

was higher than non-resilient students. Similar findings were also found for teachers who majored in primary education but did not specialize in mathematics or science. In contrast, the proportion of resilient students was smaller than non-resilient students for those who were taught by teachers who had major in mathematics/science but not in education, had all other majors, or had no formal education beyond upper secondary.

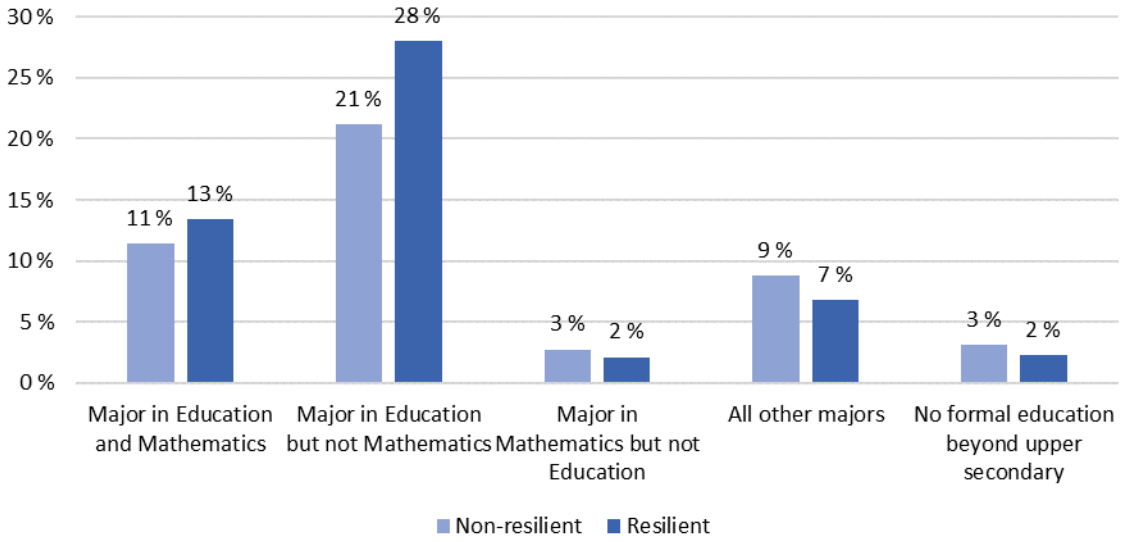

Figure 11. The proportion of resilient and non-resilient students across teacher major or main area of study.

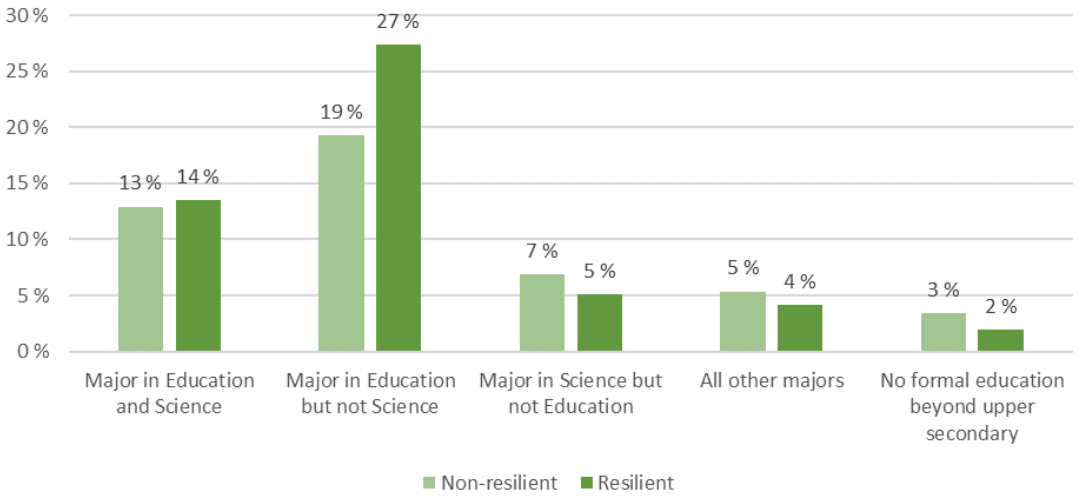

Figure 12. The proportion of resilient and non-resilient students across teacher major or main area of study.

As shown in Appendix 6-7, less than 500 disadvantaged students were taught by teachers who did not major in education, except in Italy (767 disadvantaged students and 65% of them are resilient students who were taught by teachers with no formal education beyond upper secondary), Iran (789 disadvantaged students and 24% of them are resilient students

who were taught by teachers had formal education beyond upper secondary but did not major in education), and United Arab Emirates (1254 disadvantaged students and 45% of them are resilient students who were taught by teachers had formal education beyond upper secondary but did not major in education).

4.3.3. Hours of professional development

Figure 13 shows an overview of the proportion of resilient and non-resilient students in mathematics and science across the number of hours teachers participated in professional development in the last two years. While there was no difference in the proportion of resilient and non-resilient students taught by teachers who participated in professional development more than 35 hours, clear differences were found in other categories (i.e., no professional development, participated less than 6 hours, and participated between 6-15 hours, and participated 16-35 hours), especially in mathematics. Appendix 8 shows the proportion of resilient and non-resilient students in various hours of professional development across 58 countries.

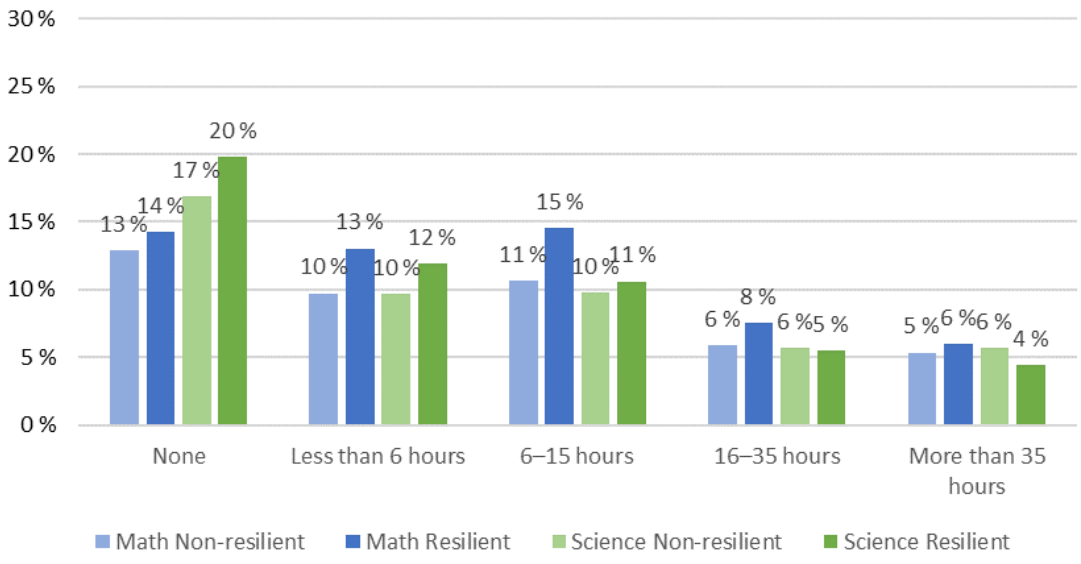

Figure 13. The proportion of resilient and non-resilient students across the number of hours teachers participated in professional development in the last two years.

4.4. The characteristics of teaching quality between resilient and non-resilient students (RQ3)

4.4.1. Classroom management (disorderly behaviour)

In general, mathematics classrooms with disorderly behaviours that occurred in a few or some lessons had a higher proportion of resilient students compared to the classrooms with disorderly behaviour that occurred in most lessons (Figure 14). These findings were

also found in 38 out of 58 countries, including Azerbaijan, Germany, Japan, and the United States (Appendix 9).

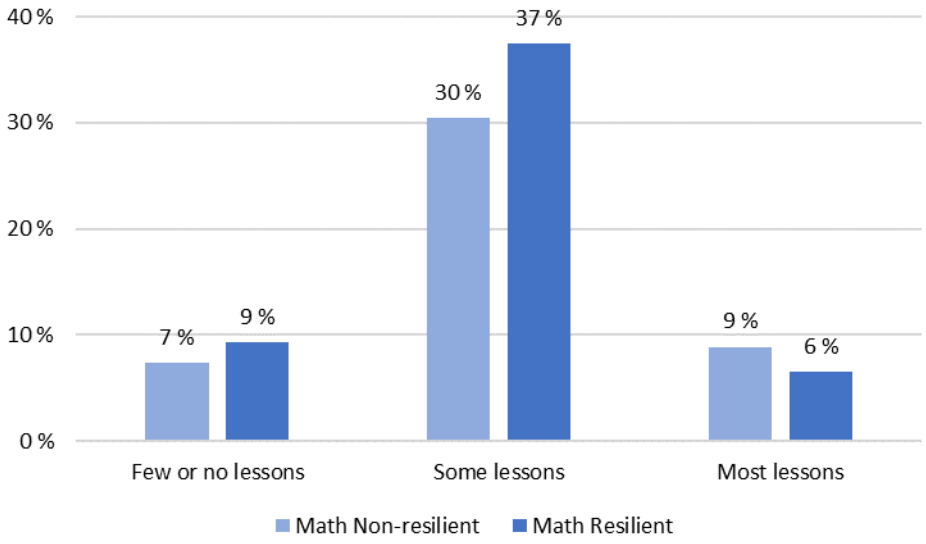

Figure 14. The proportion of resilient and non-resilient students in mathematics across the frequency of disorderly behaviour that occurred in the classrooms.

4.4.2.Cognitive activation

Cognitive activation is a subject-specific teaching quality. In mathematics, the proportion of resilient students who engaged more often in three types of cognitive activation strategies was higher than the proportion of non-resilient students (Figure 15).

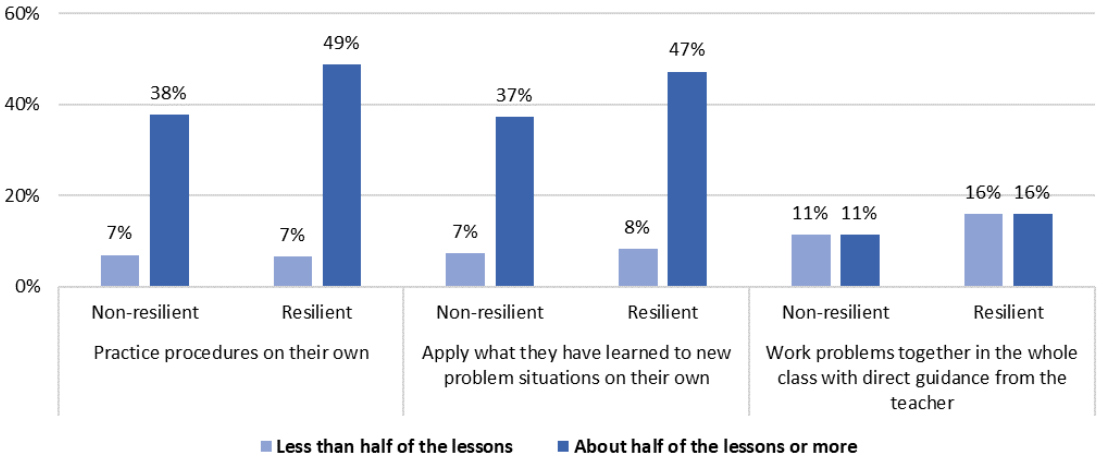

Figure 15. The proportion of resilient and non-resilient students based on how often three activities related to cognitive activation were implemented in mathematics.

In science classrooms, cognitive activation relates to teacher emphasis on science investigation. As shown in Figure 16, the proportion of resilient students was higher when

students engaged in science investigation less than half the lessons, but it was lower when students engaged in science investigation about half the lessons or more.

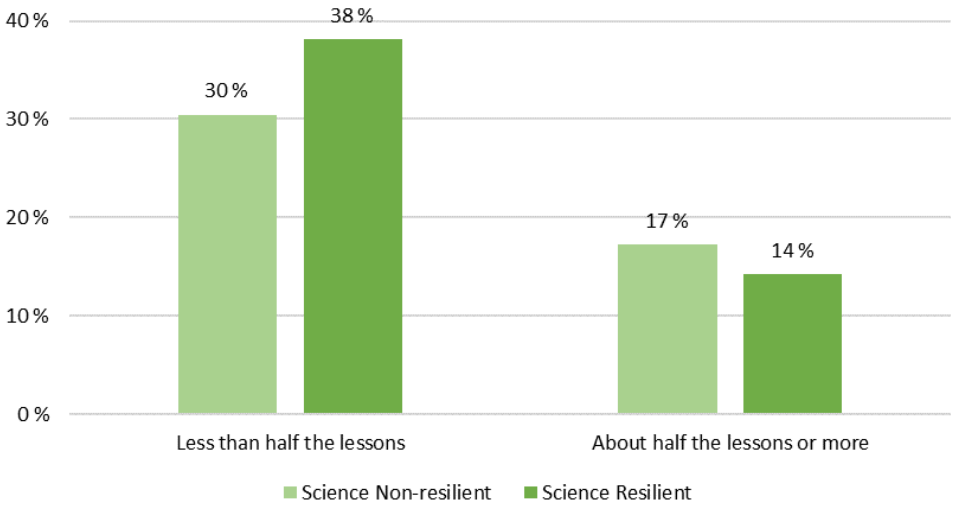

Figure 16. The proportion of resilient and non-resilient students based on how often teachers emphasise science investigation in the classrooms.

4.4.3. Teacher support and instructional clarity

The proportion of resilient students taught by teachers who provided high support and instructional clarity was higher than non-resilient students, both in mathematics and science (Figure 17). Similar findings were found in 40 out of 58 countries, including Australia, Bahrain, Bulgaria, Portugal, and Turkey. See further details for each country in Appendix 10.

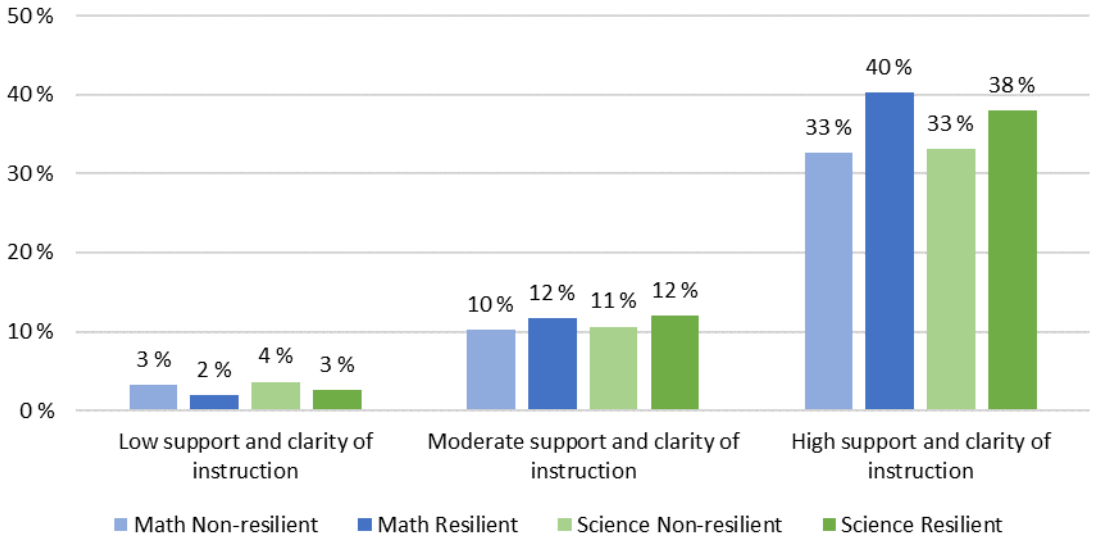

Figure 17. The proportion of resilient and non-resilient students across different levels of teacher support and instructional clarity in mathematics and science using fixed performance threshold.

In contrast, the proportion of non-resilient students was higher for those who were by teachers that provided low support and instructional clarity (Figure 17). Similar findings were found in 34 out of 58 countries for mathematics (e.g., Morocco, Oman, Pakistan, Philippine, Kuwait, Iran, North Macedonia, and Sweden) and 30 out of 58 countries for science (e.g., Azerbaijan, Qatar, Saudi Arabia, South Africa, France, and Georgia). Appendix 11 provides further information on the proportion of resilient and non-resilient students based on the different levels of clarity of instruction in science from each 58 countries.

5. Discussion

5.1. RQ1: Academically resilient students

Not all disadvantaged students are equally vulnerable; some students are able to beat the odds and succeed. This study aims to investigates academic resilient of disadvantaged students from low-income families by focusing on the role of teacher and teaching quality. The study examines the prevalence of ARISE across and within 58 countries. It also explores the characteristics of teacher quality (i.e., teacher education, specialisation, and professional development) and teaching quality (classroom management, cognitive activation, teacher support and clarity of instruction) that differentiate resilient and non-resilient students. This study extends previous research on academic resilience by (1) focusing on in mathematics and science in primary school rather than broadly applicable to all subjects and educational stages, (2) linking student and teacher data from TIMSS to investigate academic resilience cross-nationally in 58 countries around the world, and (3) applying the alignment method to construct a comparable SES construct for identifying socioeconomically disadvantaged students across 58 countries.

