Malta

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Introduction

Overview of Education System

The Ministry for Education, Sport, Youth, Research and Innovation (MEYR) is responsible for education in Malta, with equity and inclusion underscoring the government's objective of providing high-quality education for all. Commitment to these principles is evidenced by inclusivity at all levels and the provision of free public school education for all, from kindergarten to the tertiary level. The government also subsidizes church schools, which do not charge tuition fees, while parents whose children attend schools in the independent sector benefit from tax rebates.

The Education Act of 1988 is the legal framework regulating education provision in Malta.[1] A 2006 amendment to the act established two directorates. The amended Education Act further decentralized decision-making by forming college networks in the state sector.[2] There are 11 college networks, each with its own legal and distinct identity. Ten of the college networks consist of multiple preprimary centers, primary schools, a middle school, and at least one secondary school, while the 11th college network is responsible for postcompulsory educational institutions falling within the remit of the education directorates.

The Directorate for Quality and Standards in Education (DQSE) was responsible for establishing and monitoring the standards and quality of the programs and services provided in all schools, both state and nonstate, throughout the compulsory education cycles. Eventually this responsibility was passed on to the Directorate for Curriculum, Lifelong Learning and Employability (DCLLE). Currently, the Quality Assurance Department (QAD) and the Accreditation Unit fall under the remit of the DQSE.

The DCLLE is responsible for formulating, implementing, and monitoring the curriculum. The National Curriculum Framework for All (NCF),[3] which guides education provision in compulsory schooling in Malta, was launched in 2012. The NCF addressed the gaps in Malta's learning processes by shifting the emphasis of classroom instruction from teaching the subject to teaching the learner. The NCF is presented within a lifelong learning perspective and celebrates diversity by catering to all learners at each stage of their education. It aims to introduce greater equity and decentralization to the national education system while seeking to present a seamless curriculum that emphasizes smooth transitions and building on firm foundations laid in early childhood education.

In essence, the NCF aims to provide quality education for all learners, to encourage student enrollment in further and higher education, and to reduce the percentage of early school leavers. The NCF proposed a Learning Outcomes Framework (LOF) as the keystone for learning and assessment throughout compulsory schooling. The aim of the LOF is to free schools and learners from centrally imposed knowledge-centric syllabi, which in turn will give schools the freedom to develop programs that fulfill the objectives of knowledge, attitudes, and skills-based outcomes to which all learners in Malta are entitled. The LOF is intended to create greater curricular autonomy for colleges and schools, which will allow them to better address the learning needs of their students.

Compulsory education in Malta covers ages 5 to 16 and comprises three main cycles: Early Years (ages 5 to 7), Junior Years (ages 7 to 11), and Secondary Years (ages 11 to 16). Prior to the start of primary education (ages 5 to 11, or Early Years and Junior Years), there is provision for early childhood education and care through the Free Childcare for All Scheme, established in April 2014 for children ages 3 months to 3 years, and kindergarten for children ages 3 to 5. Although preprimary education is not compulsory, attendance is very high and reaches close to 100% between the ages of 4 and 5. Parallel to the public education sector is a nonstate sector composed of church and independent schools. All primary and secondary state schools are coeducational.

Education provision in the first 2 years of the secondary cycle is of a general nature. However, when proceeding to Year 9, students get to choose two subjects from a wide range of options. Since academic year 2011–2012, these subjects have included several vocational areas and, as of September 2019, also include applied subjects. Thus, education provision in Years 9 to 11 includes aspects of vocational and applied education if students opt for such subjects.

Following compulsory education, students can choose to follow a general or a vocational education path. Two-year general education courses leading to tertiary education are provided by the state or by nonstate educational institutions. On the other hand, students may follow vocational courses at two state educational institutions, the Malta College of Arts, Science, and Technology (MCAST) and the Institute of Tourism Studies (ITS). Tertiary education is provided by the University of Malta and MCAST.

