New Zealand

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Introduction

Overview of Education System

New Zealand has a decentralized education system that has three distinct levels: early childhood, schooling, and tertiary. Authority for operations and financial management is devolved from central government to educational institutions. Responsibility for governance of state or state-integrated schools[b] is assigned to school boards. These boards consist of elected parent and community volunteers, the school principal, a staff representative, and a student representative in secondary schools.

Four organizations play pivotal roles in developing, implementing, and monitoring education policies across New Zealand's schooling sector:

- The Ministry of Education | Te Tāhuhu o te Mātauranga is the government's lead agency for the education system and is responsible for developing a national curriculum, providing policy advice to the government, and monitoring the education system's effectiveness. It also allocates funds and resources and manages a large property portfolio.[1]
- The Education Review Office | Te Tari Arotake Mātauranga evaluates and reports on the education and care of students in schools and early childhood services.[2]
- The New Zealand Qualifications Authority | Mana Tohu Mātauranga o Aotearoa ensures that New Zealand qualifications are nationally and internationally accepted as credible and robust. The authority administers the National Certificate of Educational Achievement (NCEA).[3]
- The Teaching Council of Aotearoa New Zealand | Matatū Aotearoa is the professional and regulatory organization for registered teachers in the early childhood education and schooling sectors.[4]

Early childhood education refers to the education and care of children as young as infants through school-entry age. While early childhood education is not compulsory, most children

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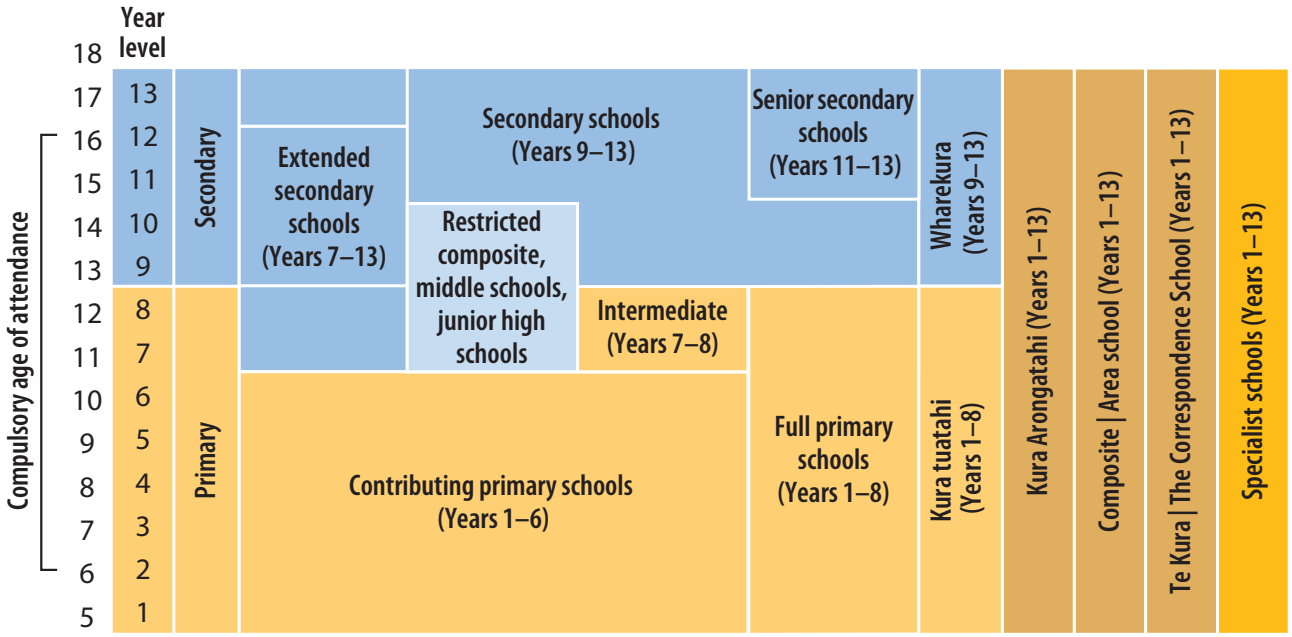
b State-integrated schools are formerly registered private (independent) schools that have integrated into the state education system. These schools are funded by central government and teach the national curriculum, although they can retain their special character.

attend a service before starting primary school.[5,6] Exhibit 1 shows the structure of New Zealand's schooling sector. Schooling is compulsory for all students ages 6 to 16, although most children begin on or soon after their fifth birthday and progress through 13 years of schooling.[7] Schooling is divided into two parts: primary education from entry to Year 8 (typically ages 5 to 12) and secondary education from Years 9 to 13 (typically ages 13 to 18). Secondary schools are comprehensive with no tracking of students into academic or vocational streams. Single-sex education is more prevalent in the secondary sector than in the primary sector, although most secondary school students are enrolled in coeducational schools. The NCEA, New Zealand's official school qualification system for secondary schools, offers subjects across the full breadth of the curriculum, including both academic and vocational subjects.