The measurement of academic resilience, as either a fixed or relative performance threshold, affects the proportion of resilient students in different countries. Additionally, the specific values set by researchers to define the performance threshold have an impact on the proportion of resilient students. When the fixed threshold is used (i.e., the TIMSS Intermediate International Benchmark with above 475 points), countries such as the Philippines, South Africa, Pakistan, and Morocco have the lowest proportion of resilient students in both subjects. However, when the relative threshold is used (i.e., the top 1/3 of the performance distribution in a country), these countries have a much higher proportion of resilient students. For example, using the fixed threshold, Pakistan has only 9.43% and 10.55% of resilient students in mathematics and science, respectively. In contrast, using the relative threshold, Pakistan has the highest proportion of resilient students in science (35.16%) and the third-highest proportion in mathematics (32.37%). The opposite is true for countries with the highest proportion of resilient students using a fixed threshold, such as South Korea, Hong Kong, and Chinese Taipei, as their proportion of resilient students dropped when a relative threshold was used. Notably, some countries like Russia and Latvia continued to have a high proportion of resilient students, while Iran and Qatar remained to have a low proportion of resilient students, using either fixed or relative thresholds in both subjects.

How academic resilience is defined in a study is critical in understanding its prevalence across different contexts. Previous studies have shown that different conceptualizations, such as fixed versus relative thresholds, can result in varying proportions and compositions of students classified as resilient (e.g., Ye et al., 2021). It is essential to consider the effects of different performance thresholds, particularly when using the proportion of academically resilient students as an indicator of the quality and equity of an education system, as has been done in the previous studies (e.g., Agasisti et al., 2018, 2021; OECD, 2018). For instance, using a fixed threshold could lead to the conclusion that Chinese Taipei had a higher level of quality and equity than Norway, but using relative threshold would reveal no significant difference between the two.

In addition to these varying conceptualizations, the proportion of academically resilient students can also differ across subjects. Using a relative threshold, countries like Bahrain, Hungary, and Singapore showed a higher proportion of resilient students in mathematics, while Morocco, Ireland, and Japan had a higher proportion in science. While mathematics and science are closely related, some students may be more resilient in one subject area than the other. Acknowledging these differences is essential in interpreting, identifying, and comparing academically resilient students accurately. Educational interventions that aim to promote student resilience must also take into account these varying contexts to be effective. For example, tailored interventions that address the unique challenges and opportunities in each subject area may help to enhance academic resilience among students.

5.2. RQ2: The characteristics of teacher quality

Research has shown that teacher quality is a key element of student academic success (e.g., Baumert et al., 2010; Goe, 2007; Kraft et al., 2018). While teacher quality is considered instrumental in mitigating the risk of low achievement for disadvantaged students, the present study found that few characteristics of teacher qualifications, which serve as an approximation of teacher quality, differed between resilient and non-resilient students.

Across 58 countries that participated in TIMSS 2019 in Grade 4, about 8 in 10 disadvantaged students received instruction from teachers with at least a bachelor's degree. There was no difference in the proportion of resilient and non-resilient students across teachers' educational level, except for those taught by teachers with a master's degree. The proportion of resilient students was higher than non-resilient students for those who were taught by teachers with master's degree. The lack of differences in the proportion of resilient and non-resilient students may reflect the highest level of

educational attainment among the teaching workforces. As the vast majority of students had teachers with at least a bachelor's degree, any potential differences in proportion of resilient and non-resilient students may have been muted.

About 7 in 10 disadvantaged students were taught by teachers with a major area of study or specialisation in education or specialisation in education and mathematics or science. There was a clear pattern showing a higher proportion of resilient than non-resilient students for teachers who had a specialisation in education but not in mathematics or science. Teachers with a strong subject matter knowledge would be more equipped to help students to understand difficult concepts and develop problem-solving skills (Abell, 2013). However, this study shows that teacher specialisation in education seems to matter more than specialisation in mathematics or science, especially for young students in this sample. This finding is consistent with related evidence showing that teaching effectiveness is reduced when teachers teach fewer subjects to more students and the importance of teacher-student relationship for vulnerable students (e.g., Hwang & Kisida, 2022).

About one-fourth of disadvantaged students were taught by teachers who did not participate in professional development in the last two years. This study found no strong characteristics that differentiate between the share of resilient and non-resilient students across the number of hours teachers participated in professional development. While teachers who participated in professional development programs tended to be more effective in the classroom, the number of hours of professional development alone did not predict their effectiveness (Darling-Hammond et al., 2017; Nilsen et al., 2020; Timperley et al., 2007). Instead, the effectiveness of professional development are more closely related to the quality of the training, the content and relevance of the training to the teachers' needs and classroom context, and the opportunities for follow-up support and instructional supervision (Darling-Hammond et al., 2017; Loucks-Horsley et al., 2009). In addition, the quantity of professional development — as used in the present study — may not be a reliable indicator of the depth or intensity of the learning that takes place. Some teachers may participate in numerous training sessions, but if these are not aligned with their needs or if they do not engage deeply with the material, the impact on their practice and student outcomes may be limited.

To sum up, while teachers are recognized as playing a key role in promoting academic success, it is likely that a range of factors beyond teachers' education level, specialisation, and professional development contribute to academic resilience. For instance, teaching quality can mediate or moderate the importance of teacher qualification on student outcomes (Nilsen et al., 2020).

5.3. RQ3: The characteristics of teaching quality

In contrast to teacher quality, this study found a clear pattern of teaching quality that distinguish resilient and non-resilient students. The proportion of resilient students was higher in mathematics classrooms with few occurrences of disorderly behaviours. Teachers who implement a good classroom management helps students to maintain a sense of stability and structure in their learning environment (Marzano et al., 2003; Wolff et al., 2021). When the classroom is orderly, students are better able to focus on their studies and engage in learning activities without distractions. This can help them to develop the necessary skills and knowledge to succeed academically (Marder et al., 2023). Disorderly behaviour, on the other hand, can disrupt the learning process and impede academic progress (Fauth et al., 2014; Praetorius et al., 2018). This can take many forms, including disruptive talking or behaviour, late arrivals, students interrupt the teacher, or other disruptions to the learning environment. These disorderly behaviours can affect not only the student engaging in them but also the learning experience of others in the classroom.

The proportion of resilient students was also higher in the classrooms with more frequent implementation of cognitive activation strategies. Cognitive activation strategies help students to develop a deeper understanding of the subjects (Baumert et al., 2010; Teig et al., 2019). When students are actively engaged in problem-solving and critical thinking to solve challenging tasks, they are more likely to develop self-regulation skills they need to manage their own learning, to make connections between different concepts and to see the relevance of what they are learning (Baumert et al., 2010; Charlesworth, 2015). This can help to foster a sense of curiosity, engagement, and confidence that is essential for academic success.

Unlike in mathematics, more frequent cognitive activation in science, especially activities related to science investigation, does not necessarily lead to better outcomes (Teig et al., 2021; Teig et al., 2018). This study also shows that the proportion of resilient students was higher when students engaged in science investigation less than half the lessons, but it was lower in about half the lessons or more. Science experiments often requires considerable time and efforts, both for teachers to plan an elaborate, well-thought lesson and for students to pursue a variety of science activities (Teig et al., 2018, 2019). As such, a high quality, rather than quantity of science investigation is likely to be more beneficial to promote student learning.

This study also found a greater percentage of resilient students taught by teachers who offered strong support and clear instruction, as compared to those who were not resilient. Teachers who provide support and encouragement to their students can establish positive

relationships with them, which in turn help to build trust and increase student motivation to learn (Brophy & Good, 1986; Teig & Nilsen, 2022). Establishing supportive teacher-student relationship is especially important for socioeconomically disadvantaged students, who may face social and emotional challenges (Hwang & Kisida, 2022). A supportive and caring teacher can help to build a sense of safety and belonging in the classroom (Nilsen & Teig, 2022). When students feel that they are respected, heard, and valued, they are more likely to participate in the classroom, take risks, and persevere through challenging tasks (Wang et al., 2020).

Research has shown that teacher expectations can have a powerful impact on student outcomes (Bergem et al., 2016; Charalambous, 2015). When teachers communicate the belief that students are capable of achieving at high levels, students are more likely to see themselves as capable of success and to work harder to achieve their goals (Fullerton et al., 2021; Nilsen et al., 2020). Disadvantaged students may face internalized negative stereotypes about their ability to succeed academically. They may have experienced academic setbacks in the past and are less likely to see themselves as capable learners (Henschel, 2021). Teachers who set high expectations and provide encouraging feedback can help to counteract these stereotypes and develop students' confidence to realize their full potential (Atlay et al., 2019; Wang et al., 2020).

By providing clear and explicit instruction, teachers can create a more equitable and supportive learning environment, where all students can succeed (Atlay et al., 2019; Banerjee, 2016). This is particularly important for disadvantaged students who may have inadequate prior knowledge or may be struggling with language barriers, as they may need more explicit and detailed explanations to fully grasp the content effectively. Teachers who are good at explaining the content, such as by linking mathematical and scientific concepts to students' everyday lives, are more likely to engage students with the content and can help them stay motivated and invested in their learning (Kyriakides et al., 2013; Minner et al., 2010; Teig et al., 2021).

5.4. Limitations and further direction

While the findings of this research are valuable, it is important to consider certain limitations that may impact the interpretation of the results.

First, academic resilience is a multifaceted construct. This study only focuses on student SES and achievement to represent student adversity and adjustment, respectively. These two factors are used to identify resilient and non-resilient students. Other related factors, such as students' perceptions of resilience or their non-cognitive outcomes, are not included in the study and should be investigated in future research. Furthermore, this study

only highlighted the role of specific aspects in teacher quality and teaching quality for academic resilience. This decision leaves out other important factors from the analyses, including teacher experience, collaboration, supervision, and self-beliefs. As TIMSS and other international studies cover a broader aspect of teacher and teaching quality, investigating these factors could be potentially interesting directions for future studies.

Second, teaching quality measure is based on teacher and student background surveys across 58 countries in TIMSS 2019. The survey items measure students' or teachers' perceptions of teaching quality and mostly focused on the frequency rather than the quality of various practices. There is also a possibility that the items are interpreted differently across the countries, which is a significant challenge for any international study that relies on self-report surveys. Future research could apply the alignment method, as was done to the SES construct in this study, to examine possible differences in cross-cultural interpretation that underlie the response patterns from the surveys. Adding qualitative perspective and other sources of information about the actual teacher instruction in the classrooms, such as through video observations and expert ratings, could enhance the robustness of the findings. Although this kind of research is generally costly and difficult to standardize across classrooms, it captures important characteristics of teaching quality as it is enacted in actual classrooms.

Third, this study presented a secondary analysis of TIMSS data. Even though TIMSS data are representative and offer numerous advantages for advancing research on academic resilience, TIMSS is designed as a cross-sectional study. Given the cross-sectional nature of the data, we cannot draw inferences about cause-and-effect relationships, particularly in discussing the characteristics of teacher and teaching quality that vary between resilient and non-resilient students. By taking a longitudinal perspective or experimental investigation, future studies could establish whether these relationships are, in fact, causal.

RECOMMENDATIONS

The overall message from this study is encouraging. Disadvantaged students, with the right support, can succeed academically, and teachers play a critical role in this process. This study also outlines a set of recommendations for educational policy and practice, as follows:

1. The proportion of academically resilient students has been used as an indicator of country's quality and equity in education. However, this study highlights that this measure is significantly influenced by the conceptualization of academic resilience used. Therefore, it is important to take into account the effects of different

conceptualizations to avoid drawing potentially misleading conclusions about the level of quality and equity of educational systems.

2. Highly qualified teachers are crucial for enhancing learning outcomes for all students, especially those from disadvantaged backgrounds. One possible approach to ensure equitable distribution of qualified teachers is to provide targeted financial incentives or salary increases for teachers working in under-resourced or disadvantaged schools. This could help attract and retain qualified teachers who may otherwise opt to work in schools with more resources and better working conditions.
3. Disadvantaged students may require learning experiences that go above and beyond the average to overcome their challenges and achieve academic success. In order for schools to be a catalyst for social mobility, it is important that students have access to sufficient teaching and learning resources that can be utilized to provide high-quality learning experiences. These experiences can help students recognize the relevance of mathematics and science in real-world contexts and encourage them to pursue careers in these fields. It is worth noting that disadvantaged students may have very limited exposure to such experiences at home compared to their more advantaged peers. Hence, schools play a critical role in providing them with the opportunity to success.
4. High-quality of instruction, especially teacher support and clarity of instruction, is crucial for promoting academic resilience among disadvantaged students. Teacher education and professional development need to equip teachers with the necessary knowledge, skills, and strategies to effectively address the unique challenges faced by these students. Ongoing training can help teachers keep up with the latest teaching methodologies, technologies, and strategies. Teachers should be trained on how to create a classroom environment that is inclusive and respectful of diverse cultures, backgrounds, and experiences. This includes understanding the social and cultural contexts that shape the lives of disadvantaged students and using that knowledge to tailor teaching strategies to meet their specific needs. Collaboration with other teachers who work with disadvantaged students is also beneficial. Professional learning communities can provide a platform for teachers to share their experiences and discuss effective teaching strategies.

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REFERENCES

Abell, S. K. (2013). Research on science teacher knowledge. In *Handbook of research on science education* (pp. 1105-1149). Routledge.

Agasisti, T., Avvisati, F., Borgonovi, F., & Longobardi, S. (2018). *Academic resilience: What schools and countries do to help disadvntaged students suceed in PISA* (OECD Education Working Papers, No. 167, Issue January 2018).

Agasisti, T., Avvisati, F., Borgonovi, F., & Longobardi, S. (2021). What school factors are associated with the success of socio-economically disadvantaged students? An empirical investigation using PISA data. *Social Indicators Research*(157), 749–781. https://doi.org/10.1007/s11205-021-02668-w

Akmal, M., & Pritchett, L. (2021). Learning equity requires more than equality: Learning goals and achievement gaps between the rich and the poor in five developing countries⋆. *International Journal of Educational Development*, *82*, 102350.

Ashcraft, M. H. (2002). Math Anxiety: Personal, Educational, and Cognitive Consequences. *Current Directions in Psychological Science*, *11*(5), 181-185. https://doi.org/10.1111/1467-8721.00196

Asparouhov, T., & Muthén, B. (2014). Multiple-Group Factor Analysis Alignment. *Structural Equation Modeling: A Multidisciplinary Journal*, *21*(4), 495-508. https://doi.org/10.1080/10705511.2014.919210

Atlay, C., Tieben, N., Hillmert, S., & Fauth, B. (2019). Instructional quality and achievement inequality: How effective is teaching in closing the social achievement gap? *Learning and Instruction*, *63*, 101211. https://doi.org/10.1016/j.learninstruc.2019.05.008

Banerjee, P. A. (2016). A systematic review of factors linked to poor academic performance of disadvantaged students in science and maths in schools. *Cogent Education*, *3*(1), 1178441.

Baumert, J., Kunter, M., Blum, W., Brunner, M., Voss, T., Jordan, A., Klusmann, U., Krauss, S., Neubrand, M., & Tsai, Y.-M. (2010). Teachers' mathematical knowledge, cognitive activation in the classroom, and student progress. *American educational research journal*, *47*(1), 133-180.

Bergem, O. K., Nilsen, T., & Scherer, R. (2016). Undervisningskvalitet i Matematikk [Instructional quality in Mathematics]. In O. K. Bergem, H. Kaarstein, & T. Nilsen (Eds.), *Vi kan lykkes i realfag [We can suceed in mathematics and science]*. Universitetsforlaget.

Blömeke, S., Olsen, R. V., & Suhl, U. (2016). Relation of student achievement to the quality of their teachers and instructional quality. In *Teacher Quality, Instructional Quality and Student Outcomes* (pp. 21-50). Springer.

Brophy, J., & Good, T. (1986). Teacher behavior and student achievement. In M. Witrock (Ed.), *Handbook of research on teaching* (Vol. 3, pp. 328–375). Macmillan.

Cefai, C. (2021). A Transactional, Whole-School Approach to Resilience. In *Multisystemic Resilience*. Oxford University Press. https://doi.org/10.1093/oso/9780190095888.003.0013

Charalambous, C. Y. (2015). Working at the intersection of teacher knowledge, teacher beliefs, and teaching practice: A multiple-case study. *Journal Of Mathematics Teacher Education*, *18*, 427-445.

Charlesworth, R. (2015). *Math and science for young children*. Cengage Learning.

Darling-Hammond, L. (2015). *The flat world and education: How America's commitment to equity will determine our future*. Teachers College Press.

Darling-Hammond, L., Hyler, M. E., & Gardner, M. (2017). Effective teacher professional development.

Duit, R. (2009). *Bibliography STCSE: Students' and teachers' conceptions and science education*. IPN - Leibniz Institute for Science Education, Kiel, Germany.

Duit, R., Treagust, D., & Widodo, A. (2008). Teaching science for conceptual change. In S. Vosniadou (Ed.), *International handbook of research on conceptual change* (pp. 740). Routledge.

European Commission. (2020). *Educational inequalities in Europe and physical school closures during Covid-19*. https://ec.europa.eu/jrc/sites/jrcsh/files/fairness_pb2020_wave04_covid_education_jrc_i1_19jun2020.pdf

Even, R., & Tirosh, D. (2002). Teacher knowledge and understanding of students' mathematical learning. *Handbook of international research in mathematics education*, 219-240.

Fauth, B., Decristan, J., Rieser, S., Klieme, E., & Büttner, G. (2014). Student ratings of teaching quality in primary school: Dimensions and prediction of student outcomes. *Learning and Instruction*, *29*, 1-9.