Use and Impact of TIMSS

Malta participated in TIMSS 2007, TIMSS 2015, and TIMSS 2023 with students in eighth grade (Year 9) and in TIMSS 2011 and TIMSS 2019 with students in fourth grade (Year 5). After each TIMSS cycle, the resulting country information is analyzed to assist policymakers in identifying areas for further focus and development. Malta has envisaged that the NCF and the development and implementation of the LOF and related pedagogy will lead to improved results in both math and science.

In science, the LOF is based on the conclusions of the policy document *A Vision for Science Education in Malta*, published in December 2011. The policy recommended major changes in science education, such as increasing instruction time allocated for science in primary schools and introducing integrated science throughout secondary education, replacing physics as the compulsory science subject during the last 3 years of secondary education. It also recommended that teachers adopt a pedagogy of inquiry-based learning in their classes.

The Mathematics Curriculum in Primary and Lower Secondary Grades

Mathematics is an important tool by which information can be organized, manipulated, and communicated. It is also an ever-expanding body of facts, skills, concepts, and strategies that may be used to solve a wide range of problems. Mathematics teachers in both primary and secondary schools emphasize both the utilitarian and aesthetic aspects of mathematics.

The *Handbook for the Teaching of Mathematics* (2012) states that teachers should support and facilitate students' engagement to do the following:

- understand and appreciate the role and purpose of mathematics in culture and society, in the past as well as the present
- apply mathematical knowledge and understanding to solve a wide range of standard and nonstandard problems, ideally from real-life situations
- think and communicate mathematically (i.e., precisely, logically, and effectively)
- develop a positive attitude toward mathematics that fosters creativity, confidence, perseverance, and enjoyment of the subject
- develop the ability to work both independently and cooperatively when doing mathematics
- acquire a secure foundation for the further study of mathematics
- appreciate the interdependence of the different branches of mathematics
- appreciate the interdisciplinary nature of mathematics and its use in other areas of knowledge
- make efficient, creative, and effective use of appropriate technology in mathematics

The LOF for Malta includes Subject Learning Outcomes (SLOs) for mathematics that range from Attainment Level 5 to Attainment Level 10. Within the LOF, Level 10 is viewed as the "gifted

and talented" level. Outcomes within this level sit at the upper end of the ability spectrum and extend learners further. Level 10 learners demonstrate a deeper understanding and wider application of Level 9 content, which marks the end of compulsory schooling. Level 10 outcomes may draw on three main areas: increased sophistication of understanding the Level 9 content, greater learning autonomy in developing understanding and skills, and increased application and problem-solving.

Exhibit 1 presents the curriculum attainment levels along with their corresponding academic years and age ranges. The NCF encourages a move away from emphasizing specific subject content teaching in favor of pedagogies that enhance curricular links and thus facilitate learning processes in the Early Years. Throughout the Early Years, children should be provided with different learning opportunities based on their skills, needs, and interests within an emergent curriculum. While children are engaged in meaningful practices, mathematizing shall be provoked and encouraged, thus stimulating their mathematical literacy.

Exhibit 1: Curriculum Attainment Levels with Corresponding Year and Age Ranges

<table>
<tr><th>Level of Attainment</th><th>Year</th><th>School Cycle</th><th>Educational Institution</th><th>Age</th></tr>
<tr><td rowspan="2">1–3</td><td rowspan="2">childcare, kindergarten 1, kindergarten 2</td><td rowspan="3">Early Years</td><td>childcare centers</td><td rowspan="3">0–7</td></tr>
<tr><td>kindergartens</td></tr>
<tr><td>4</td><td>1–2</td><td rowspan="3">primary school</td></tr>
<tr><td>5</td><td>3–4</td><td rowspan="2">Junior Years</td><td>7–9</td></tr>
<tr><td>6</td><td>5–6</td><td>9–11</td></tr>
<tr><td>7</td><td>7–8</td><td>Middle Years</td><td rowspan="4">secondary school</td><td>11–12</td></tr>
<tr><td>8</td><td>9–10</td><td rowspan="3">Secondary Years</td><td>13–14</td></tr>
<tr><td>9</td><td rowspan="2">11</td><td>15–16</td></tr>
<tr><td>10</td><td>lifelong</td></tr>
</table>

Mathematics from Level 5 to Level 10 is organized according to eight SLOs, which are translated to subject foci and then to specific learning outcomes (LOs). Exhibit 2 shows the eight SLOs and subject foci (from Attainment Levels 5 to 10).