Exhibit 1: Structure of New Zealand's Schooling Sector[8]



Most New Zealand schools are either state secular or special character state-integrated schools, with all required to implement the national curriculum. In addition, New Zealand has a relatively small number of private (independent) schools run by religious or philosophical organizations, and they are attended by around 4% of primary and secondary school students. Private schools do receive some funding from central government, but most funding is sourced from attendance fees. There is no requirement for private schools to follow the national curriculum.[9]

While most teaching and learning in New Zealand schools is in English, an important feature of the system is Māori-medium education. Māori-medium education is where the curriculum is taught in or through te reo Māori (the Māori language). In 2023, about 3% of all primary and

secondary students were enrolled in Māori-medium education.[10] Pacific language–medium education (e.g., Samoan, Tongan) is also available in some schools.[c]

Specialist education in New Zealand is designed to support both early childhood services and schools to teach students who have a range of disabilities. Most students with high or very high learning needs receive support and specialist teaching to enable them to attend their local schools. There is provision for students who are unable to be accommodated within the regular schooling system to be educated in day or residential specialist schools.

The national curriculum is the official policy for teaching and learning in New Zealand's state and state-integrated schools. It comprises two documents: The *New Zealand Curriculum* (NZC) for English-medium education, introduced in 2007, and *Te Marautanga o Aotearoa* for Māori-medium education, introduced in 2008. The two documents were developed independently and are not translations of each other.[11,12] Each document outlines the education vision, principles, values, key competencies, and learning (subject) areas for learners from school entry to Year 13. Eight learning (subject) areas are described in the NZC, including Mathematics and Statistics, and Science. *Te Marautanga o Aotearoa* describes nine learning areas, including *Pāngarau* (Mathematics) and *Pūtaiao* (Science). Both documents set out broad achievement objectives for each learning area throughout eight progressive levels. There are no specific objectives for students at a given year (grade) level. Each of Levels 1 to 5 covers approximately 2 years of schooling, and each of Levels 6 to 8 is equivalent to about 1 year of schooling. *He Whāriki Mātauranga mō ngā Mokopuna o Aotearoa–Early Childhood Curriculum* is the curriculum document for early childhood education.[13]

Each school has autonomy over how the curriculum is implemented. The curriculum documents offer a framework for schools to develop their own curriculum plans and teaching practices. Each school's board, principal, and teachers are responsible for developing and implementing locally appropriate programs consistent with the principles, values, key competencies, and various achievement objectives. The curriculum recognizes that students are likely to progress at different rates through each learning area, and teachers are therefore expected to adapt their teaching to meet students' needs.

In early 2021, the government announced that the national curriculum would be refreshed to "make it more relevant, easier to use, and more explicitly about what learners need to understand, know and do."[14] At the time of writing, the Ministry of Education was 2 years into a 6-year program to refresh the NZC. It is unlikely that the program would have impacted the mathematics and science teaching and learning at either year (grade) in TIMSS 2023. Implementation of a redesigned Te Marautanga o Aotearoa began in February 2024.[15]

c With one exception, New Zealand has only ever assessed TIMSS students in English. The one exception was TIMSS 2003, when Grade 4 students learning in full immersion settings also took part. However, as second language learners, most of these students had not acquired the mathematical and scientific vocabulary required to complete the TIMSS assessment in the Māori language. There are too few Year 9 students learning in full immersion settings to include them in TIMSS.

Use and Impact of TIMSS

New Zealand has participated in all cycles of TIMSS. Along with the national curriculum monitoring studies, including the former National Monitoring Study of Student Achievement (NMSSA),[d] and other international studies, such as the Programme for International Student Assessment (PISA), TIMSS has provided invaluable longitudinal insights into the performance of students in New Zealand's education system, providing critical monitoring of the "health" of the New Zealand education system in mathematics and science.[16,17] The achievement and contextual data collected are used to inform policy for mathematics and science education, as well as to monitor equity in the provision of education in New Zealand.