Fullerton, D. J., Zhang, L. M., & Kleitman, S. (2021). An integrative process model of resilience in an academic context: Resilience resources, coping strategies, and positive adaptation. *Plos One*, *16*(2), e0246000. https://doi.org/10.1371/journal.pone.0246000

Goe, L. (2007). The link between teacher quality and student outcomes: A research synthesis. *National Comprehensive Center For Teacher Quality*.

Goldhaber, D., Lavery, L., & Theobald, R. (2015). Uneven Playing Field? Assessing the Teacher Quality Gap Between Advantaged and Disadvantaged Students. *Educational Researcher*, *44*(5), 293-307. https://doi.org/10.3102/0013189x15592622

Goldhaber, D., Theobald, R., & Fumia, D. (2022). The role of teachers and schools in explaining STEM outcome gaps. *Social Science Research*, *105*, 102709.

Henschel, S. (2021). Antecedents of science anxiety in elementary school. *The Journal of Educational Research*, *114*(3), 263-277. https://doi.org/10.1080/00220671.2021.1922989

Hwang, N., & Kisida, B. (2022). Spread Too Thin: The Effect of Specialization on Teaching Effectiveness. *Educational Evaluation and Policy Analysis*, *44*(4), 593-607.

Kim, S. W., Cho, H., & Kim, L. Y. (2019). Socioeconomic status and academic outcomes in developing countries: A meta-analysis. *Review of Educational Research*, *89*(6), 875-916. https://doi.org/10.3102/0034654319877155

Klieme, E., Pauli, C., & Reusser, K. (2009). The pythagoras study: Investigating effects of teaching and learning in Swiss and German mathematics classrooms. In T. Janik & T. Seidel (Eds.), *The power of video studies in investigating teaching and learning in the classroom* (pp. 137-160). Waxmann Publicing Co.

Klingebiel, F., & Klieme, E. (2016). Teacher qualifications and professional knowledge. In K. E. Kuger S., Jude N., Kaplan D (Ed.), *Assessing Contexts of Learning* (pp. 447-468). Springer.

Konstantopoulos, S., & Chung, V. (2011). Teacher Effects on Minority and Disadvantaged Students' Grade 4 Achievement. *The Journal of Educational Research*, *104*(2), 73-86. https://doi.org/10.1080/00220670903567349

Kraft, M. A., Blazar, D., & Hogan, D. (2018). The effect of teacher coaching on instruction and achievement: A meta-analysis of the causal evidence. *Review of Educational Research*, *88*(4), 547-588.

Kuger, S., Klieme, E., Jude, N., & Kaplan, D. (2016). *Assessing contexts of learning: An international perspective*. Springer.

Kyriakides, L., Christoforou, C., & Charalambous, C. Y. (2013). What matters for student learning outcomes: A meta-analysis of studies exploring factors of effective teaching. *Teaching and Teacher Education*, *36*, 143-152. https://doi.org/10.1016/j.tate.2013.07.010

Loucks-Horsley, S., Stiles, K. E., Mundry, S., Love, N., & Hewson, P. W. (2009). *Designing professional development for teachers of science and mathematics*. Corwin press.

Luthar, S. S. (2006). Resilience in development: A synthesis of research across five decades. In *Developmental psychopathology: Risk, disorder, and adaptation, Vol. 3, 2nd ed.* (pp. 739-795). John Wiley & Sons, Inc.

Luthar, S. S., Cicchetti, D., & Becker, B. (2000). The construct of resilience: a critical evaluation and guidelines for future work. *Child Development*, *71*(3), 543-562. https://doi.org/10.1111/1467-8624.00164

Lynch, R. G., & Oakford, P. (2014). The Economic Benefits of Closing Educational Achievement Gaps: Promoting Growth and Strengthening the Nation by Improving the Educational Outcomes of Children of Color. *Center for American Progress*.

Marder, J., Thiel, F., & Göllner, R. (2023). Classroom management and students' mathematics achievement: The role of students' disruptive behavior and teacher classroom management. *Learning and Instruction*, *86*, 101746. https://doi.org/https://doi.org/10.1016/j.learninstruc.2023.101746

Martin, A. J., & Marsh, H. W. (2006). Academic resilience and its psychological and educational correlates: A construct validity approach. *Psychology in the Schools*, *43*(3), 267-281.

Martin, M. O., von Davier, M., & Mullis, I. V. (2020). Methods and Procedures: TIMSS 2019 Technical Report. *International Association for the Evaluation of Educational Achievement*.

Marzano, R. J., Marzano, J. S., & Pickering, D. (2003). *Classroom management that works: Research-based strategies for every teacher*. ASCD.

Masten, A. S. (2015). *Ordinary magic: Resilience in development*. Guilford Publications.

Mincu, M. E. (2015). Teacher quality and school improvement: what is the role of research? *Oxford Review Of Education*, *41*(2), 253-269.

Minner, D. D., Levy, A. J., & Century, J. (2010). Inquiry-based science instruction—what is it and does it matter? Results from a research synthesis years 1984 to 2002. *Journal of Research in Science Teaching*, *47*(4), 474-496.

Muthén, B., & Muthén, L. (1998-2021). *Mplus*. In (Version 7.3) Muthén & Muthén.

Neumann, K., Kauertz, A., & Fischer, H. E. (2012). Quality of Instruction in Science Education. In B. J. Fraser, K. Tobin, & C. J. McRobbie (Eds.), *Second International Handbook of Science Education* (pp. 247-258). Springer Netherlands. https://doi.org/10.1007/978-1-4020-9041-7_18

Nilsen, T., Scherer, R., Gustafsson, J.-E., Teig, N., & Kaarstein, H. (2020). Teachers' role in enhancing equity—a multilevel structural equation modelling with mediated moderation. In T. S. Frønes, A. Pettersen, J. Radišić, & N. Buchholtz (Eds.), *Equity, equality and diversity in the Nordic model of education* (pp. 173-196). Springer International Publishing. https://doi.org/10.1007/978-3-030-61648-9_7

Nilsen, T., & Teig, N. (2022). A systematic review of studies investigating the relationships between school climate and student outcomes in TIMSS, PISA, and PIRLS. In T. Nilsen, A. Stancel-Piątak, & J.-E. Gustafsson (Eds.), *International Handbook of Comparative Large-Scale Studies in Education: Perspectives, Methods and Findings* (pp. 1-34). Springer International Publishing. https://doi.org/10.1007/978-3-030-38298-8_34-1

OECD. (2016). *PISA 2015 Results Excellence And Equity in Education vol. I*. OECD Publishing.

OECD. (2018). *The Resilience of Students with an Immigrant Background*. OECD Publishing.

Praetorius, A.-K., Klieme, E., Herbert, B., & Pinger, P. (2018). Generic dimensions of teaching quality: The German framework of three basic dimensions. *ZDM*, *50*(3), 407-426.

Qin, L., & Bowen, D. H. (2019). The distributions of teacher qualification: A cross-national study. *International Journal of Educational Development*, *70*, 102084.

Rjosk, C., Richter, D., Hochweber, J., Lüdtke, O., Klieme, E., & Stanat, P. (2014). Socioeconomic and language minority classroom composition and individual reading achievement: The mediating role of instructional quality. *Learning and Instruction*, *32*, 63-72.

Rudd, G., Meissel, K., & Meyer, F. (2021). Measuring academic resilience in quantitative research: A systematic review of the literature. *Educational Research Review*, 100402.

Schlesinger, L., Jentsch, A., Kaiser, G., König, J., & Blömeke, S. (2018). Subject-specific characteristics of instructional quality in mathematics education. *ZDM*, *50*(3), 475-490.

Senden, B., Nilsen, T., & Blömeke, S. (2022). Instructional Quality: A Review of Conceptualizations, Measurement Approaches, and Research Findings. *Ways of Analyzing Teaching Quality: Potentials and Pitfalls*, 140-172.

Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher*, *15*(2), 4-14.

Sirin, S. R. (2005). Socioeconomic status and academic achievement: A meta-analytic review of research. *Review of Educational Research*, *75*(3), 417-453.

Teig, N., Bergem, O. K., Nilsen, T., & Senden, B. (2021). Gir utforskende arbeidsmåter i naturfag bedre læringsutbytte? [Does inquiry-based teaching practice in science provide better learning outcomes?]. In T. Nilsen & H. Kaarstein (Eds.), *Med blikket mot naturfag [A view towards science]* (pp. 46-72). Universitetsforlaget.

Teig, N., & Nilsen, T. (2022). Profiles of instructional quality in primary and secondary education: Patterns, predictors, and relations to student achievement and motivation in science. *Studies in Educational Evaluation*, *74*, 101170. https://doi.org/https://doi.org/10.1016/j.stueduc.2022.101170

Teig, N., Scherer, R., & Nilsen, T. (2018). More isn't always better: The curvilinear relationship between inquiry-based teaching and student achievement in science. *Learning and Instruction*, *56*, 20-29.

Teig, N., Scherer, R., & Nilsen, T. (2019). I know I can, but do I have the time? The role of teachers' self-efficacy and perceived time constraints in implementing cognitive-activation strategies in science [Original Research]. *Frontiers in psychology*, *10*(1697).

Teig, N., Scherer, R., & Olsen, R. V. (2022). A systematic review of studies investigating science teaching and learning: over two decades of TIMSS and PISA. *International Journal of Science Education*, *44*(12), 2035-2058. https://doi.org/10.1080/09500693.2022.2109075

Timperley, H., Wilson, A., Barrar, H., & Fung, I. (2007). *Teacher professional development and learning: Best evidence synthesis iteration (BES)*. Ministry of Education.

Tudor, K. E., & Spray, C. M. (2017). Approaches to measuring academic resilience: A systematic review. *International Journal of Research Studies in Education*, *7*(4).

Ungar, M. (2021). Modeling multisystemic resilience: Connecting biological, psychological, social, and ecological adaptation in contexts of adversity. In *Multisystemic Resilience*. Oxford University Press.

United Nations. (2020). *Policy Brief: Education during COVID-19 and Beyond*. https://www.un.org/development/desa/dspd/wp-content/uploads/sites/22/2020/08/sg_policy_brief_covid-19_and_education_august_2020.pdf

Wang, M.-T., & Degol, J. (2013). Motivational pathways to STEM career choices: Using expectancy–value perspective to understand individual and gender differences in STEM fields. *Developmental Review*, *33*(4), 304-340. https://doi.org/10.1016/j.dr.2013.08.001

Wang, M.-T., L. Degol, J., Amemiya, J., Parr, A., & Guo, J. (2020). Classroom climate and children's academic and psychological wellbeing: A systematic review and meta-analysis. *Developmental Review*, *57*, 100912. https://doi.org/10.1016/j.dr.2020.100912

Wang, M. C., Haertal, G., & Walgberg, H. (1994). Educational resilience in inner-city. In M. C. Wang & E. W. Gordon (Eds.), *Educational resilience in inner-city America: Challenges and prospects* (pp. 45-72). Lawrence Erlbaunm Associates.

Wilson, S. M. (2011). Effective STEM teacher preparation, induction, and professional development. NRC Workshop on Highly Successful STEM Schools or Programs. Available: http://www7. nationalacademies. org/bose/Successful_STEM_ Schools_Homepage. html [May 2011],

Wolff, C. E., Jarodzka, H., & Boshuizen, H. P. A. (2021). Classroom Management Scripts: a Theoretical Model Contrasting Expert and Novice Teachers' Knowledge and Awareness of Classroom Events. *Educational psychology review*, *33*(1), 131-148. https://doi.org/10.1007/s10648-020-09542-0

Ye, W., Strietholt, R., & Blömeke, S. (2021). Academic resilience: underlying norms and validity of definitions. *Educational Assessment, Evaluation and Accountability*, *33*(1), 169-202. https://doi.org/10.1007/s11092-020-09351-7

APPENDICES

Appendix 1. Description of the student who participated in TIMSS 2019 Grade 4 across 58 countries.

Country	Percentage of students							
	Female	Male	Born in the country		Confident in mathematics		Confident in science	
			Yes	No	Low or medium	High	Low or medium	High
Albania	48.7	51.3	89	11	48.2	51.8	38.4	61.6
Armenia	48	52	96.5	3.5	56.1	43.9	53.2	46.8
Australia	49.7	50.3	86.3	13.7	72.2	27.8	68.7	31.3
Austria	48	52	89.1	10.9	59.9	40.1	49.3	50.7
Azerbaijan. Republic of	46.5	53.5	94	6	57	43	52.6	47.4
Bahrain	48.4	51.6	81.3	18.7	58	42	44.3	55.7
Belgium (Flemish)	50.6	49.4	92	8	68.5	31.5	63.3	36.7
Bosnia and Herzegovina	48.9	51.1	94.3	5.7	57	43	53.6	46.4
Bulgaria	48.8	51.2	96.9	3.1	54.3	45.7	38.8	61.2
Canada	49.4	50.6	87.2	12.8	67.9	32.1	64.5	35.5
Chile	49.9	50.1	95.4	4.6	77	23	75.3	24.7
Chinese Taipei	48	52	97.1	2.9	85.3	14.7	69.1	30.9
Croatia	49.9	50.1	98.4	1.6	70.7	29.3	61.3	38.7
Cyprus	52.2	47.8	87.6	12.4	51.8	48.2	60.3	39.7
Czech Republic	48.8	51.2	96.9	3.1	77.8	22.2	75.2	24.8
Denmark	50.2	49.8	93.9	6.1	71.1	28.9	70.7	29.3
England	50.2	49.8	89.5	10.5	68.6	31.4	71.1	28.9
Finland	48.6	51.4	94.5	5.5	67.8	32.2	73	27
France	49.4	50.6	92.8	7.2	66.1	33.9	71.9	28.1
Georgia	49.8	50.2	97.1	2.9	60.4	39.6	56.1	43.9
Germany	49.1	50.9	89.2	10.8	66.9	33.1	61	39
Hong Kong. SAR	46.6	53.4	88.7	11.3	81	19	76.8	23.2
Hungary	48.2	51.8	98	2	62.3	37.7	55.3	44.7
Iran. Islamic Republic of	49.7	50.3	97.7	2.3	65.2	34.8	42.9	57.1
Ireland	50.6	49.4	92.2	7.8	65.9	34.1	65.1	34.9
Italy	50.3	49.7	96.5	3.5	65.7	34.3	62	38
Japan	48.4	51.6	99.2	0.8	84.3	15.7	72.9	27.1
Kazakhstan	49.1	50.9	96.3	3.7	58.4	41.6	56.7	43.3
Korea. Republic of	47.8	52.2	98.3	1.7	84.7	15.3	82.1	17.9
Kosovo	49	51	97.4	2.6	48.4	51.6	53.2	46.8
Kuwait	48.1	51.9	82.2	17.8	69.2	30.8	54.1	45.9
Latvia	50.8	49.2	97	3	77.2	22.8	69.6	30.4
Lithuania	49.1	50.9	96.9	3.1	71.1	28.9	69.3	30.7
Malta	48.4	51.6	86.9	13.1	66.4	33.6	57.5	42.5

Country	Percentage of students							
	Female	Male	Born in the country		Confident in mathematics		Confident in science	
			Yes	No	Low or medium	High	Low or medium	High
Montenegro	46.6	53.4	93.8	6.2	48.7	51.3	47.4	52.6
Morocco	48.3	51.7	96.7	3.3	65	35	55.5	44.5
Netherlands	49.6	50.4	93.5	6.5	61.6	38.4	67.8	32.2
New Zealand	48.4	51.6	85.2	14.8	80.4	19.6	78.6	21.4
North Macedonia	48.1	51.9	94.7	5.3	51.2	48.8	50.2	49.8
Northern Ireland	49.7	50.3	91.4	8.6	70.5	29.5	70.6	29.4
Norway	49.3	50.7	91.4	8.6	63.8	36.2	56.3	43.7
Oman	50	50	81.1	18.9	65	35	49.3	50.7
Pakistan	42.9	57.1	97.6	2.4	81.8	18.2	75.6	24.4
Philippines	48.4	51.6	91.6	8.4	91.9	8.1	89.2	10.8
Poland	48.8	51.2	96.7	3.3	77.1	22.9	68.9	31.1
Portugal	48.7	51.3	93.7	6.3	78.4	21.6	56.6	43.4
Qatar	51	49	61.4	38.6	69.8	30.2	56.8	43.2
Russian Federation	50.3	49.7	96.8	3.2	75.1	24.9	70	30
Saudi Arabia	50.4	49.6	88.5	11.5	56.3	43.7	49.1	50.9
Serbia	49.5	50.5	97.9	2.1	65.1	34.9	64.1	35.9
Singapore	50	50	83.2	16.8	79.1	20.9	77.9	22.1
Slovak Republic	49.3	50.7	96.3	3.7	69.4	30.6	66.1	33.9
South Africa	49.5	50.5	92.2	7.8	83.4	16.6	77.1	22.9
Spain	48.3	51.7	94.9	5.1	72.1	27.9	66.3	33.7
Sweden	49.4	50.6	89	11	64.2	35.8	64.5	35.5
Turkey	52.2	47.8	97.2	2.8	66	34	49.2	50.8
United Arab Emirates	50.5	49.5	63.8	36.2	65.7	34.3	53.8	46.2
United States	49.4	50.6	92.2	7.8	67.6	32.4	62.5	37.5

Appendix 2. Mathematics and science performance in TIMSS 2019 across 58 countries.