Exhibit 2: Subject Learning Outcomes and Corresponding Subject Foci

Subject Learning Outcome	Subject Foci
I understand the structure of the number system and the relationship between numbers.	Number: The Number System
I can calculate mentally and using pencil and paper and assistive technology. I can calculate to the most appropriate level of accuracy. I can check the reasonableness of the answers obtained in calculations by rounding numbers and making rough approximations.	Number: Numerical Calculations

Exhibit 2: Subject Learning Outcomes and Corresponding Subject Foci (Continued)

Subject Learning Outcome	Subject Foci
I can recognize and describe patterns and relationships in various mathematical ways and can use algebraic manipulations.	Algebra: Fundamentals of Algebra
I understand and can use forms of measurement and can make reasonable estimations.	Shape, Space, and Measures: Measures
I can recognize and describe the properties of shapes. I can use these properties to construct shapes using appropriate mathematical instruments and to prove given geometric statements.	Shape, Space, and Measures: Euclidean Geometry
I can describe position and movement of shapes in a plane.	Shape, Space, and Measures: Transformation Geometry
I can collect, analyze, interpret, and communicate statistical information.	Data Handling: Statistics
I understand ideas of chance and uncertainty.	Data Handling: Probability

The implementation of the LOF was launched in academic year 2018–2019 and is being phased in gradually. All primary students will be following the LOF program by academic year 2023–2024. LOs in the Primary Mathematics Syllabus (2014) presented topics in four strands: Number and Algebra, Measurement, Space and Shapes, and Data Handling (see Exhibit 3).

Exhibit 3: Strands and Topics in the Primary Mathematics Syllabus (2014)

Strand	Topics
Number and Algebra	• number and place value • addition and subtraction • multiplication and division • fractions, decimals, percentages, and proportion
Measurement	• mass • capacity • length, perimeter, and area • time • money
Space and Shapes	• shapes and symmetry • position, direction, and angles
Data Handling	• tables, graphs, and averages

The Primary Mathematics Syllabus (2014) promoted a problem-solving approach (teaching for, about, and through problem-solving) and encouraged the opportunities exhibited in the word cloud shown in Exhibit 4 through the mathematics lessons.

Exhibit 4: Opportunities Through the Mathematics Lessons

Since 2015, many primary schools have adopted a mastery approach (or elements of it). Emphasis is mainly on the concrete-pictorial-abstract process. Mathematics teaching in the lower secondary school years aims to develop the following:

- a deep understanding of mathematics that is based on knowledge of facts, procedures, and meaning
- the ability to use and apply mathematical knowledge and understanding to solve a wide range of standard and nonstandard problems ideally related to real-life situations
- an understanding and appreciation of the role and purpose of mathematics in our culture and society through appropriate references to the history of the subject
- the ability to think and communicate mathematically—precisely, logically, creatively, and effectively
- a positive attitude toward mathematics that fosters creativity, confidence, perseverance, and enjoyment of the subject
- the ability to work independently, collaboratively, and cooperatively when doing mathematics
- a secure foundation for the further study of mathematics
- an appreciation of the interdependence of the different strands and topics of mathematics
- an appreciation of the interdisciplinary nature of mathematics and its use in other areas of knowledge
- the ability to make efficient, creative, and effective use of appropriate technology in mathematics

The implementation of the LOF was launched in the first year of lower secondary school (Year 7) in academic year 2018–2019 and was phased in entirely by academic year 2022–2023 in all lower secondary schools. LOs in the Lower Secondary Mathematics Syllabus (2022) presented topics in strands, as shown in Exhibit 5.