The release of the TIMSS 1995 middle primary school results highlighted areas of concern in mathematics and science education in New Zealand. The release, combined with teachers' reports of difficulties implementing the then new curricula, were the impetus for the establishment of the Mathematics and Science Taskforce in 1997.[18] The taskforce's recommendations led to several initiatives, such as the development of specific mathematics and science resources, research seminars to identify key issues in mathematics and science education, assessment tools for mathematics, and professional development programs for primary school teachers that focused on strategies to teach mathematics, particularly number and algebra.

TIMSS 2007 brought attention to gaps in science education, prompting the Education Review Office (ERO) to undertake research about what exemplifies good practices in primary science teaching. As a result, the quality of science teaching at the upper primary level, and more recently at the lower secondary level, has been a focus of the ERO's review for more than a decade since its first report was published.[19,20,21]

In 2009, the government established the Chief Science Advisor role, with the incumbent reporting directly to the prime minister.[e,22] The Chief Science Advisor has been responsible for evaluating and planning the direction of science education in primary and secondary schools, drawing on data from TIMSS.[23] TIMSS data were also used in developing the Science in Society's A Nation of Curious Minds initiative,[f] which aims to encourage and enable better engagement with science and technology by 2024. TIMSS 2023 is likely to be used as a key indicator when monitoring and evaluating the initiative's success.[24]

TIMSS data were an impetus for the creation of the Bullying-Free New Zealand School Framework in 2016. The framework sets out the core elements of successful school approaches to bullying prevention based on evidence of positive impacts when they are implemented consistently.[25]

d A redesigned NMSSA, the Curriculum Insights and Progress Study, has picked up this monitoring function. Building on NMSSA, it aims is to provide greater insight into students' progress across the curriculum. Results from the first collection in 2023 will be available in the second half of 2024.

e Now the Office of the Prime Minister's Chief Science Advisor, its main function is to advise the prime minister on the role of science in decision-making, as well as raising the profile of science in New Zealand.

f For more on A Nation of Curious Minds, see the Special Initiatives in Mathematics and Science Education section.

The current refresh of the NZC's Mathematics and Statistics and Science learning areas draws on a range of national and international evidence, including TIMSS. For example, in 2021, the Royal Society Te Apārangi Expert Advisory Panel on Mathematics and Statistics, established to provide advice to the Ministry of Education, drew extensively on TIMSS as part of its synthesis of evidence for refreshing the Mathematics and Statistics learning area.[26]

Despite the breadth of use, TIMSS data are underused in New Zealand. The challenge for education circles is to move beyond the "bad news" narrative sometimes created by international league tables to one that better recognizes and uses the wealth of trend data collected in TIMSS.

The Mathematics Curriculum in Primary and Lower Secondary Grades[g]

The NZC Mathematics and Statistics learning area is structured around three strands: Number and Algebra, Measurement and Geometry, and Statistics. The following summary details the Level 3 achievement objectives.[27] It is expected that most students will be introduced to or taught each of the following topics or skills by the end of Year 5:

- Number and Algebra—Use a range of additive and simple multiplicative strategies with whole numbers, fractions, decimals (simple), and percentages; know basic multiplication and division facts; know counting sequences for whole numbers; know how many tenths, tens, hundreds, and thousands are in whole numbers; know fractions and percentages in everyday use; record and interpret additive and simple multiplicative strategies using words, diagrams, and symbols, with an understanding of equality; generalize the properties of addition and subtraction with whole numbers; and connect members of sequential patterns with their ordinal position and use tables, graphs, and diagrams to find relationships between successive elements of number and spatial patterns.
- Geometry and Measurement—Use linear scales and whole numbers of metric units for length, area, volume and capacity, weight (mass), angle, temperature, and time; find areas of rectangles and volumes of cuboids by applying multiplication; classify plane shapes and prisms by their spatial features; represent objects with drawings and models; use a coordinate system or the language of direction and distance to specify locations and describe paths; and describe transformations (reflection, rotation, or translation) that have mapped one object onto another.
- Statistics—Gather, sort, and display multivariate categorical and whole-number data and simple time-series data to answer questions; identify patterns and trends in context, within and between datasets; communicate findings using data displays; evaluate the effectiveness of different data displays; and investigate simple situations

g for students learning in English-medium settings

involving elements of chance by comparing experimental results with expectations from models of all outcomes, acknowledging that samples vary.