Country	Number of students	Country average achievement				Percentage of students who reached the TIMSS Intermediate International Benchmark (475)	
		Math	*SE*[a]	Science	*SE*[a]	Math	Science
Albania	4426	494	3	489	4	62	59
Armenia	5399	498	3	466	3	64	47
Australia	5890	516	3	533	2	70	78
Austria	4464	539	2	522	3	84	75
Azerbaijan	5245	515	3	427	3	72	32
Bahrain	5762	480	3	493	3	54	60
Belgium (Flemish)	4655	532	2	501	2	80	66
Bosnia and Herzegovina	5617	452	2	459	3	40	44
Bulgaria	4268	515	4	521	5	71	71
Canada	13653	512	2	523	2	69	75
Chile	4174	441	3	469	3	33	48
Chinese Taipei	3765	599	2	558	2	96	89
Croatia	3785	509	2	524	2	70	80
Cyprus	4062	532	3	511	3	77	70
Czech Republic	4692	533	3	534	3	78	81
Denmark	3227	525	2	522	2	75	76
England	3396	556	3	537	3	83	81
Finland	4730	532	2	555	3	78	87
France	4186	485	3	488	3	57	59
Georgia	3787	482	4	454	4	56	43
Germany	3437	521	2	518	2	75	72
Hong Kong SAR	2968	602	3	531	3	96	79
Hungary	4571	523	3	529	3	74	76
Iran	6010	443	4	441	4	39	40
Ireland	4582	548	3	528	3	84	77
Italy	3741	515	2	510	3	73	71
Japan	4196	593	2	562	2	95	90
Kazakhstan	4791	512	3	494	3	71	59
Korea	3893	600	2	588	2	95	95
Kosovo	4496	444	3	413	4	37	25
Kuwait	4437	383	5	392	6	21	27
Latvia	4481	546	3	542	2	85	85
Lithuania	3741	542	3	538	3	81	81
Malta	3630	509	1	496	1	69	63
Montenegro	5076	453	2	453	3	43	44
Morocco	7723	383	4	374	6	18	21
Netherlands	3355	538	2	518	3	84	76
New Zealand	5019	487	3	503	2	56	64
North Macedonia	3270	472	5	426	6	52	34
Northern Ireland	3497	566	3	518	2	85	74
Norway	3951	543	2	539	2	82	83
Oman	6814	431	4	435	4	33	38
Pakistan	3980	328	12	290	13	8	7

Country	Number of students	Country average achievement				Percentage of students who reached the TIMSS Intermediate International Benchmark (475)	
		Math	*SE*[a]	Science	*SE*[a]	Math	Science
Philippines	5515	297	6	249	8	6	5
Poland	4882	520	3	531	3	73	79
Portugal	4300	525	3	504	3	74	67
Qatar	4933	449	3	449	4	40	43
Russian	4022	567	3	567	3	91	92
Saudi Arabia	5453	398	4	402	4	23	28
Serbia	4380	508	3	517	4	68	73
Singapore	5986	625	4	595	3	96	93
Slovak Republic	4247	510	4	521	4	71	76
South Africa	11891	374	4	324	5	16	14
Spain	9555	502	2	511	2	65	71
Sweden	3965	521	3	537	3	74	80
Turkey	4028	523	4	526	4	70	75
United Arab Emirates	25834	481	2	473	2	53	53
United States	8776	535	3	539	3	77	79

[a] *SE* = Standard error

Appendix 3. The percentage of academically resilient and non-resilient students across gender using relative threshold (within-country performance).

Country	Mathematics				Science			
	Resilient		Non-Resilient		Resilient		Non-Resilient	
	Female	Male	Female	Male	Female	Male	Female	Male
Albania	49.2	50.8	54.8	45.2	55.9	44.1	52.5	47.5
Armenia	49.5	50.5	48.1	51.9	53.7	46.3	46.8	53.2
Australia	41.6	58.4	47.1	52.9	41.7	58.3	47.2	52.8
Austria	41.5	58.5	52.9	47.1	47.8	52.2	51.0	49.0
Azerbaijan, Republic of	47.0	53.0	49.0	51.0	46.8	53.2	49.1	50.9
Bahrain	47.7	52.3	44.8	55.2	51.9	48.1	43.5	56.5
Belgium (Flemish)	36.8	63.2	47.4	52.6	43.5	56.5	45.4	54.6
Bosnia and Herzegovina	44.6	55.4	50.8	49.2	49.3	50.7	48.9	51.1
Bulgaria	38.7	61.3	46.3	53.7	42.9	57.1	44.9	55.1
Canada	36.2	63.8	47.7	52.3	41.0	59.0	46.5	53.5
Chile	43.1	56.9	50.5	49.5	37.2	62.8	52.1	47.9
Chinese Taipei	42.8	57.2	51.1	48.9	48.5	51.5	49.5	50.5
Croatia	47.0	53.0	51.2	48.8	48.9	51.1	50.5	49.5
Cyprus	43.2	56.8	55.4	44.6	51.2	48.8	53.1	46.9
Czech Republic	39.0	61.0	51.3	48.7	43.6	56.4	50.0	50.0
Denmark	34.7	65.3	48.9	51.1	42.3	57.7	47.0	53.0
England	33.9	66.1	45.5	54.5	35.3	64.7	45.1	54.9
Finland	36.1	63.9	46.3	53.7	44.5	55.5	43.4	56.6
France	40.4	59.6	50.9	49.1	47.1	52.9	49.3	50.7
Georgia	45.3	54.7	49.2	50.8	48.5	51.5	48.1	51.9
Germany	35.9	64.1	52.4	47.6	42.9	57.1	50.7	49.3
Hong Kong, SAR	46.6	53.4	48.9	51.1	38.0	62.0	50.3	49.7
Hungary	41.4	58.6	49.7	50.3	42.8	57.2	49.0	51.0
Iran, Islamic Republic of	39.2	60.8	50.0	50.0	41.6	58.4	49.4	50.6
Ireland	38.3	61.7	45.3	54.7	41.1	58.9	44.4	55.6
Italy	41.2	58.8	52.0	48.0	43.6	56.4	51.0	49.0
Japan	47.7	52.3	54.3	45.7	52.5	47.5	53.0	47.0
Kazakhstan	42.4	57.6	48.6	51.4	45.2	54.8	47.6	52.4
Korea, Republic of	36.6	63.4	41.5	58.5	34.8	65.2	42.1	57.9
Kosovo	51.3	48.7	53.6	46.4	57.4	42.6	51.1	48.9
Kuwait	48.2	51.8	48.2	51.8	54.8	45.2	45.4	54.6
Latvia	47.8	52.2	53.6	46.4	53.0	47.0	51.4	48.6
Lithuania	38.1	61.9	50.1	49.9	42.2	57.8	48.8	51.2
Malta	45.6	54.4	46.6	53.4	50.0	50.0	44.7	55.3
Montenegro	47.0	53.0	49.5	50.5	49.0	51.0	48.7	51.3
Morocco	54.5	45.5	56.3	43.7	54.2	45.8	56.6	43.4
Netherlands	37.6	62.4	47.4	52.6	43.4	56.6	45.4	54.6
New Zealand	40.5	59.5	45.1	54.9	47.3	52.7	43.2	56.8
North Macedonia	50.2	49.8	47.6	52.4	53.4	46.6	46.7	53.3
Northern Ireland	42.4	57.6	41.7	58.3	42.7	57.3	41.6	58.4
Norway	26.6	73.4	46.1	53.9	28.5	71.5	45.4	54.6

Oman	57.2	42.8	50.6	49.4	59.5	40.5	50.0	50.0
Pakistan	34.8	65.2	42.1	57.9	44.9	55.1	36.5	63.5
Philippines	61.7	38.3	44.3	55.8	58.8	41.2	45.6	54.4
Poland	36.0	64.0	46.1	53.9	40.1	59.9	44.6	55.4
Portugal	35.6	64.4	49.5	50.5	39.6	60.4	48.4	51.6
Qatar	48.7	51.3	51.4	48.6	48.0	52.0	51.6	48.4
Russian Federation	48.6	51.4	56.8	43.2	51.8	48.2	55.3	44.7
Saudi Arabia	44.6	55.4	38.8	61.2	54.3	45.7	36.7	63.3
Serbia	43.3	56.7	49.8	50.2	47.7	52.3	48.2	51.8
Singapore	37.6	62.4	47.6	52.4	39.9	60.1	47.0	53.0
Slovak Republic	36.8	63.2	51.0	49.0	35.9	64.1	50.9	49.1
South Africa	62.2	37.8	57.4	42.6	60.9	39.1	57.9	42.1
Spain	40.2	59.8	50.0	50.0	43.1	56.9	48.9	51.1
Sweden	39.9	60.1	46.0	54.0	48.5	51.5	44.4	55.6
Turkey	46.5	53.5	56.4	43.6	49.6	50.4	55.8	44.2
United Arab Emirates	45.6	54.4	48.6	51.4	45.9	54.1	48.5	51.5
United States	37.0	63.0	47.2	52.8	39.7	60.3	46.4	53.6
Total	43.4	56.6	49.2	50.8	46.6	53.4	48.2	51.8

Appendix 4. The percentage of resilient and non-resilient students in mathematics based on different teacher education levels using the fixed threshold.

Education level	Country	Number of students	Resilient	Non-Resilient
Did not complete upper secondary	Albania	10	80.0%	20.0%
	Armenia	355	48.2%	51.8%
	Croatia	2	0.0%	100.0%
	Denmark	13	69.2%	30.8%
	Morocco	41	2.4%	97.6%
	Netherlands	4	71.4%	28.6%
	North Macedonia	7	71.4%	28.6%
	Oman	8	75.0%	25.0%
	Pakistan	24	0.0%	100.0%
	Philippines	22	0.0%	100.0%
	Russian Federation	6	90.9%	9.1%
	United Arab Emirates	7	33.3%	66.7%
	Total	499	44.9%	55.1%
Upper secondary	Albania	174	50.6%	49.4%
	Armenia	131	55.0%	45.0%
	Azerbaijan, Republic of	129	71.0%	29.0%
	Bosnia and Herzegovina	9	55.6%	44.4%
	Czech Republic	70	75.7%	24.3%
	Denmark	17	64.7%	35.3%
	Finland	3	66.7%	33.3%
	France	30	33.3%	66.7%
	Hungary	3	33.3%	66.7%
	Iran, Islamic Republic of	24	41.7%	58.3%
	Ireland	1	100.0%	0.0%
	Italy	767	65.1%	34.9%
	Kazakhstan	2	0.0%	100.0%
	Kosovo	70	41.4%	58.6%
	Kuwait	25	12.0%	88.0%
	Malta	58	55.2%	44.8%
	Morocco	427	10.5%	89.5%
	Netherlands	9	50.0%	50.0%
	North Macedonia	6	30.8%	69.2%
	Northern Ireland	317	68.6%	31.4%
	Oman	130	33.3%	66.7%
	Pakistan	88	11.4%	88.6%
	Philippines	27	5.4%	94.6%
	Russian Federation	14	90.9%	9.1%
	Saudi Arabia	10	18.5%	81.5%
	Serbia	96	21.4%	78.6%
	Singapore	51	60.0%	40.0%
	South Africa	17	8.3%	91.7%
	Sweden	107	47.1%	52.9%
	United Arab Emirates	35	52.9%	47.1%

	Total	2847	41.9%	58.1%
Post-secondary or non-tertiary	Albania	9	33.3%	66.7%
	Armenia	30	100.0%	0.0%
	Azerbaijan, Republic of	4	66.7%	33.3%
	Bahrain	10	0.0%	100.0%
	Bosnia and Herzegovina	347	33.7%	66.3%
	Chinese Taipei	5	100.0%	0.0%
	Finland	4	0.0%	100.0%
	Iran, Islamic Republic of	7	28.6%	71.4%
	Italy	42	71.4%	28.6%
	Kazakhstan	111	55.0%	45.0%
	Kosovo	5	60.0%	40.0%
	Kuwait	24	37.5%	62.5%
	Lithuania	9	66.7%	33.3%
	Malta	8	87.5%	12.5%
	Montenegro	3	100.0%	0.0%
	Morocco	37	16.2%	83.8%
	North Macedonia	24	21.1%	78.9%
	Oman	119	41.7%	58.3%
	Pakistan	160	7.6%	92.4%
	Russian Federation	639	86.3%	13.8%
	Saudi Arabia	305	11.3%	88.7%
	Serbia	46	58.4%	41.6%
	Singapore	20	82.6%	17.4%
	South Africa	10	0.0%	100.0%
	Sweden	4	80.0%	20.0%
	United Arab Emirates	38	25.0%	75.0%
	Total	2020	36.8%	63.2%
Short-cycle tertiary	Albania	11	9.1%	90.9%
	Armenia	432	59.0%	41.0%
	Australia	62	48.4%	51.6%
	Austria	462	75.1%	24.9%
	Azerbaijan, Republic of	512	68.1%	31.9%
	Belgium (Flemish)	117	75.0%	25.0%
	Bosnia and Herzegovina	103	30.8%	69.2%
	Bulgaria	1	50.5%	49.5%
	Canada	9	100.0%	0.0%
	Chile	510	0.0%	100.0%
	Croatia	11	63.5%	36.5%
	Cyprus	7	54.5%	45.5%
	Denmark	10	71.4%	28.6%
	Finland	87	70.0%	30.0%
	France	7	50.6%	49.4%
	Georgia	40	14.3%	85.7%
	Germany	32	42.5%	57.5%
	Hong Kong, SAR	13	87.5%	12.5%
	Hungary	207	0.0%	100.0%

	Iran, Islamic Republic of	8	28.0%	72.0%
	Ireland	21	100.0%	0.0%
	Italy	26	81.0%	19.0%
	Japan	5	80.8%	19.2%
	Korea, Republic of	143	100.0%	0.0%
	Kosovo	15	24.5%	75.5%
	Kuwait	67	13.3%	86.7%
	Lithuania	50	62.7%	37.3%
	Malta	313	86.0%	14.0%
	Montenegro	50	36.1%	63.9%
	Morocco	31	10.0%	90.0%
	Netherlands	168	81.5%	18.5%
	New Zealand	93	39.8%	60.2%
	North Macedonia	4	26.0%	74.0%
	Northern Ireland	125	83.3%	16.7%
	Norway	66	50.0%	50.0%
	Oman	14	41.9%	58.1%
	Pakistan	66	23.2%	76.8%
	Portugal	75	71.2%	28.8%
	Qatar	21	14.3%	85.7%
	Russian Federation	87	80.3%	19.7%
	Saudi Arabia	11	16.0%	84.0%
	Serbia	741	66.7%	33.3%
	Singapore	38	80.5%	19.5%
	Slovak Republic	71	63.6%	36.4%
	South Africa	80	7.6%	92.4%
	Spain	96	78.9%	21.1%
	Sweden	12	46.5%	53.5%
	United Arab Emirates	4	56.3%	43.8%
	Total	5134	48.1%	51.9%
Bachelor	Albania	219	58.0%	42.0%
	Armenia	644	56.0%	44.0%
	Australia	1029	55.0%	45.0%
	Austria	729	75.0%	25.0%
	Azerbaijan, Republic of	830	65.7%	34.3%
	Bahrain	184	48.2%	51.8%
	Belgium (Flemish)	1117	70.3%	29.7%
	Bosnia and Herzegovina	243	32.9%	67.1%
	Bulgaria	2276	62.6%	37.4%
	Canada	851	52.7%	47.3%
	Chile	307	20.9%	79.1%
	Chinese Taipei	151	90.6%	9.4%
	Croatia	219	60.3%	39.7%
	Cyprus	25	68.9%	31.1%
	Czech Republic	475	68.0%	32.0%
	Denmark	77	59.6%	40.4%
	England	322	75.0%	25.0%
	Finland	145	71.4%	28.6%

	France	12	41.9%	58.1%
	Georgia	351	43.4%	56.6%
	Germany	873	50.0%	50.0%
	Hong Kong, SAR	1560	91.2%	8.8%
	Hungary	990	63.7%	36.3%
	Iran, Islamic Republic of	53	27.4%	72.6%
	Ireland	653	76.7%	23.3%
	Italy	1306	69.8%	30.2%
	Japan	760	89.1%	10.9%
	Kazakhstan	1100	64.5%	35.5%
	Korea, Republic of	504	89.9%	10.1%
	Kosovo	457	30.0%	70.0%
	Kuwait	739	15.3%	84.7%
	Latvia	704	77.5%	22.5%
	Lithuania	1195	72.7%	27.3%
	Malta	492	58.4%	41.6%
	Montenegro	1012	38.1%	61.9%
	Morocco	637	10.6%	89.4%
	Netherlands	799	78.0%	22.0%
	New Zealand	350	42.6%	57.4%
	Norway	19	72.9%	27.1%
	North Macedonia	479	39.5%	60.5%
	Northern Ireland	18	79.2%	20.8%
	Oman	1217	24.1%	75.9%
	Pakistan	642	10.5%	89.5%
	Philippines	387	2.7%	97.3%
	Poland	32	55.6%	44.4%
	Portugal	900	66.0%	34.0%
	Qatar	804	17.4%	82.6%
	Russian Federation	5	89.4%	10.6%
	Saudi Arabia	1085	21.9%	78.1%
	Serbia	1389	59.0%	41.0%
	Singapore	471	88.6%	11.4%
	Slovak Republic	2575	80.0%	20.0%
	South Africa	596	8.3%	91.7%
	Spain	679	58.5%	41.5%
	Sweden	1200	57.5%	42.5%
	Turkey	548	49.2%	50.8%
	United Arab Emirates	783	40.6%	59.4%
	United States	1033	64.0%	36.0%
	Total	39252	52.9%	47.1%
Master	Albania	613	51.7%	48.3%
	Armenia	58	45.4%	54.6%
	Australia	176	55.7%	44.3%
	Austria	129	78.3%	21.7%
	Azerbaijan, Republic of	113	82.8%	17.2%
	Bahrain	97	42.5%	57.5%
	Belgium (Flemish)	69	57.4%	42.6%