Exhibit 5: Strands and Topics in the Lower Secondary Mathematics (Year 9) Syllabus (2022)

Strand	Topics
Number System and Number Calculations	• factors and highest common factor (HCF) • approximations • directed numbers • indices and reciprocals • standard form • inequalities • percentage and interest • proportion
Algebra	• sequences • algebraic manipulation • linear equations • simultaneous equations (algebraic and graphical) • linear and quadratic graphs
Measures	• Pythagorean theorem • trigonometry • bearings and scale drawings • mensuration of circles • surface area and volume of cylinders
Euclidean Geometry	• angle properties of polygons • plan, front, and side elevations of cube and cuboids • nets of 3D shapes • circle theorems
Transformation Geometry	• tessellations
Statistics	• discrete and continuous data • histograms (equal intervals) • measures of central tendency and range
Probability	• probability of an event

The Science Curriculum in Primary and Lower Secondary Grades

The launch of the policy document *A Vision for Science Education in Malta* (2011) and the NCF have provided the impetus for the education reform currently taking place in Maltese state and most nonstate schools. A learning outcome, competence-based approach to teaching and learning is presently being encouraged with the introduction of the LOF. The introduction of the new LOs has brought about a reform in assessment, where half-yearly summative assessments have been replaced by a continuous and more formative mode of assessment. This education reform is also recognizing science as a core subject, not just on paper but also in practice. The focus for primary science is to foster knowledge but, more importantly, nurture attitudes and develop problem-solving skills and 21st-century life skills and competencies. In this context, an inquiry-based approach to teaching and learning is highly encouraged in primary and lower secondary grades with the aim of nurturing scientifically literate citizens and lifelong learners.

New LOs are being introduced at different stages across different year groups in the Early, Primary, and Secondary Years, as highlighted in Exhibit 6.

Exhibit 6: Introduction of Learning Outcomes

Year Group	Academic Year						
	2018–2019	2019–2020	2020–2021	2021–2022	2022–2023	2023–2024	2024–2025
Kindergarten 1	✓						
Kindergarten 2		✓					
Year 1					✓		
Year 2						✓	
Year 3	✓						
Year 4		✓					
Year 5					✓		
Year 6						✓	
Year 7	✓						
Year 8	✓						
Year 9					✓		
Year 10						✓	
Year 11							✓

Note: The shaded rows in Exhibit 6 (Year 5 and Year 9) indicate the years assessed in TIMSS.

The primary science syllabus is divided into three core areas of science related to biology, physics, and chemistry—Sharing Our World, Energy, and Materials—each of which is developed into 11 specific topics:

1. other animals and us
2. plant life
3. habitats
4. weather watch
5. forces
6. electricity
7. sounds
8. light
9. change
10. uses and properties of materials
11. our planet and its neighbors

In the early primary years (Years 1 to 3), students are expected to use their senses to observe and group objects and events in their immediate environment. Students are encouraged, with the help of the teacher, to identify opportunities for scientific investigation resulting from their observations. They use observations to make predictions, suggest possible solutions and simple investigations, and take basic measurements using nonstandard units. Students also conduct investigations in groups, make simple evaluations, and compare their results to their predictions. They are also encouraged to share their procedures and findings with the class.

In the later primary years (Years 4 to 6), students are expected to compare and classify objects and events in their immediate environment, use these ideas to make testable predictions, and discover ways to conduct a fair test. They also learn to select appropriate resources and equipment and use standard measurements with appropriate precision. Investigations are generally carried out in groups, and students record and analyze data using simple tables and/or graphs, discuss their findings, and compare findings to the initial prediction. Based on the information gathered, students are encouraged to draw conclusions and relate research findings to everyday life experiences. Students are highly encouraged to communicate research findings to the class.