The following summary details the Level 5 achievement objectives.[28] It is expected that most students will be introduced to or taught each of the following topics or skills by the end of Year 9:

- Number and Algebra—Reason with linear proportions; use prime numbers, common factors and multiples, and powers (including square roots); understand operations on fractions, decimals, percentages, and integers; use rates and ratios; know commonly used fraction, decimal, and percentage conversions; know and apply standard form, significant figures, rounding, and decimal place value; form and solve linear and simple quadratic equations; generalize the properties of operations with fractional numbers and integers; and relate tables, graphs, and equations to linear relationships found in number and spatial patterns.
- Geometry and Measurement—Select and use appropriate metric units for length, area, volume and capacity, weight (mass), temperature, angle, and time, with awareness that measurements are approximate; convert between metric units using decimals; deduce and use formulas to find perimeters and areas of polygons and volumes of prisms; find perimeters and areas of circles and composite shapes; deduce angle properties of intersecting and parallel lines and angle properties of polygons and apply these properties; create accurate nets for simple polyhedra and connect three-dimensional solids with different two-dimensional representations; construct and describe simple loci; interpret points and lines in coordinate planes, including scales and bearings on maps; define and use transformations and describe the invariant properties of figures and objects under these transformations; and apply trigonometric ratios and the Pythagorean theorem in two dimensions.
- Statistics—Determine appropriate variables and measures; consider sources of variation; gather and clean data; use multiple displays, and recategorize data to find patterns, variations, relationships, and trends in multivariate datasets; compare sample distributions visually, using measures of center, spread, and proportion; present a report of findings; evaluate statistical investigations or probability activities undertaken by others, including data collection methods, choice of measures, and validity of findings; compare and describe the variation between theoretical and experimental distributions in situations involving elements of chance; and calculate probabilities, using fractions, percentages, and ratios.

The Science Curriculum in Primary and Lower Secondary Grades[h]

The NZC Science learning area is structured around the overarching, unifying strand Nature of Science and the context strands Physical World, Material World, Living World, and Planet Earth and Beyond, through which students develop their understanding about the nature of science.

The following summary details the Level 3 Science achievement objectives.[29] It is expected that most students will be introduced to or taught each of the following topics or skills by the end of Year 5:

- Nature of Science—Appreciate science as a way of explaining the world and that science knowledge changes over time; identify ways scientists collaborate and provide evidence supporting their ideas; build on prior experiences, working together to share and examine their own and others' knowledge; ask questions, find evidence, explore simple models, and carry out appropriate investigations to develop simple explanations; begin to use a range of scientific symbols, conventions, and vocabulary; engage with a range of science texts and begin to question the purposes for which these texts are constructed; use their growing science knowledge when considering issues of personal concern; and explore various aspects of an issue and make decisions about possible actions.
- Living World—Recognize that there are life processes common to all living things and that these occur in different ways; explain how living things are suited to their particular habitats and how they respond to environmental changes, both natural and human-induced; begin to group plants, animals, and other living things into science-based classifications; and explore how groups of living things in the world have changed over long periods of time and appreciate that some living things in New Zealand are quite different from those in other areas of the world.
- Planet Earth and Beyond—Appreciate that water, air, rocks and soil, and life forms make up our planet, and recognize these as Earth's resources; investigate the water cycle and its effect on climate, landforms, and life; and investigate the components of the solar system, developing an appreciation of the distances between them.
- Physical World—Explore, describe, and represent patterns and trends for everyday examples of physical phenomena, such as movement, forces, electricity and magnetism, light, sound, waves, and heat. For example, identify and describe the effect of forces (contact and noncontact) on the motion of objects; and identify and describe everyday examples of sources of energy, forms of energy, and energy transformations.
- Material World—Group a range of materials in different ways, based on observations and measurements of characteristic chemical and physical properties; compare chemical and physical changes; and relate observed, characteristic chemical and

h for students learning in English-medium settings

physical properties of a range of different materials to technological uses and natural processes.