Bosnia and Herzegovina	918	40.6%	59.4%
Bulgaria	534	66.2%	33.8%
Canada	70	51.1%	48.9%
Chile	305	20.0%	80.0%
Chinese Taipei	577	92.8%	7.2%
Croatia	471	62.9%	37.1%
Cyprus	1049	66.7%	33.3%
Czech Republic	63	71.2%	28.8%
Denmark	1299	71.4%	28.6%
England	450	70.0%	30.0%
Finland	660	68.9%	31.1%
France	498	38.9%	61.1%
Georgia	114	46.4%	53.6%
Germany	62	59.2%	40.8%
Hong Kong, SAR	202	89.5%	10.5%
Hungary	469	58.1%	41.9%
Iran, Islamic Republic of	329	21.3%	78.7%
Ireland	32	78.7%	21.3%
Italy	36	69.6%	30.4%
Japan	257	93.8%	6.3%
Kazakhstan	97	72.2%	27.8%
Korea, Republic of	91	90.7%	9.3%
Kosovo	505	34.0%	66.0%
Kuwait	341	34.1%	65.9%
Latvia	206	80.6%	19.4%
Lithuania	47	71.3%	28.7%
Malta	70	65.0%	35.0%
Montenegro	121	59.6%	40.4%
Morocco	12	4.3%	95.7%
Netherlands	488	75.0%	25.0%
New Zealand	157	39.3%	60.7%
North Macedonia	160	54.5%	45.5%
Northern Ireland	343	83.1%	16.9%
Norway	761	77.7%	22.3%
Oman	127	33.1%	66.9%
Pakistan	144	8.1%	91.9%
Philippines	562	0.9%	99.1%
Poland	1	59.8%	40.2%
Portugal	209	59.8%	40.2%
Qatar	201	25.0%	75.0%
Russian Federation	1004	89.7%	10.3%
Saudi Arabia	7	0.0%	100.0%
Serbia	597	63.2%	36.8%
Singapore	115	92.5%	7.5%
Slovak Republic	1119	54.9%	45.1%
South Africa	80	57.1%	42.9%
Spain	33	62.5%	37.5%
Sweden	1180	55.7%	44.3%

	Turkey	40	47.5%	52.5%
	United Arab Emirates	207	37.6%	62.4%
	United States	47	63.7%	36.3%
	Total	18722	59.6%	40.4%
Doctor	Albania	21	66.7%	33.3%
	Armenia	2	33.3%	66.7%
	Australia	8	100.0%	0.0%
	Bahrain	9	37.5%	62.5%
	Bosnia and Herzegovina	8	25.0%	75.0%
	Bulgaria	3	100.0%	0.0%
	Canada	7	71.4%	28.6%
	Chinese Taipei	6	100.0%	0.0%
	Croatia	11	90.9%	9.1%
	Cyprus	40	65.0%	35.0%
	Czech Republic	34	52.9%	47.1%
	Finland	6	83.3%	16.7%
	France	13	53.8%	46.2%
	Germany	34	64.7%	35.3%
	Hungary	10	40.0%	60.0%
	Ireland	22	86.4%	13.6%
	Italy	15	60.0%	40.0%
	Korea, Republic of	6	66.7%	33.3%
	Kuwait	5	0.0%	100.0%
	Oman	9	33.3%	66.7%
	Pakistan	14	0.0%	100.0%
	Philippines	6	0.0%	100.0%
	Poland	1	100.0%	0.0%
	Portugal	2	0.0%	100.0%
	Qatar	28	3.6%	96.4%
	Slovak Republic	7	100.0%	0.0%
	Spain	4	50.0%	50.0%
	United Arab Emirates	31	48.4%	51.6%
	United States	22	63.6%	36.4%
	Total	384	53.4%	46.6%

Appendix 5. The percentage of resilient and non-resilient students in science based on different teacher education levels.

Education level	Country	Number of students	Resilient	Non-Resilient
Did not complete upper secondary	Albania	10	70.0%	30.0%
	Armenia	355	30.7%	69.3%
	Croatia	2	0.0%	100.0%
	Denmark	13	38.5%	61.5%
	Morocco	41	9.8%	90.2%
	Netherlands	4	42.9%	57.1%
	North Macedonia	7	42.9%	57.1%
	Oman	8	100.0%	0.0%
	Pakistan	24	0.0%	100.0%
	Philippines	22	0.0%	100.0%
	Russian Federation	6	95.5%	4.5%
	United Arab Emirates	7	16.7%	83.3%
	Total	499	31.5%	68.5%
Upper secondary	Albania	174	50.6%	49.4%
	Armenia	131	37.2%	62.8%
	Azerbaijan, Republic of	129	23.7%	76.3%
	Bosnia and Herzegovina	9	22.2%	77.8%
	Czech Republic	70	65.7%	34.3%
	Denmark	17	64.7%	35.3%
	Finland	3	33.3%	66.7%
	France	30	36.7%	63.3%
	Hungary	3	33.3%	66.7%
	Iran, Islamic Republic of	24	50.0%	50.0%
	Ireland	1	100.0%	0.0%
	Italy	767	63.1%	36.9%
	Kazakhstan	2	0.0%	100.0%
	Kosovo	70	27.1%	72.9%
	Kuwait	25	16.0%	84.0%
	Malta	58	56.9%	43.1%
	Morocco	427	15.5%	84.5%
	Netherlands	9	66.7%	33.3%
	North Macedonia	6	12.1%	87.9%
	Northern Ireland	317	48.6%	51.4%
	Oman	130	11.1%	88.9%
	Pakistan	88	12.0%	88.0%
	Philippines	27	0.8%	99.2%
	Russian Federation	14	88.6%	11.4%
	Saudi Arabia	10	14.8%	85.2%
	Serbia	96	21.4%	78.6%
	Singapore	51	50.0%	50.0%
	South Africa	17	2.1%	97.9%
	Sweden	107	60.8%	39.2%
	United Arab Emirates	35	52.9%	47.1%

	Total	2847	37.4%	62.6%
Post-secondary or non-tertiary	Albania	9	22.2%	77.8%
	Armenia	30	70.0%	30.0%
	Azerbaijan, Republic of	4	30.0%	70.0%
	Bahrain	10	25.0%	75.0%
	Bosnia and Herzegovina	347	39.5%	60.5%
	Chinese Taipei	5	100.0%	0.0%
	Finland	4	0.0%	100.0%
	Iran, Islamic Republic of	7	42.9%	57.1%
	Italy	42	71.4%	28.6%
	Kazakhstan	111	45.9%	54.1%
	Kosovo	5	40.0%	60.0%
	Kuwait	24	45.8%	54.2%
	Lithuania	9	66.7%	33.3%
	Malta	8	62.5%	37.5%
	Montenegro	3	66.7%	33.3%
	Morocco	37	21.6%	78.4%
	North Macedonia	24	13.2%	86.8%
	Oman	119	45.8%	54.2%
	Pakistan	160	6.7%	93.3%
	Russian Federation	639	91.9%	8.1%
	Saudi Arabia	305	14.9%	85.1%
	Serbia	46	66.2%	33.8%
	Singapore	20	73.9%	26.1%
	South Africa	10	0.0%	100.0%
	Sweden	4	80.0%	20.0%
	United Arab Emirates	38	0.0%	100.0%
	Total	2020	39.1%	60.9%
Short-cycle tertiary	Albania	11	27.3%	72.7%
	Armenia	432	37.1%	62.9%
	Australia	62	58.1%	41.9%
	Austria	462	62.8%	37.2%
	Azerbaijan, Republic of	512	24.5%	75.5%
	Belgium (Flemish)	117	75.0%	25.0%
	Bosnia and Herzegovina	103	29.9%	70.1%
	Bulgaria	1	45.6%	54.4%
	Canada	9	100.0%	0.0%
	Chile	510	0.0%	100.0%
	Croatia	11	74.9%	25.1%
	Cyprus	7	63.6%	36.4%
	Denmark	10	71.4%	28.6%
	Finland	87	80.0%	20.0%
	France	7	46.0%	54.0%
	Georgia	40	0.0%	100.0%
	Germany	32	45.0%	55.0%
	Hong Kong, SAR	13	56.3%	43.8%
	Hungary	207	15.4%	84.6%

	Iran, Islamic Republic of	8	31.4%	68.6%
	Ireland	21	87.5%	12.5%
	Italy	26	81.0%	19.0%
	Japan	5	80.8%	19.2%
	Korea, Republic of	143	100.0%	0.0%
	Kosovo	15	16.1%	83.9%
	Kuwait	67	20.0%	80.0%
	Lithuania	50	56.7%	43.3%
	Malta	313	74.0%	26.0%
	Montenegro	50	33.2%	66.8%
	Morocco	31	10.0%	90.0%
	Netherlands	168	69.6%	30.4%
	New Zealand	93	49.5%	50.5%
	North Macedonia	4	17.7%	82.3%
	Northern Ireland	125	83.3%	16.7%
	Norway	66	75.0%	25.0%
	Oman	14	51.6%	48.4%
	Pakistan	66	22.4%	77.6%
	Portugal	75	60.6%	39.4%
	Qatar	21	7.1%	92.9%
	Russian Federation	87	86.4%	13.6%
	Saudi Arabia	11	18.7%	81.3%
	Serbia	741	66.7%	33.3%
	Singapore	38	75.9%	24.1%
	Slovak Republic	71	72.7%	27.3%
	South Africa	80	5.8%	94.2%
	Spain	96	76.3%	23.7%
	Sweden	12	52.1%	47.9%
	United Arab Emirates	4	60.0%	40.0%
	Total	5134	41.1%	58.9%
Bachelor	Albania	219	61.6%	38.4%
	Armenia	644	33.2%	66.8%
	Australia	1029	68.3%	31.7%
	Austria	729	59.3%	40.7%
	Azerbaijan, Republic of	830	24.7%	75.3%
	Bahrain	184	49.4%	50.6%
	Belgium (Flemish)	1117	50.7%	49.3%
	Bosnia and Herzegovina	243	37.6%	62.4%
	Bulgaria	2276	63.8%	36.2%
	Canada	851	64.6%	35.4%
	Chile	307	34.3%	65.7%
	Chinese Taipei	151	81.1%	18.9%
	Croatia	219	80.1%	19.9%
	Cyprus	25	56.2%	43.8%
	Czech Republic	475	72.0%	28.0%
	Denmark	77	56.2%	43.8%
	England	322	71.4%	28.6%
	Finland	145	76.6%	23.4%

	France	12	39.1%	60.9%
	Georgia	351	36.6%	63.4%
	Germany	873	41.7%	58.3%
	Hong Kong, SAR	1560	66.4%	33.6%
	Hungary	990	66.2%	33.8%
	Iran, Islamic Republic of	53	28.0%	72.0%
	Ireland	653	70.9%	29.1%
	Italy	1306	73.6%	26.4%
	Japan	760	81.9%	18.1%
	Kazakhstan	1100	47.8%	52.2%
	Korea, Republic of	504	90.4%	9.6%
	Kosovo	457	21.0%	79.0%
	Kuwait	739	22.0%	78.0%
	Latvia	704	83.2%	16.8%
	Lithuania	1195	71.6%	28.4%
	Malta	492	52.4%	47.6%
	Montenegro	1012	38.3%	61.7%
	Morocco	637	14.4%	85.6%
	Netherlands	799	68.0%	32.0%
	New Zealand	350	48.3%	51.7%
	North Macedonia	19	24.7%	75.3%
	Northern Ireland	479	67.2%	32.8%
	Norway	18	67.7%	32.3%
	Oman	1217	27.8%	72.2%
	Pakistan	642	10.5%	89.5%
	Philippines	387	2.1%	97.9%
	Poland	32	66.7%	33.3%
	Portugal	900	59.3%	40.7%
	Qatar	804	19.6%	80.4%
	Russian Federation	5	90.4%	9.6%
	Saudi Arabia	1085	18.8%	81.3%
	Serbia	1389	65.0%	35.0%
	Singapore	471	82.1%	17.9%
	Slovak Republic	2575	80.0%	20.0%
	South Africa	596	6.9%	93.1%
	Spain	679	62.9%	37.1%
	Sweden	1200	62.4%	37.6%
	Turkey	548	55.0%	45.0%
	United Arab Emirates	783	38.6%	61.4%
	United States	1033	68.0%	32.0%
	Total	39252	51.1%	48.9%
Master	Albania	613	52.5%	47.5%
	Armenia	58	28.9%	71.1%
	Australia	176	63.6%	36.4%
	Austria	129	66.7%	33.3%
	Azerbaijan, Republic of	113	51.7%	48.3%
	Bahrain	97	46.9%	53.1%
	Belgium (Flemish)	69	40.4%	59.6%

Bosnia and Herzegovina	918	39.1%	60.9%
Bulgaria	534	63.4%	36.6%
Canada	70	67.8%	32.2%
Chile	305	28.6%	71.4%
Chinese Taipei	577	83.9%	16.1%
Croatia	471	74.5%	25.5%
Cyprus	1049	58.0%	42.0%
Czech Republic	63	72.5%	27.5%
Denmark	1299	71.4%	28.6%
England	450	67.5%	32.5%
Finland	660	79.6%	20.4%
France	498	40.2%	59.8%
Georgia	114	32.3%	67.7%
Germany	62	54.4%	45.6%
Hong Kong, SAR	202	53.5%	46.5%
Hungary	469	67.7%	32.3%
Iran, Islamic Republic of	329	26.7%	73.3%
Ireland	32	74.4%	25.6%
Italy	36	68.4%	31.6%
Japan	257	90.6%	9.4%
Kazakhstan	97	55.6%	44.4%
Korea, Republic of	91	92.6%	7.4%
Kosovo	505	29.9%	70.1%
Kuwait	341	41.8%	58.2%
Latvia	206	82.2%	17.8%
Lithuania	47	63.9%	36.1%
Malta	70	58.7%	41.3%
Montenegro	121	59.6%	40.4%
Morocco	12	7.1%	92.9%
Netherlands	488	66.7%	33.3%
New Zealand	157	47.1%	52.9%
North Macedonia	160	27.3%	72.7%
Northern Ireland	343	72.0%	28.0%
Norway	761	77.7%	22.3%
Oman	127	30.6%	69.4%
Pakistan	144	13.8%	86.3%
Philippines	562	0.0%	100.0%
Poland	1	66.6%	33.4%
Portugal	209	52.0%	48.0%
Qatar	201	32.6%	67.4%
Russian Federation	1004	92.9%	7.1%
Saudi Arabia	7	0.0%	100.0%
Serbia	597	65.6%	34.4%
Singapore	115	86.6%	13.4%
Slovak Republic	1119	60.3%	39.7%
South Africa	80	28.6%	71.4%
Spain	33	66.2%	33.8%
Sweden	1180	64.3%	35.7%

	Turkey	40	53.8%	46.3%
	United Arab Emirates	207	33.9%	66.1%
	United States	47	66.9%	33.1%
	Total	18722	60.5%	39.5%
Doctor	Albania	21	66.7%	33.3%
	Armenia	2	22.2%	77.8%
	Australia	8	100.0%	0.0%
	Bahrain	9	25.0%	75.0%
	Bosnia and Herzegovina	8	50.0%	50.0%
	Bulgaria	3	66.7%	33.3%
	Canada	7	100.0%	0.0%
	Chinese Taipei	6	100.0%	0.0%
	Croatia	11	81.8%	18.2%
	Cyprus	40	47.5%	52.5%
	Czech Republic	34	64.7%	35.3%
	Finland	6	100.0%	0.0%
	France	13	69.2%	30.8%
	Germany	34	55.9%	44.1%
	Hungary	10	30.0%	70.0%
	Ireland	22	68.2%	31.8%
	Italy	15	60.0%	40.0%
	Korea, Republic of	6	66.7%	33.3%
	Kuwait	5	0.0%	100.0%
	Oman	9	44.4%	55.6%
	Pakistan	14	0.0%	100.0%
	Philippines	6	0.0%	100.0%
	Poland	1	100.0%	0.0%
	Portugal	2	0.0%	100.0%
	Qatar	28	3.6%	96.4%
	Slovak Republic	7	100.0%	0.0%
	Spain	4	75.0%	25.0%
	United Arab Emirates	31	58.1%	41.9%
	United States	22	68.2%	31.8%
	Total	384	52.9%	47.1%

Appendix 6. The percentage of resilient and non-resilient students in mathematics based on teachers' major or main area of study.