The integrated science curriculum for secondary education builds on the primary science framework and guides students in learning integrated science during Years 7 and 8. This curriculum has three strands: Life Processes and Living Things, Materials and Their Properties, and Physical Sciences. These strands aim to support the following skills:

- Life Processes and Living Things allows students to understand and investigate life processes, as well as appreciate the diversity of living things and how they interact with each other and with the surrounding environment.

- Materials and Their Properties allows students to become aware of the diversity of naturally occurring materials, particularly through inquiry and investigations; to become familiar with the structures and properties of mixtures; and to understand ways of processing raw materials to form new products with different properties.
- Physical Sciences allows students to understand the properties of a variety of forces existing in the universe and to investigate their effects. Consequently, students discover how interactive forces produce conversion in energy from one form to another.

Each strand is organized into several units while each unit comprises a number of teaching objectives, examples of teaching activities and experiences, and indicators of LOs. The approach to teaching and learning science is inquiry based and student centered, and units support a constructivist approach by following the 5E model: Engage, Explore, Explain, Elaborate, and Evaluate. During each session, teachers determine the topic of inquiry or focus question to engage students' interest and curiosity. Students observe, explore, predict, plan, and conduct investigations; collect and interpret data; and give explanations. Students are then challenged to elaborate on their understanding by linking the known with the new and by applying concepts and skills in new contexts. Students are encouraged to evaluate their understanding and competencies, and teachers assess areas of strength and weakness highlighted by student performance in the activities.

During the last 3 years of secondary education (Years 9 to 11), students choose two subjects to study as core curriculum options. In Years 9 to 11, students are required to study at least one science subject (physics, chemistry, or biology) and may choose one or two additional science subjects. Students in state schools may choose biology and/or chemistry, as physics is compulsory in Years 9 to 11. In most nonstate schools, students may choose any one of the science subjects together with one or both of the other science subjects as an elective.

With respect to biology, Year 9 students are exposed to sections of the following LOs:

- LO 1: Identify the fundamental processes necessary for life on Earth.
- LO 2: Describe the relationship between energy and food for different organisms.
- LO 3: Explain the various mechanisms and processes that allow organisms to exchange substances with their environment and transport such substances internally.
- LO 5: Describe how organisms produce new offspring carrying inherited genetic material.
- LO 6: Recognize how organisms relate to one another and to their environment and how human activities impact the environment.
- LO 8: Demonstrate an understanding of how biology works and is communicated.[a]

a Further details relating to assessment criteria can be accessed at https://curriculum.gov.mt/en/Curriculum/Year-9-to-11/Documents/curric_f3_f5/Biology/Biology_syllabus_booklet_updated_April_2023.pdf

With respect to chemistry, Year 9 students are exposed to the following LOs:

- LO 1: Demonstrate an understanding of how chemistry works and is communicated.
- LO 2 : Describe and explain the properties of gases that may be found in air and how to prepare them in the lab.
- LO 3 : Describe the solvent action of water, including the impact of water hardness.
- LO 4 : Describe the chemical properties of acids, bases, and salts.[b]

With respect to physics, Year 9 students are exposed to the following LOs:

- LO 2: Relate forces and energy to motion.
- LO 3: Show an understanding of the properties of states of matter and of thermal processes.
- LO 7: Show an awareness of some features of Earth and the universe.
- LO 8: Demonstrate an understanding of how physics works and is communicated.[c]

Teacher Professional Development Requirements and Programs

All in-service teachers are required to attend a maximum of 10 hours of Community of Professional Educators (CoPE) training sessions specific to the needs of primary science peripatetic teachers and primary mathematics support teachers that are held throughout the school year. The CoPE training sessions for both mathematics and science teams are organized by the Directorate for STEM (science, technology, engineering, and mathematics) and VET (vocational education and training) Programmes (DSVP) within the Ministry for Education and Employment (MEDE). Both teams also meet regularly to discuss pedagogical and content issues, share good practices, and plan for upcoming training sessions. The science peripatetic teachers and the mathematics support teachers also participate in voluntary training courses and/or seminars organized both locally and abroad. The primary mathematics and primary science teams also offer support in schools during CoPE training sessions for primary teaching staff. Such CoPE training sessions are very often aligned with school development plans. CoPE training sessions are also organized for year group teachers, particularly with the introduction of the new LOs across different year groups. Such CoPE training sessions address the implementation of the new LOs and formative assessment strategies.