The following summary details the Level 5 Science achievement objectives.[30] It is expected that most students will be introduced to or taught each of the following topics or skills by the end of Year 9:

- Nature of Science—Understand that scientists' investigations are informed by current scientific theories and aim to collect evidence to be interpreted through processes of logical argument; develop and carry out more complex investigations, including using models; show an increasing awareness of the complexity of working scientifically, including recognition of multiple variables; begin to evaluate the suitability of the investigative methods chosen; use a wider range of science vocabulary, symbols, and conventions; apply their understandings of science to evaluate both popular and scientific texts (including visual and numerical literacy); and develop an understanding of socioscientific issues by gathering relevant scientific information in order to draw evidence-based conclusions and to take action where appropriate.
- Living World—Identify the key structural features and functions involved in the life processes of plants and animals; describe the organization of life at the cellular level; investigate the interdependence of living things (including humans) in an ecosystem; and describe the basic processes by which genetic information is passed from one generation to the next.
- Planet Earth and Beyond—Investigate the composition, structure, and features of the geosphere, hydrosphere, and atmosphere; investigate how heat from the Sun, the Earth, and human activities is distributed around Earth by the geosphere, hydrosphere, and atmosphere; and investigate conditions on the planets and their moons, and the factors affecting them.
- Physical World—Identify and describe the patterns associated with physical phenomena found in simple everyday situations involving movement, forces, electricity and magnetism, light, sound, waves, and heat (e.g., identify and describe energy changes and conservation of energy, simple electrical circuits, and the effect of contact and noncontact on the motion of objects); and explore a technological or biological application of physics.
- Material World—Investigate the chemical and physical properties of different groups of substances, (e.g., acids and bases, fuels, and metals); distinguish between pure substances and mixtures and between elements and compounds; describe the structure of atoms of different elements; distinguish at the particle level between an element and a compound, and a pure substance and a mixture; and link the properties of different groups of substances to the way they are used in society or occur in nature.

Teacher Professional Development Requirements and Programs

Teacher registration with the Teaching Council of Aotearoa New Zealand is mandatory for all teachers employed in New Zealand schools. Upon registration, a teacher receives a practicing certificate, to be renewed every 3 years. To have their practicing certificate renewed, teachers are expected to comply with the Code of Professional Responsibility and Standards for the Teaching Profession.[31] One standard requires that teachers engage in professional learning and adaptively apply this learning in practice. A professional leader must testify that a teacher has undertaken satisfactory professional learning and development at each 3-year certificate renewal.

Specialist secondary mathematics or science teachers are expected to have undertaken tertiary study in these subjects or a related field, as well as completed some tertiary-level mathematics or science papers during their initial teacher education. However, due to the scarcity of secondary teachers in these areas, there may be staff teaching outside their area of specialization.

Schools are responsible for ensuring that teachers participate regularly in professional learning and development (PLD), most of which occurs in school contexts. Beginning in 2017, the funding and delivery model for PLD moved from being nationally focused to being primarily regionally focused but aligned to national PLD priorities.[i] This means individuals, schools, and clusters of schools in a given region access PLD tailored to their specific needs, particularly in relation to their school's student body.[32] PLD using a "for teachers, by teachers" approach is also available through Networks of Expertise comprised of peer-to-peer teaching networks and subject associations.[33]

After a reset in 2020, the national PLD priorities have focused on core curriculum capabilities that promote equity and responsiveness in the education system. The priorities for English-medium settings are cultural capability, local curriculum design, and assessment for learning. The priorities for Māori-medium settings are mātauranga and te reo Māori (Māori values and language), marau ā-kura (localized curricula), and aromatawai (assessment). In 2023, digital fluency was a priority for teachers and leaders in all schools and kura.[j,34]

A range of professional development opportunities, including short courses and webinars, can be found in the Ministry of Education's *Education Gazette*, published fortnightly, and on the gazette website.[35]

i At the time of writing, changes from a regional model toward one that was centrally designed had been signaled.

j In this context, "kura" refers to schools where instruction is in Māori.

Monitoring Student Progress in Mathematics and Science

Other than the national assessments for NCEA qualifications, there is no national testing in New Zealand. Instead, the national monitoring program and international assessment studies are used to provide an overview of achievement at different education levels in the primary school sector. Until 2022, NMSSA, a sample-based study of Years 4 and 8 students, played a pivotal role in monitoring primary school student achievement. In 2023, the Curriculum Insights and Progress Study, also a sample-based study but of Years 3, 6, and 8 students, was first implemented. Like NMSSA, it will provide snapshots of achievement in all NZC learning areas, including Mathematics and Statistics and Science, for students learning in English-medium state and state-integrated primary school settings. It is also designed to provide better measures of student progress, as well as insights about teaching and learning, to support policy development and inform classroom practice.[36] New Zealand's participation in both TIMSS and PISA allow monitoring of New Zealand's students in mathematics and science in an international context.