Teacher major/main area of study	Country	Number of students	Resilient	Non-Resilient
No formal education beyond upper secondary	Albania	184	52.2%	47.8%
	Armenia	131	50.0%	50.0%
	Azerbaijan, Republic of	484	71.0%	29.0%
	Bosnia and Herzegovina	9	55.6%	44.4%
	Croatia	2	0.0%	100.0%
	Czech Republic	70	75.7%	24.3%
	Denmark	30	66.7%	33.3%
	Finland	3	66.7%	33.3%
	France	30	33.3%	66.7%
	Hungary	3	33.3%	66.7%
	Iran, Islamic Republic of	24	41.7%	58.3%
	Ireland	1	100.0%	0.0%
	Italy	767	65.1%	34.9%
	Kazakhstan	2	0.0%	100.0%
	Kosovo	70	41.4%	58.6%
	Kuwait	25	12.0%	88.0%
	Malta	58	55.2%	44.8%
	Morocco	468	9.8%	90.2%
	Netherlands	13	61.5%	38.5%
	North Macedonia	13	33.3%	66.7%
	Northern Ireland	325	68.6%	31.4%
	Oman	154	46.2%	53.8%
	Pakistan	110	11.1%	88.9%
	Philippines	27	4.5%	95.5%
	Russian Federation	14	90.9%	9.1%
	Saudi Arabia	10	18.5%	81.5%
	Serbia	96	21.4%	78.6%
	Singapore	51	60.0%	40.0%
	South Africa	23	8.3%	91.7%
	Sweden	114	47.1%	52.9%
	United Arab Emirates	35	47.8%	52.2%
	Total	3346	42.4%	57.6%
All other majors	Albania	36	66.7%	33.3%
	Armenia	88	56.2%	43.8%
	Australia	62	37.1%	62.9%
	Azerbaijan, Republic of	399	63.6%	36.4%
	Bahrain	137	48.6%	51.4%
	Bosnia and Herzegovina	36	36.1%	63.9%
	Bulgaria	74	77.0%	23.0%
	Canada	376	52.1%	47.9%
	Chile	25	24.0%	76.0%
	Chinese Taipei	172	90.7%	9.3%
	Croatia	35	57.1%	42.9%

	Cyprus	9	88.9%	11.1%
	Czech Republic	211	68.2%	31.8%
	Denmark	101	56.4%	43.6%
	England	115	77.8%	22.2%
	Finland	211	63.5%	36.5%
	France	32	39.8%	60.2%
	Georgia	52	40.6%	59.4%
	Germany	68	61.5%	38.5%
	Hong Kong, SAR	8	91.2%	8.8%
	Hungary	789	62.5%	37.5%
	Iran, Islamic Republic of	59	24.2%	75.8%
	Ireland	238	76.3%	23.7%
	Italy	90	72.3%	27.7%
	Japan	30	91.1%	8.9%
	Kazakhstan	36	56.7%	43.3%
	Korea, Republic of	251	88.9%	11.1%
	Kuwait	82	12.7%	87.3%
	Latvia	38	70.7%	29.3%
	Lithuania	250	63.2%	36.8%
	Malta	8	70.8%	29.2%
	Montenegro	283	75.0%	25.0%
	Morocco	223	4.9%	95.1%
	New Zealand	74	35.1%	64.9%
	North Macedonia	20	41.3%	58.7%
	Northern Ireland	90	70.9%	29.1%
	Norway	201	85.0%	15.0%
	Oman	402	27.4%	72.6%
	Pakistan	21	6.7%	93.3%
	Philippines	401	0.5%	99.5%
	Poland	42	60.9%	39.1%
	Portugal	350	52.4%	47.6%
	Qatar	16	17.0%	83.0%
	Russian Federation	171	88.1%	11.9%
	Saudi Arabia	86	12.9%	87.1%
	Serbia	576	62.5%	37.5%
	Singapore	189	80.1%	19.9%
	Slovak Republic	35	45.3%	54.7%
	South Africa	1254	6.9%	93.1%
	Spain	215	60.8%	39.2%
	Sweden	104	25.7%	74.3%
	Turkey	391	47.9%	52.1%
	United Arab Emirates	126	45.4%	54.6%
	United States	134	56.5%	43.5%
	Total	9522	43.5%	56.5%
Major in mathematics but not education	Albania	22	77.3%	22.7%
	Armenia	61	63.4%	36.6%
	Australia	30	6.7%	93.3%
	Azerbaijan, Republic of	100	60.7%	39.3%

Bahrain	41	44.0%	56.0%
Bosnia and Herzegovina	31	22.6%	77.4%
Bulgaria	8	75.0%	25.0%
Canada	68	45.6%	54.4%
Chile	16	37.5%	62.5%
Chinese Taipei	30	90.0%	10.0%
Cyprus	13	53.8%	46.2%
Czech Republic	25	36.0%	64.0%
Denmark	200	60.0%	40.0%
England	2	87.5%	12.5%
Finland	139	0.0%	100.0%
France	8	41.0%	59.0%
Georgia	20	87.5%	12.5%
Germany	11	65.0%	35.0%
Hong Kong, SAR	63	100.0%	0.0%
Iran, Islamic Republic of	18	33.3%	66.7%
Ireland	62	88.9%	11.1%
Italy	16	61.3%	38.7%
Japan	79	75.0%	25.0%
Kuwait	16	22.8%	77.2%
Latvia	1	100.0%	0.0%
Lithuania	27	100.0%	0.0%
Malta	23	55.6%	44.4%
Montenegro	71	43.5%	56.5%
Morocco	167	5.6%	94.4%
Netherlands	5	100.0%	0.0%
New Zealand	14	50.0%	50.0%
North Macedonia	32	17.5%	82.5%
Northern Ireland	35	86.7%	13.3%
Norway	30	71.9%	28.1%
Oman	189	19.2%	80.8%
Pakistan	8	5.7%	94.3%
Philippines	82	3.3%	96.7%
Poland	4	59.8%	40.2%
Portugal	105	75.0%	25.0%
Qatar	11	17.1%	82.9%
Russian Federation	191	100.0%	0.0%
Saudi Arabia	17	12.4%	87.6%
Serbia	255	63.6%	36.4%
Singapore	43	95.3%	4.7%
Slovak Republic	33	23.5%	76.5%
South Africa	375	6.7%	93.3%
Spain	77	79.1%	20.9%
Sweden	40	45.5%	54.5%
Turkey	44	24.7%	75.3%
United Arab Emirates	8	45.6%	54.4%
United States	15	65.9%	34.1%
Total	2981	43.7%	56.3%

Major in education but not mathematics	Albania	796	51.1%	48.9%
	Armenia	310	57.7%	42.3%
	Australia	982	56.7%	43.3%
	Azerbaijan, Republic of	133	63.2%	36.8%
	Bahrain	111	51.1%	48.9%
	Bosnia and Herzegovina	864	33.2%	66.8%
	Bulgaria	865	61.2%	38.8%
	Canada	1953	53.7%	46.3%
	Chile	480	21.0%	79.0%
	Chinese Taipei	232	91.4%	8.6%
	Croatia	1012	62.6%	37.4%
	Cyprus	510	66.5%	33.5%
	Czech Republic	804	72.9%	27.1%
	Denmark	68	64.7%	35.3%
	England	1132	72.8%	27.2%
	Finland	201	69.1%	30.9%
	France	27	43.8%	56.2%
	Georgia	168	55.6%	44.4%
	Germany	173	60.1%	39.9%
	Hong Kong, SAR	743	91.3%	8.7%
	Hungary	826	62.4%	37.6%
	Iran, Islamic Republic of	1074	29.1%	70.9%
	Ireland	90	78.2%	21.8%
	Italy	435	78.9%	21.1%
	Japan	607	89.0%	11.0%
	Kazakhstan	818	62.6%	37.4%
	Korea, Republic of	282	89.7%	10.3%
	Kosovo	112	31.6%	68.4%
	Kuwait	535	21.4%	78.6%
	Latvia	887	82.4%	17.6%
	Lithuania	462	72.6%	27.4%
	Malta	817	57.8%	42.2%
	Montenegro	101	38.3%	61.7%
	Morocco	193	7.9%	92.1%
	New Zealand	1068	40.8%	59.2%
	North Macedonia	140	37.4%	62.6%
	Northern Ireland	83	81.1%	18.9%
	Norway	423	72.1%	27.9%
	Oman	174	23.8%	76.2%
	Pakistan	750	6.0%	94.0%
	Philippines	123	3.3%	96.7%
	Poland	606	57.5%	42.5%
	Portugal	185	64.8%	35.2%
	Qatar	707	17.1%	82.9%
	Russian Federation	163	89.4%	10.6%
	Saudi Arabia	600	9.7%	90.3%
	Serbia	557	61.7%	38.3%
	Singapore	1324	85.3%	14.7%

	Slovak Republic	120	61.2%	38.8%
	South Africa	1138	8.3%	91.7%
	Spain	213	59.1%	40.9%
	Sweden	388	51.7%	48.3%
	Turkey	1722	53.5%	46.5%
	United Arab Emirates	338	34.4%	65.6%
	United States	609	64.2%	35.8%
	Total	30234	56.9%	43.1%
Major in education and mathematics	Albania	149	52.3%	47.7%
	Armenia	486	57.6%	42.4%
	Australia	173	60.1%	39.9%
	Azerbaijan, Republic of	178	68.7%	31.3%
	Bahrain	465	44.4%	55.6%
	Bosnia and Herzegovina	693	33.8%	66.2%
	Bulgaria	76	68.4%	31.6%
	Canada	352	48.6%	51.4%
	Chile	402	19.4%	80.6%
	Chinese Taipei	138	92.8%	7.2%
	Croatia	180	66.7%	33.3%
	Cyprus	205	67.3%	32.7%
	Czech Republic	10	90.0%	10.0%
	Denmark	124	62.9%	37.1%
	England	95	74.2%	25.8%
	Finland	107	75.8%	24.2%
	France	442	32.7%	67.3%
	Georgia	296	45.7%	54.3%
	Germany	221	60.1%	39.9%
	Hong Kong, SAR	30	89.6%	10.4%
	Hungary	234	50.0%	50.0%
	Iran, Islamic Republic of	165	23.9%	76.1%
	Ireland	45	76.4%	23.6%
	Italy	116	57.8%	42.2%
	Japan	751	88.8%	11.2%
	Kazakhstan	149	64.6%	35.4%
	Korea, Republic of	253	91.3%	8.7%
	Kosovo	178	22.9%	77.1%
	Kuwait	264	19.7%	80.3%
	Latvia	198	77.3%	22.7%
	Lithuania	217	68.2%	31.8%
	Malta	661	59.0%	41.0%
	Montenegro	23	34.2%	65.8%
	Morocco	594	0.0%	100.0%
	Netherlands	175	82.3%	17.7%
	New Zealand	129	41.1%	58.9%
	North Macedonia	311	36.8%	63.2%
	Northern Ireland	168	83.6%	16.4%
	Norway	56	74.6%	25.4%
	Oman	15	25.9%	74.1%

	Pakistan	612	21.4%	78.6%
	Philippines	137	1.8%	98.2%
	Poland	515	40.0%	60.0%
	Portugal	55	66.7%	33.3%
	Qatar	654	26.3%	73.7%
	Russian Federation	598	87.6%	12.4%
	Saudi Arabia	282	12.7%	87.3%
	Serbia	422	56.9%	43.1%
	Singapore	450	89.1%	10.9%
	Slovak Republic	560	50.0%	50.0%
	South Africa	835	9.0%	91.0%
	Spain	121	63.3%	36.7%
	Sweden	68	58.0%	42.0%
	Turkey	205	54.5%	45.5%
	United Arab Emirates	97	37.5%	62.5%
	United States	140	70.7%	29.3%
		15275		
	Total	1187	54.0%	46.0%
Total	Albania	1076	52.4%	47.6%
	Armenia	1247	54.7%	45.3%
	Australia	810	55.0%	45.0%
	Azerbaijan, Republic of	1238	66.5%	33.5%
	Bahrain	1633	47.5%	52.5%
	Bosnia and Herzegovina	1023	33.4%	66.6%
	Bulgaria	2749	63.0%	37.0%
	Canada	923	52.6%	47.4%
	Chile	572	20.7%	79.3%
	Chinese Taipei	1229	91.4%	8.6%
	Croatia	737	63.0%	37.0%
	Cyprus	1120	66.8%	33.2%
	Czech Republic	523	71.5%	28.5%
	Denmark	1347	61.0%	39.0%
	England	688	74.3%	25.7%
	Finland	509	69.0%	31.0%
	France	536	39.8%	60.2%
	Georgia	473	46.6%	53.4%
	Germany	784	60.4%	39.6%
	Hong Kong, SAR	1936	90.7%	9.3%
	Hungary	1317	61.9%	38.1%
	Iran, Islamic Republic of	1202	26.8%	73.2%
	Ireland	657	78.1%	21.9%
	Italy	1390	67.1%	32.9%
	Japan	1003	88.9%	11.1%
	Kazakhstan	605	63.5%	36.5%
	Korea, Republic of	645	89.9%	10.1%
	Kosovo	897	29.1%	70.9%
	Kuwait	1124	17.4%	82.6%
	Latvia	1014	80.2%	19.8%

Lithuania	1509	71.5%	28.5%
Malta	946	61.0%	39.0%
Montenegro	1190	36.8%	63.2%
Morocco	193	7.6%	92.4%
Netherlands	1285	81.3%	18.7%
New Zealand	503	40.6%	59.4%
North Macedonia	701	36.1%	63.9%
Northern Ireland	864	79.6%	20.4%
Norway	780	74.2%	25.8%
Oman	1391	25.1%	74.9%
Pakistan	743	12.1%	87.9%
Philippines	1277	2.8%	97.2%
Poland	722	59.5%	40.5%
Portugal	1402	65.5%	34.5%
Qatar	1133	18.7%	81.3%
Russian Federation	985	88.8%	11.2%
Saudi Arabia	1906	12.2%	87.8%
Serbia	2006	59.1%	40.9%
Singapore	799	88.0%	12.0%
Slovak Republic	3625	55.9%	44.1%
South Africa	626	7.8%	92.2%
Spain	714	60.7%	39.3%
Sweden	2362	54.4%	45.6%
Turkey	569	48.2%	51.8%
United Arab Emirates	933	40.2%	59.8%
United States	61358	63.5%	36.5%
Total	184	52.7%	47.3%

Appendix 7. The percentage of resilient and non-resilient students in science based on teachers' major or main area of study.

Teacher major/main area of study	Country	Number of students	Resilient	Non-Resilient
No formal education beyond upper secondary	Albania	184	51.6%	48.4%
	Armenia	131	32.4%	67.6%
	Azerbaijan, Republic of	484	23.7%	76.3%
	Bosnia and Herzegovina	9	22.2%	77.8%
	Croatia	2	0.0%	100.0%
	Czech Republic	70	65.7%	34.3%
	Denmark	30	53.3%	46.7%
	Finland	3	33.3%	66.7%
	France	30	36.7%	63.3%
	Hungary	3	33.3%	66.7%
	Iran, Islamic Republic of	24	50.0%	50.0%
	Ireland	1	100.0%	0.0%
	Italy	767	63.1%	36.9%
	Kazakhstan	2	0.0%	100.0%
	Kosovo	70	27.1%	72.9%
	Kuwait	25	16.0%	84.0%
	Malta	58	56.9%	43.1%
	Morocco	468	15.0%	85.0%
	Netherlands	13	53.8%	46.2%
	North Macedonia	13	14.0%	86.0%
	Northern Ireland	325	48.6%	51.4%
	Oman	154	38.5%	61.5%
	Pakistan	110	11.7%	88.3%
	Philippines	27	0.6%	99.4%
	Russian Federation	14	90.0%	10.0%
	Saudi Arabia	10	14.8%	85.2%
	Serbia	96	21.4%	78.6%
	Singapore	51	50.0%	50.0%
	South Africa	23	2.1%	97.9%
	Sweden	114	60.8%	39.2%
	United Arab Emirates	35	43.5%	56.5%
	Total	3346	36.5%	63.5%
All other majors	Albania	20	60.0%	40.0%
	Armenia	114	30.4%	69.6%
	Australia	48	56.3%	43.8%
	Azerbaijan, Republic of	60	17.5%	82.5%
	Bahrain	56	53.3%	46.7%
	Bosnia and Herzegovina	53	35.8%	64.2%
	Bulgaria	36	86.1%	13.9%
	Canada	323	62.5%	37.5%
	Chile	33	45.5%	54.5%
	Chinese Taipei	103	87.4%	12.6%
	Croatia	23	78.3%	21.7%

	Cyprus	20	70.0%	30.0%
	Czech Republic	126	69.8%	30.2%
	Denmark	143	54.5%	45.5%
	England	105	68.5%	31.5%
	Finland	169	72.4%	27.6%
	France	15	31.4%	68.6%
	Georgia	28	40.0%	60.0%
	Germany	67	35.7%	64.3%
	Hong Kong, SAR	3	67.2%	32.8%
	Hungary	779	100.0%	0.0%
	Iran, Islamic Republic of	57	25.0%	75.0%
	Ireland	242	61.4%	38.6%
	Italy	90	73.1%	26.9%
	Japan	20	84.4%	15.6%
	Kazakhstan	25	45.0%	55.0%
	Korea, Republic of	38	96.0%	4.0%
	Kuwait	23	7.9%	92.1%
	Latvia	28	87.0%	13.0%
	Lithuania	204	42.9%	57.1%
	Malta	17	63.2%	36.8%
	Montenegro	215	58.8%	41.2%
	Morocco	59	9.3%	90.7%
	New Zealand	79	45.6%	54.4%
	North Macedonia	28	37.1%	62.9%
	Northern Ireland	63	61.1%	38.9%
	Norway	192	64.3%	35.7%
	Oman	107	20.3%	79.7%
	Pakistan	21	6.3%	93.7%
	Philippines	55	0.5%	99.5%
	Poland	31	69.2%	30.8%
	Portugal	102	47.6%	52.4%
	Qatar	19	21.8%	78.2%
	Russian Federation	103	96.8%	3.2%
	Saudi Arabia	42	21.6%	78.4%
	Serbia	482	57.9%	42.1%
	Singapore	169	71.8%	28.2%
	Slovak Republic	35	50.0%	50.0%
	South Africa	281	5.2%	94.8%
	Spain	33	64.5%	35.5%
	Sweden	89	34.3%	65.7%
	Turkey	354	39.4%	60.6%
	United Arab Emirates	108	33.8%	66.2%
	United States	131	61.6%	38.4%
	Total	5866	43.5%	56.5%
Major in science but not education	Albania	40	67.5%	32.5%
	Armenia	42	39.5%	60.5%
	Australia	44	22.7%	77.3%
	Azerbaijan, Republic of	534	38.1%	61.9%

Bahrain	124	49.8%	50.2%
Bosnia and Herzegovina	14	7.1%	92.9%
Bulgaria	62	56.5%	43.5%
Canada	121	57.9%	42.1%
Chile	9	44.4%	55.6%
Chinese Taipei	87	79.3%	20.7%
Croatia	12	75.0%	25.0%
Cyprus	3	66.7%	33.3%
Czech Republic	110	63.6%	36.4%
Denmark	155	57.4%	42.6%
England	12	81.5%	18.5%
Finland	253	83.3%	16.7%
France	25	44.7%	55.3%
Georgia	49	36.0%	64.0%
Germany	25	73.5%	26.5%
Hong Kong, SAR	5	60.0%	40.0%
Hungary	73	40.0%	60.0%
Iran, Islamic Republic of	13	43.8%	56.2%
Ireland	54	92.3%	7.7%
Italy	30	61.1%	38.9%
Japan	3	80.0%	20.0%
Kazakhstan	11	100.0%	0.0%
Korea, Republic of	327	90.9%	9.1%
Kuwait	81	23.2%	76.8%
Latvia	14	79.0%	21.0%
Lithuania	59	64.3%	35.7%
Malta	14	67.8%	32.2%
Montenegro	302	50.0%	50.0%
Morocco	387	12.3%	87.7%
New Zealand	13	84.6%	15.4%
North Macedonia	24	12.8%	87.2%
Northern Ireland	69	62.5%	37.5%
Norway	66	79.2%	20.8%
Oman	483	23.8%	76.2%
Pakistan	8	8.7%	91.3%
Philippines	481	1.5%	98.5%
Poland	15	67.1%	32.9%
Portugal	383	50.0%	50.0%
Qatar	8	18.1%	81.9%
Russian Federation	263	100.0%	0.0%
Saudi Arabia	67	14.9%	85.1%
Serbia	371	75.0%	25.0%
Singapore	67	89.0%	11.0%
Slovak Republic	33	38.8%	61.2%
South Africa	1484	6.2%	93.8%
Spain	290	71.6%	28.4%
Sweden	39	54.5%	45.5%
Turkey	81	56.6%	43.4%

	United Arab Emirates	27	43.5%	56.5%
	United States	24	63.0%	37.0%
	Total	7390	42.3%	57.7%
Major in education but not science	Albania	755	52.1%	47.9%
	Armenia	351	34.3%	65.7%
	Australia	939	69.1%	30.9%
	Azerbaijan, Republic of	12	25.6%	74.4%
	Bahrain	280	25.0%	75.0%
	Bosnia and Herzegovina	846	35.8%	64.2%
	Bulgaria	867	58.8%	41.2%
	Canada	1920	66.7%	33.3%
	Chile	526	31.9%	68.1%
	Chinese Taipei	202	79.7%	20.3%
	Croatia	886	74.6%	25.4%
	Cyprus	507	56.0%	44.0%
	Czech Republic	779	74.2%	25.8%
	Denmark	101	56.4%	43.6%
	England	1096	72.4%	27.6%
	Finland	188	80.7%	19.3%
	France	20	47.3%	52.7%
	Georgia	163	35.0%	65.0%
	Germany	264	49.7%	50.3%
	Hong Kong, SAR	714	65.2%	34.8%
	Hungary	834	65.4%	34.6%
	Iran, Islamic Republic of	1096	30.8%	69.2%
	Ireland	114	73.2%	26.8%
	Italy	408	69.3%	30.7%
	Japan	740	82.4%	17.6%
	Kazakhstan	818	48.0%	52.0%
	Korea, Republic of	293	90.7%	9.3%
	Kosovo	30	25.9%	74.1%
	Kuwait	433	16.7%	83.3%
	Latvia	881	84.8%	15.2%
	Lithuania	487	69.8%	30.2%
	Malta	884	51.7%	48.3%
	Montenegro	83	36.8%	63.2%
	Morocco	150	12.0%	88.0%
	New Zealand	1054	46.8%	53.2%
	North Macedonia	246	21.6%	78.4%
	Northern Ireland	53	70.8%	29.2%
	Norway	399	66.7%	33.3%
	Oman	14	30.7%	69.3%
	Pakistan	832	3.8%	96.2%
	Philippines	42	1.0%	99.0%
	Poland	619	64.3%	35.7%
	Portugal	36	57.3%	42.7%
	Qatar	758	31.0%	69.0%
	Russian Federation	121	91.3%	8.7%

	Saudi Arabia	609	11.1%	88.9%
	Serbia	374	66.1%	33.9%
	Singapore	1245	76.0%	24.0%
	Slovak Republic	174	67.7%	32.3%
	South Africa	622	6.4%	93.6%
	Spain	10	64.1%	35.9%
	Sweden	319	59.2%	40.8%
	Turkey	1688	70.0%	30.0%
	United Arab Emirates	319	22.2%	77.8%
	United States	624	68.1%	31.9%
	Total	28825	58.6%	41.4%
Major in education and science	Albania	168	54.2%	45.8%
	Armenia	418	37.2%	62.8%
	Australia	213	71.4%	28.6%
	Azerbaijan, Republic of	330	25.1%	74.9%
	Bahrain	296	47.6%	52.4%
	Bosnia and Herzegovina	680	39.0%	61.0%
	Bulgaria	74	68.9%	31.1%
	Canada	376	63.6%	36.4%
	Chile	337	35.3%	64.7%
	Chinese Taipei	170	84.7%	15.3%
	Croatia	306	78.1%	21.9%
	Cyprus	208	56.3%	43.8%
	Czech Republic	35	68.6%	31.4%
	Denmark	89	64.0%	36.0%
	England	132	64.0%	36.0%
	Finland	119	75.0%	25.0%
	France	444	39.5%	60.5%
	Georgia	296	30.2%	69.8%
	Germany	130	56.4%	43.6%
	Hong Kong, SAR	59	60.8%	39.2%
	Hungary	213	61.0%	39.0%
	Iran, Islamic Republic of	152	25.4%	74.6%
	Ireland	21	71.1%	28.9%
	Italy	143	66.7%	33.3%
	Japan	618	85.3%	14.7%
	Kazakhstan	149	48.2%	51.8%
	Korea, Republic of	192	91.9%	8.1%
	Kosovo	266	18.2%	81.8%
	Kuwait	364	28.9%	71.1%
	Latvia	198	82.7%	17.3%
	Lithuania	192	65.7%	34.3%
	Malta	575	50.5%	49.5%
	Montenegro	41	36.2%	63.8%
	Morocco	623	7.3%	92.7%
	Netherlands	76	71.1%	28.9%
	New Zealand	140	51.4%	48.6%
	North Macedonia	205	15.6%	84.4%

	Northern Ireland	184	63.2%	36.8%
	Norway	76	76.1%	23.9%
	Oman	182	31.6%	68.4%
	Pakistan	524	23.4%	76.6%
	Philippines	218	5.3%	94.7%
	Poland	499	65.9%	34.1%
	Portugal	222	61.1%	38.9%
	Qatar	603	26.6%	73.4%
	Russian Federation	637	91.2%	8.8%
	Saudi Arabia	279	10.8%	89.2%
	Serbia	605	64.7%	35.3%
	Singapore	533	81.6%	18.4%
	Slovak Republic	498	53.4%	46.6%
	South Africa	1356	6.8%	93.2%
	Spain	325	66.8%	33.2%
	Sweden	64	65.1%	34.9%
	Turkey	239	56.9%	43.1%
	United Arab Emirates	111	39.2%	60.8%
	United States	125	70.7%	29.3%
	Total	16328	51.1%	48.9%
Total	Albania	1167	53.0%	47.0%
	Armenia	1056	34.6%	65.4%
	Australia	1244	67.4%	32.6%
	Azerbaijan, Republic of	936	24.8%	75.2%
	Bahrain	1240	48.9%	51.1%
	Bosnia and Herzegovina	1602	36.8%	63.2%
	Bulgaria	1039	60.3%	39.7%
	Canada	2740	65.4%	34.6%
	Chile	905	33.8%	66.2%
	Chinese Taipei	562	82.6%	17.4%
	Croatia	1229	75.4%	24.6%
	Cyprus	738	56.5%	43.5%
	Czech Republic	1120	72.0%	28.0%
	Denmark	518	57.3%	42.7%
	England	1348	70.4%	29.6%
	Finland	759	79.4%	20.6%
	France	504	41.2%	58.8%
	Georgia	536	31.0%	69.0%
	Germany	486	54.9%	45.1%
	Hong Kong, SAR	784	64.0%	36.0%
	Hungary	1923	64.9%	35.1%
	Iran, Islamic Republic of	1319	28.6%	71.4%
	Ireland	1198	72.6%	27.4%
	Italy	671	65.7%	34.3%
	Japan	1383	83.2%	16.8%
	Kazakhstan	1003	48.1%	51.9%
	Korea, Republic of	555	91.0%	9.0%
	Kosovo	686	23.4%	76.6%

Kuwait	901	24.1%	75.9%
Latvia	1121	83.5%	16.5%
Lithuania	1000	68.3%	31.7%
Malta	1490	55.1%	44.9%
Montenegro	1109	36.9%	63.1%
Morocco	1232	12.6%	87.4%
Netherlands	89	68.5%	31.5%
New Zealand	1286	47.6%	52.4%
North Macedonia	503	21.3%	78.7%
Northern Ireland	694	67.4%	32.6%
Norway	887	71.0%	29.0%
Oman	786	28.6%	71.4%
Pakistan	1385	13.4%	86.6%
Philippines	796	1.2%	98.8%
Poland	1274	67.0%	33.0%
Portugal	770	58.6%	41.4%
Qatar	1402	21.4%	78.6%
Russian Federation	1134	91.4%	8.6%
Saudi Arabia	997	14.4%	85.6%
Serbia	1928	65.0%	35.0%
Singapore	2014	81.6%	18.4%
Slovak Republic	791	61.0%	39.0%
South Africa	3766	6.0%	94.0%
Spain	658	65.1%	34.9%
Sweden	625	61.7%	38.3%
Turkey	2362	56.1%	43.9%
United Arab Emirates	565	37.7%	62.3%
United States	939	67.2%	32.8%
Total	61755	52.0%	48.0%

Appendix 8. The percentage of resilient and non-resilient students in mathematics based on teachers' hours of professional development.

Country	Resilient					Non-Resilient				
	None	Less than 6 hours	6—15 hours	16—35 hours	More than 35 hours	None	Less than 6 hours	6—15 hours	16—35 hours	More than 35 hours
Albania	24.2%	26.7%	29.4%	12.9%	6.7%	20.9%	28.6%	30.1%	13.4%	7.1%
Armenia	50.2%	7.7%	21.7%	12.3%	8.0%	53.4%	5.4%	23.6%	8.8%	8.8%
Australia	19.1%	32.8%	28.0%	12.1%	7.9%	25.7%	29.8%	28.3%	9.6%	6.6%
Austria	17.5%	30.9%	36.1%	11.7%	3.7%	24.7%	37.5%	29.8%	5.0%	3.0%
Azerbaijan, Republic of	35.8%	17.3%	19.5%	19.0%	8.4%	38.2%	14.2%	19.7%	20.1%	7.9%
Bahrain	0.0%	33.3%	23.8%	28.6%	14.3%	0.0%	43.5%	21.7%	13.0%	21.7%
Belgium (Flemish)	30.7%	39.1%	24.6%	5.0%	0.6%	31.3%	40.8%	22.8%	4.8%	0.3%
Bosnia and Herzegovina	56.7%	28.8%	10.3%	3.0%	1.2%	58.4%	28.6%	9.1%	2.7%	1.2%
Bulgaria	42.5%	19.3%	16.1%	14.2%	7.8%	50.1%	16.7%	12.7%	15.7%	4.7%
Canada	16.5%	27.4%	31.2%	15.4%	9.5%	14.7%	24.1%	34.1%	17.4%	9.7%
Chile	18.1%	18.1%	16.4%	21.6%	25.9%	24.3%	14.3%	19.4%	19.6%	22.4%
Chinese Taipei	9.9%	22.5%	60.6%	7.0%	0.0%	42.9%	0.0%	42.9%	0.0%	14.3%
Croatia	19.5%	43.9%	33.4%	3.2%	0.0%	24.7%	42.3%	28.6%	3.9%	0.4%
Cyprus	9.9%	42.8%	40.5%	4.1%	2.7%	12.6%	37.9%	45.6%	2.9%	1.0%
Czech Republic	19.0%	22.6%	31.7%	13.5%	13.3%	20.2%	27.0%	27.0%	21.4%	4.4%
Denmark	33.1%	22.7%	24.3%	6.6%	13.3%	38.9%	10.6%	27.4%	11.5%	11.5%
England	2.6%	17.5%	43.9%	32.7%	3.2%	1.0%	16.5%	40.2%	40.2%	2.1%
Finland	63.3%	23.9%	9.2%	1.9%	1.7%	56.4%	30.0%	11.1%	1.5%	1.0%
France	20.2%	19.0%	51.8%	6.3%	2.7%	14.3%	22.7%	50.3%	10.9%	1.8%
Georgia	11.4%	7.6%	33.3%	19.8%	27.8%	17.8%	8.1%	34.8%	17.4%	21.9%
Germany	41.3%	16.5%	29.6%	9.7%	2.9%	28.0%	21.6%	24.0%	21.6%	4.8%
Hong Kong, SAR	4.7%	17.4%	52.3%	16.3%	9.3%	12.5%	12.5%	50.0%	12.5%	12.5%
Hungary	36.2%	22.7%	18.2%	10.5%	12.4%	38.9%	19.7%	17.2%	12.6%	11.6%
Iran, Islamic Republic of	20.6%	16.9%	23.5%	18.1%	20.9%	15.0%	17.2%	23.7%	19.0%	25.2%
Ireland	28.9%	28.0%	21.9%	8.1%	13.0%	27.9%	34.0%	19.6%	9.5%	8.9%
Italy	24.0%	12.1%	20.7%	25.8%	17.5%	27.3%	11.3%	20.6%	22.3%	18.5%
Japan	31.1%	35.8%	16.3%	15.3%	1.5%	31.5%	35.2%	18.5%	14.8%	0.0%
Kazakhstan	18.5%	20.5%	19.5%	12.7%	28.7%	22.5%	16.9%	24.0%	15.0%	21.7%
Korea, Republic of	38.7%	25.7%	20.3%	11.0%	4.4%	41.4%	34.3%	11.4%	7.1%	5.7%
Kosovo	38.4%	7.0%	13.9%	13.4%	27.3%	36.7%	8.1%	16.7%	12.6%	25.9%
Latvia	15.1%	19.0%	37.6%	21.2%	7.2%	18.4%	13.6%	39.8%	22.3%	5.8%
Lithuania	25.2%	23.9%	39.0%	10.5%	1.4%	24.4%	25.6%	37.7%	9.6%	2.8%
Malta	8.5%	29.0%	39.7%	16.4%	6.4%	4.3%	33.7%	43.7%	9.1%	9.1%
Montenegro	32.3%	10.0%	32.0%	18.3%	7.4%	34.7%	14.6%	30.0%	14.4%	6.5%
Morocco	48.4%	20.3%	4.6%	20.3%	6.5%	49.6%	30.3%	9.4%	4.5%	6.2%
Netherlands	38.9%	22.2%	11.9%	16.8%	10.2%	39.0%	20.7%	15.2%	17.1%	7.9%
New Zealand	20.6%	28.7%	26.1%	16.3%	8.3%	20.7%	24.3%	28.1%	15.3%	11.6%
North Macedonia	46.3%	18.4%	20.3%	9.2%	5.7%	41.8%	18.6%	28.4%	8.3%	3.0%
Northern Ireland	20.7%	38.7%	29.9%	7.5%	3.2%	20.9%	38.8%	29.1%	8.7%	2.4%
Norway	35.0%	24.2%	27.5%	4.6%	8.8%	35.6%	23.0%	26.4%	5.7%	9.2%
Oman	2.9%	7.7%	36.5%	25.0%	27.9%	6.5%	14.6%	32.0%	20.8%	26.0%

Pakistan	21.9%	20.3%	29.7%	1.6%	26.6%	65.9%	11.2%	10.2%	6.7%	6.0%
Philippines	7.7%	0.0%	23.1%	61.5%	7.7%	16.9%	7.8%	27.3%	19.3%	28.6%
Poland	6.8%	16.5%	27.2%	21.4%	28.2%	0.0%	13.4%	25.4%	25.4%	35.8%
Portugal	34.1%	24.3%	13.9%	16.1%	11.7%	33.3%	20.0%	12.7%	21.0%	12.9%
Qatar	6.1%	21.2%	36.4%	18.2%	18.2%	4.0%	14.7%	37.3%	17.3%	26.7%
Russian Federation	8.6%	14.5%	28.6%	19.2%	29.1%	12.7%	14.1%	22.5%	27.5%	23.2%
Saudi Arabia	11.1%	0.0%	66.7%	11.1%	11.1%	0.9%	24.8%	15.4%	39.3%	19.7%
Serbia	19.1%	18.4%	37.9%	16.6%	8.0%	23.1%	21.1%	30.3%	16.7%	8.8%
Singapore	1.0%	17.4%	38.5%	21.1%	22.1%	0.0%	14.3%	38.1%	38.1%	9.5%
Slovak Republic	42.2%	10.9%	25.6%	11.6%	9.7%	42.9%	18.9%	22.1%	7.7%	8.3%
Spain	23.1%	20.5%	18.6%	12.6%	25.2%	21.7%	18.9%	19.5%	12.6%	27.3%
Sweden	24.7%	34.3%	24.0%	12.0%	5.0%	34.7%	32.2%	19.2%	10.5%	3.3%
United Arab Emirates	15.7%	20.8%	27.7%	15.1%	20.8%	11.4%	24.3%	17.4%	15.7%	31.1%
United States	7.6%	23.4%	31.1%	21.3%	16.6%	7.9%	21.8%	33.7%	20.2%	16.4%
Total	25.7%	23.5%	26.3%	13.6%	10.8%	29.0%	21.8%	23.9%	13.3%	12.0%

Appendix 9. The percentage of resilient and non-resilient students in mathematics based on the classroom management (disorderly behaviour).