Schools are, however, required to report to students and their parents on the progress and achievement of individual students at least twice a year.[37] Regulation 21 in *Education (School Boards) Regulations 2020* requires schools to collect, analyze, and report on "good quality" assessment information.[38] While teachers in New Zealand have the freedom to write their own test items, several assessment tools—including norm-referenced tools—are available for teachers to use.[k] The tools commonly used to assess mathematics are Assessment Resource Banks (ARBs), the Electronic Assessment Tools for Teaching and Learning (e-asTTle), and Progressive Achievement Tests (PATs).[39] Tools available to assess science include ARBs and Junior Science: Thinking With Evidence.[40]

Exemplars are also provided for the curriculum to illustrate expected outcomes relative to curricular levels. These preprepared tasks and tests use a variety of formats, including multiple-choice, constructed response, and practical open-ended tasks.

From Year 11 onward, most students complete the NCEA, a three-level qualification that is also used to assess foundational literacy and numeracy skills. The NCEA is currently transitioning to a new qualification with some changes to be introduced in 2024. A significant change is the mandating of corequisite standards in literacy and numeracy (or te reo Matatini and Pāngarau for Māori-medium candidates), which will have to be met in order to obtain an NCEA qualification.[41] Full implementation is scheduled for 2029.

k In July 2024, the Minister of Education announced that the preferred tools for schools that use the NZC are PATs and e-asTTle. See https://www.education.govt.nz/news/minister-outlines-intentions-for-assessment-and-aromatawai/ for more information.

Special Initiatives in Mathematics and Science Education

The self-governing nature of New Zealand schools means that many initiatives in mathematics and science education are not mandatory. Schools choose if and when they participate.

There are several widely adopted initiatives that have been significant for mathematics education in New Zealand, such as the Numeracy Development Projects, the Accelerated Learning in Mathematics initiative, and Developing Mathematical Inquiry Communities.[l]

In 2018, with further expansion in 2021, the Networks of Expertise (NEX) initiative, more recently the Network Hub, has been funded by the Ministry of Education to provide specialized peer-to-peer professional development and support for teachers. Coordinated and supported by Teacher Development Aotearoa, NEX are comprised of varying subject and learning area associations and other peer-to-peer networks, including the New Zealand Association of Mathematics and the New Zealand Association of Science Educators.

In science education, many initiatives are built around engagement with the local community, including local bodies and research organizations. Schools can access either specific year level or whole school programs, such as Enviroschools,[42] House of Science,[43] Learning Experiences Outside the Classroom (now redesigned as Enriching Local Curriculum),[44] and other opportunities that use communities' resources to promote science. They are designed to be fully participatory, locally relevant, and responsive to change, enabling flexibility to meet the changing needs of students, schools, and communities.

A significant initiative for science education was a major joint collaboration between the Ministry for Business, Innovation, and Employment; the Chief Science Advisor to the Prime Minister; and the Ministry of Education called A Nation of Curious Minds – He Hirihi i te Mahara.[45] The long-term objective is to "encourage and enable better engagement with science and technology across all sectors of New Zealand society." The report about the initiative identifies actions in science education aimed to improve teacher confidence in science, as well as puts forward a focus on building stronger links between educators, learners, and scientists both in the classroom and in the community.

As part of A Nation of Curious Minds, the Science Learning Hub was established. The hub offers a range of opportunities for teachers to increase their science knowledge and understanding, and support their science teaching, and includes webinars and other resources.[46]

In recent years, there has been a strengthened focus on the environment and sustainability. The Department of Conservation, Ministry of Education, and Ministry for the Environment have developed the Environmental Education for Sustainability Strategy and Action Plan,[47] which aims to grow understanding and empower individuals to act as advocates for the environment. Additionally, the Ministry of Education has developed the website Pūtātara, a resource to

l See the New Zealand chapter in *TIMSS 2019 Encyclopedia: Education Policy and Curriculum in Mathematics and Science* for further information about these initiatives.

encourage and support schools and teachers to incorporate sustainability and global citizenship across the curriculum.[48]

Suggested Reading

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Ministry of Education. (2024). *Refreshing the New Zealand curriculum*. Retrieved from https://newzealandcurriculum.tahurangi.education.govt.nz/new-zealand-curriculum-online/new-zealand-curriculum/new-zealand-curriculum-refresh/5637144667.c

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