Country	Few or no lessons		Some lessons		Most lessons	
	Resilient	Non-Resilient	Resilient	Non-Resilient	Resilient	Non-Resilient
Albania	60.0%	40.0%	51.2%	48.8%	29.2%	70.8%
Armenia	62.5%	37.5%	59.1%	40.9%	43.3%	56.7%
Australia	65.3%	34.7%	60.3%	39.7%	35.1%	64.9%
Austria	85.5%	14.5%	75.7%	24.3%	65.8%	34.2%
Azerbaijan, Republic of	67.3%	32.7%	69.9%	30.1%	63.6%	36.4%
Bahrain	46.2%	53.8%	50.0%	50.0%	40.7%	59.3%
Belgium (Flemish)	78.6%	21.4%	69.8%	30.2%	56.0%	44.0%
Bosnia and Herzegovina	33.6%	66.4%	36.1%	63.9%	28.1%	71.9%
Bulgaria	73.0%	27.0%	65.7%	34.3%	48.5%	51.5%
Canada	60.7%	39.3%	55.3%	44.7%	41.1%	58.9%
Chile	23.1%	76.9%	21.7%	78.3%	21.7%	78.3%
Chinese Taipei	86.8%	13.2%	93.0%	7.0%	91.5%	8.5%
Croatia	62.0%	38.0%	65.0%	35.0%	55.2%	44.8%
Cyprus	80.0%	20.0%	68.0%	32.0%	55.0%	45.0%
Czech Republic	74.1%	25.9%	73.6%	26.4%	58.9%	41.1%
Denmark	59.5%	40.5%	61.8%	38.2%	51.6%	48.4%
England	81.4%	18.6%	78.3%	21.7%	69.4%	30.6%
Finland	72.2%	27.8%	69.9%	30.1%	60.0%	40.0%
France	57.1%	42.9%	42.4%	57.6%	31.2%	68.8%
Georgia	52.1%	47.9%	47.3%	52.7%	28.7%	71.3%
Germany	60.8%	39.2%	61.2%	38.8%	53.4%	46.6%
Hong Kong, SAR	88.8%	11.2%	91.5%	8.5%	87.7%	12.3%
Hungary	64.8%	35.2%	63.4%	36.6%	54.1%	45.9%
Iran, Islamic Republic of	24.3%	75.7%	28.7%	71.3%	28.2%	71.8%
Ireland	83.2%	16.8%	78.4%	21.6%	66.2%	33.8%
Italy	67.8%	32.2%	68.6%	31.4%	63.0%	37.0%
Japan	93.0%	7.0%	88.1%	11.9%	66.7%	33.3%
Kazakhstan	66.3%	33.7%	64.6%	35.4%	51.6%	48.4%
Korea, Republic of	87.5%	12.5%	90.1%	9.9%	96.3%	3.8%
Kosovo	32.4%	67.6%	33.9%	66.1%	18.6%	81.4%
Kuwait	19.0%	81.0%	21.3%	78.7%	14.2%	85.8%
Latvia	87.5%	12.5%	80.1%	19.9%	66.7%	33.3%
Lithuania	74.7%	25.3%	71.8%	28.2%	60.2%	39.8%
Malta	61.3%	38.7%	63.6%	36.4%	52.9%	47.1%
Montenegro	42.1%	57.9%	38.7%	61.3%	21.2%	78.8%
Morocco	11.5%	88.5%	11.1%	88.9%	6.2%	93.8%
Netherlands	73.1%	26.9%	80.5%	19.5%	73.8%	26.2%
New Zealand	58.1%	41.9%	45.1%	54.9%	31.7%	68.3%
North Macedonia	43.6%	56.4%	41.3%	58.7%	22.4%	77.6%
Northern Ireland	84.8%	15.2%	81.2%	18.8%	58.8%	41.2%
Norway	78.3%	21.7%	74.5%	25.5%	63.4%	36.6%
Oman	33.5%	66.5%	23.5%	76.5%	18.9%	81.1%

Pakistan	15.3%	84.7%	10.9%	89.1%	2.6%	97.4%
Philippines	4.3%	95.7%	2.6%	97.4%	0.8%	99.2%
Poland	62.6%	37.4%	63.8%	36.2%	54.0%	46.0%
Portugal	66.1%	33.9%	69.5%	30.5%	52.2%	47.8%
Qatar	26.3%	73.7%	16.3%	83.7%	22.2%	77.8%
Russian Federation	92.3%	7.7%	89.9%	10.1%	82.0%	18.0%
Saudi Arabia	16.7%	83.3%	12.4%	87.6%	9.6%	90.4%
Serbia	60.6%	39.4%	62.6%	37.4%	45.5%	54.5%
Slovak Republic	57.8%	42.2%	58.9%	41.1%	42.0%	58.0%
South Africa	12.0%	88.0%	8.6%	91.4%	6.7%	93.3%
Spain	70.5%	29.5%	64.2%	35.8%	44.6%	55.4%
Sweden	53.5%	46.5%	55.8%	44.2%	47.8%	52.2%
Turkey	61.1%	38.9%	47.4%	52.6%	43.2%	56.8%
United Arab Emirates	48.0%	52.0%	40.4%	59.6%	35.1%	64.9%
United States	73.6%	26.4%	67.1%	32.9%	57.1%	42.9%
Total	55.8%	44.2%	55.1%	44.9%	42.2%	57.8%

Appendix 10. The percentage of resilient and non-resilient students in mathematics based on different levels of clarity of instruction.

Country	Low		Moderate		High	
	Resilient	Non-Resilient	Resilient	Non-Resilient	Resilient	Non-Resilient
Albania	60.0%	40.0%	21.7%	78.3%	53.3%	46.7%
Armenia	47.6%	52.4%	49.4%	50.6%	59.8%	40.2%
Australia	35.3%	64.7%	49.6%	50.4%	59.0%	41.0%
Austria	52.6%	47.4%	72.6%	27.4%	77.3%	22.7%
Azerbaijan, Republic of	26.3%	73.7%	58.0%	42.0%	71.5%	28.5%
Bahrain	31.6%	68.4%	43.3%	56.7%	50.8%	49.2%
Belgium (Flemish)	44.4%	55.6%	69.5%	30.5%	69.5%	30.5%
Bosnia and Herzegovina	13.6%	86.4%	24.3%	75.7%	36.5%	63.5%
Bulgaria	46.9%	53.1%	60.4%	39.6%	66.7%	33.3%
Canada	37.4%	62.6%	50.7%	49.3%	55.1%	44.9%
Chile	12.9%	87.1%	18.1%	81.9%	25.3%	74.7%
Chinese Taipei	72.9%	27.1%	93.9%	6.1%	93.8%	6.3%
Croatia	50.0%	50.0%	61.0%	39.0%	64.9%	35.1%
Cyprus	41.9%	58.1%	62.0%	38.0%	69.0%	31.0%
Czech Republic	60.0%	40.0%	72.8%	27.2%	71.6%	28.4%
Denmark	46.9%	53.1%	60.3%	39.7%	63.0%	37.0%
England	61.2%	38.8%	76.2%	23.8%	78.5%	21.5%
Finland	55.7%	44.3%	70.8%	29.2%	69.8%	30.2%
France	50.0%	50.0%	42.3%	57.7%	40.4%	59.6%
Georgia	18.2%	81.8%	42.7%	57.3%	48.0%	52.0%
Germany	48.8%	51.2%	55.7%	44.3%	61.6%	38.4%
Hong Kong, SAR	88.4%	11.6%	91.1%	8.9%	90.5%	9.5%
Hungary	48.7%	51.3%	49.4%	50.6%	67.2%	32.8%
Iran, Islamic Republic of	9.9%	90.1%	25.4%	74.6%	28.7%	71.3%
Ireland	71.9%	28.1%	76.5%	23.5%	78.7%	21.3%
Italy	57.7%	42.3%	62.4%	37.6%	70.2%	29.8%
Japan	83.1%	16.9%	89.8%	10.2%	89.4%	10.6%
Kazakhstan	80.0%	20.0%	62.5%	37.5%	64.8%	35.2%
Korea, Republic of	76.7%	23.3%	89.5%	10.5%	94.8%	5.2%
Kosovo	19.0%	81.0%	10.7%	89.3%	32.7%	67.3%
Kuwait	13.8%	86.3%	14.9%	85.1%	22.6%	77.4%
Latvia	67.9%	32.1%	75.7%	24.3%	81.7%	18.3%
Lithuania	64.3%	35.7%	69.4%	30.6%	72.2%	27.8%
Malta	37.2%	62.8%	54.3%	45.7%	64.3%	35.7%
Montenegro	6.9%	93.1%	29.6%	70.4%	39.2%	60.8%
Morocco	4.3%	95.7%	11.3%	88.7%	11.0%	89.0%
Netherlands	59.2%	40.8%	79.2%	20.8%	80.3%	19.7%
New Zealand	38.9%	61.1%	37.0%	63.0%	44.4%	55.6%
North Macedonia	13.3%	86.7%	23.4%	76.6%	41.6%	58.4%
Northern Ireland	54.1%	45.9%	76.3%	23.7%	81.9%	18.1%
Norway	68.8%	31.3%	72.7%	27.3%	74.1%	25.9%
Oman	6.1%	93.9%	16.2%	83.8%	29.6%	70.4%

Pakistan	5.2%	94.8%	9.9%	90.1%	12.3%	87.7%
Philippines	0.0%	100.0%	1.7%	98.3%	3.5%	96.5%
Poland	54.7%	45.3%	59.6%	40.4%	63.9%	36.1%
Portugal	44.4%	55.6%	62.3%	37.7%	66.6%	33.4%
Qatar	11.5%	88.5%	10.4%	89.6%	24.1%	75.9%
Russian Federation	73.5%	26.5%	88.3%	11.7%	90.1%	9.9%
Saudi Arabia	3.9%	96.1%	11.0%	89.0%	15.4%	84.6%
Serbia	50.0%	50.0%	51.9%	48.1%	62.4%	37.6%
Singapore	71.9%	28.1%	84.1%	15.9%	92.6%	7.4%
Slovak Republic	54.1%	45.9%	59.6%	40.4%	54.7%	45.3%
South Africa	1.1%	98.9%	5.9%	94.1%	10.3%	89.7%
Spain	38.9%	61.1%	52.3%	47.7%	64.1%	35.9%
Sweden	39.3%	60.7%	55.5%	44.5%	55.1%	44.9%
Turkey	17.1%	82.9%	32.9%	67.1%	58.0%	42.0%
United Arab Emirates	19.8%	80.2%	31.7%	68.3%	46.5%	53.5%
United States	40.9%	59.1%	59.8%	40.2%	68.7%	31.3%
Total	36.7%	63.3%	53.2%	46.8%	55.2%	44.8%

Appendix 11. The percentage of resilient and non-resilient students in science based on different levels of clarity of instruction.

Country	Low		Moderate		High	
	Resilient	Non-Resilient	Resilient	Non-Resilient	Resilient	Non-Resilient
Albania	44.4%	55.6%	27.1%	72.9%	53.5%	46.5%
Armenia	37.0%	63.0%	50.9%	49.1%	59.9%	40.1%
Australia	47.2%	52.8%	56.6%	43.4%	55.7%	44.3%
Austria	64.1%	35.9%	70.4%	29.6%	77.7%	22.3%
Azerbaijan, Republic of	35.0%	65.0%	59.1%	40.9%	71.5%	28.5%
Bahrain	33.3%	66.7%	44.0%	56.0%	51.1%	48.9%
Belgium (Flemish)	53.7%	46.3%	74.2%	25.8%	68.1%	31.9%
Bosnia and Herzegovina	15.8%	84.2%	25.2%	74.8%	36.2%	63.8%
Bulgaria	65.8%	34.2%	59.9%	40.1%	66.5%	33.5%
Canada	43.5%	56.5%	55.9%	44.1%	53.3%	46.7%
Chile	8.0%	92.0%	20.5%	79.5%	24.7%	75.3%
Chinese Taipei	82.7%	17.3%	93.4%	6.6%	92.7%	7.3%
Croatia	45.8%	54.2%	64.6%	35.4%	63.5%	36.5%
Cyprus	68.9%	31.1%	71.0%	29.0%	65.2%	34.8%
Czech Republic	69.1%	30.9%	73.5%	26.5%	70.4%	29.6%
Denmark	54.5%	45.5%	64.4%	35.6%	58.6%	41.4%
England	76.9%	23.1%	79.9%	20.1%	76.2%	23.8%
Finland	56.3%	43.7%	72.1%	27.9%	69.5%	30.5%
France	47.7%	52.3%	45.0%	55.0%	38.1%	61.9%
Georgia	24.2%	75.8%	44.3%	55.7%	47.6%	52.4%
Germany	51.3%	48.7%	58.2%	41.8%	61.1%	38.9%
Hong Kong, SAR	87.3%	12.7%	90.0%	10.0%	93.3%	6.7%
Hungary	45.1%	54.9%	56.6%	43.4%	65.0%	35.0%
Iran, Islamic Republic of	12.1%	87.9%	21.1%	78.9%	28.9%	71.1%
Ireland	87.1%	12.9%	78.5%	21.5%	77.2%	22.8%
Italy	59.1%	40.9%	68.1%	31.9%	67.7%	32.3%
Japan	90.5%	9.5%	87.8%	12.2%	89.7%	10.3%
Kazakhstan	61.5%	38.5%	61.9%	38.1%	65.8%	34.2%
Korea, Republic of	83.5%	16.5%	90.9%	9.1%	91.6%	8.4%
Kosovo	17.2%	82.8%	11.7%	88.3%	33.1%	66.9%
Kuwait	8.2%	91.8%	18.2%	81.8%	21.6%	78.4%
Latvia	77.5%	22.5%	80.3%	19.7%	79.0%	21.0%
Lithuania	63.6%	36.4%	78.6%	21.4%	70.3%	29.7%
Malta	54.7%	45.3%	57.8%	42.2%	62.7%	37.3%
Montenegro	25.0%	75.0%	26.8%	73.2%	40.1%	59.9%
Morocco	3.8%	96.2%	9.1%	90.9%	11.4%	88.6%
Netherlands	65.2%	34.8%	79.4%	20.6%	80.7%	19.3%
New Zealand	43.0%	57.0%	44.6%	55.4%	40.7%	59.3%
North Macedonia	11.5%	88.5%	29.2%	70.8%	42.3%	57.7%
Northern Ireland	73.0%	27.0%	81.3%	18.7%	80.0%	20.0%
Norway	70.3%	29.7%	75.6%	24.4%	73.2%	26.8%
Oman	18.1%	81.9%	12.0%	88.0%	29.3%	70.7%

Pakistan	1.8%	98.2%	8.7%	91.3%	12.9%	87.1%
Philippines	0.0%	100.0%	2.3%	97.7%	3.1%	96.9%
Poland	60.9%	39.1%	63.0%	37.0%	60.9%	39.1%
Portugal	58.8%	41.2%	65.0%	35.0%	65.9%	34.1%
Qatar	10.2%	89.8%	13.0%	87.0%	24.0%	76.0%
Russian Federation	70.0%	30.0%	88.0%	12.0%	90.1%	9.9%
Saudi Arabia	10.3%	89.7%	10.0%	90.0%	15.6%	84.4%
Serbia	46.7%	53.3%	56.8%	43.2%	61.5%	38.5%
Singapore	77.0%	23.0%	88.7%	11.3%	89.8%	10.2%
Slovak Republic	56.9%	43.1%	58.6%	41.4%	54.7%	45.3%
South Africa	4.5%	95.5%	5.6%	94.4%	10.3%	89.7%
Spain	50.0%	50.0%	61.4%	38.6%	62.2%	37.8%
Sweden	42.6%	57.4%	58.5%	41.5%	53.1%	46.9%
Turkey	16.3%	83.7%	34.8%	65.2%	57.6%	42.4%
United Arab Emirates	21.4%	78.6%	28.2%	71.8%	47.1%	52.9%
United States	49.1%	50.9%	63.6%	36.4%	67.4%	32.6%
Total	43.8%	56.2%	55.3%	44.7%	54.4%	45.6%