The mathematics support team and primary science support team within the DSVP have been involved in organizing continuous professional development for primary classroom teachers, both during CoPE sessions and also regularly throughout the school year.

b Further details relating to assessment criteria can be accessed at https://curriculum.gov.mt/en/Curriculum/Year-9-to-11/Documents/curric_f3_f5/Chemistry/Chemistry%20State%20School%20Syllabus%20-%20updated%20March%202023.pdf

c Further details relating to assessment criteria can be accessed at https://curriculum.gov.mt/en/Curriculum/Year-9-to-11/Documents/curric_f3_f5/Physics/Physics_syllabus_updated_Nov_2023.pdf

Monitoring Student Progress in Mathematics and Science

Evaluation of student achievement is an essential component of mathematics education. It is necessary to give teachers feedback on the methods and approaches used and to assist in planning for new learning (formative assessment), as well as to assess student readiness for new learning and to find out what they have learned (summative assessment). Diagnostic assessment procedures enable teachers to become aware of individual student difficulties and plan learning activities specifically designed to meet these learning needs. Mathematics assessment focuses both on what students know and can do, and on how they think about mathematics. It involves a broad range of tasks and problems and requires the application of a number of mathematical ideas. Assessments evaluate student skills, such as the ability to communicate findings, present an argument, and explain an intuitive approach to a problem.

Assessment is an integral part of the normal teaching and learning program and involves multiple techniques, including written, oral, and demonstration formats. Group and team activities are also periodically assessed. Teachers avoid giving tests that focus only on a narrow range of skills, such as the correct application of standard algorithms (procedures), for example. While assessing skills is important, a consequence of isolating skills and knowledge in a narrow assessment procedure is that students tend to learn only in that way, approaching mathematics as a set of separate skills and concepts with little obvious connection to other aspects of learning or to the world.

In the primary years, several types of continuous assessment tasks are carried out. These include maths trails, quizzes, tests, show & tell tasks, low floor high ceiling tasks, integrated tasks, journals, Supertmatik math challenges, maths clubs, and other projects that may be suggested by class teachers. Teachers choose up to four types of continuous assessment for the school year. These continuous assessment tasks make up 40% of the total mark in Year 4 and, as of academic year 2020–2021, in Year 5. The other 60% comes from a national annual mental and written examination. Other feedback includes the completion of broad learning outcomes per term.

Assessment in science reflects a similar philosophy. During the school year, students in the upper primary years are presented with one hands-on investigation on which they are assessed. Such an investigation assesses students' ability to investigate scientifically, observe, predict, carry out the investigation task, record results, draw conclusions from results, and apply such results to everyday life situations. As previously referred to, continuous assessment tasks that are more formative in nature, namely investigations, fieldwork activities, and project work, are also given more weight with the introduction of the new LOF. The annual written science assessment assesses both content knowledge, as well as higher-order skills and competencies, including the application of knowledge.

In Years 4, 5, and 6, students take end-of-year examinations in Maltese, English, and mathematics, as well as a science assessment. For all of these examinations, teachers take into account students' different abilities when grading.

For mathematics at the secondary level, student learning is monitored by both continuous school-based assessment and summative assessment in the form of an end-of-year examination. The school-based assessment encompasses a variety of assignments that may include investigations, projects (individual or group), special homework, tests (including noncalculator tests), maths trails, quizzes, oral/digital presentations, and other suitable assignments. There are different examinations in each grade because students are tracked according to their ability level. The summative assessment process is similar to that for primary education with a national annual examination. At the end of secondary education, students may choose to take high-stakes secondary education certificate examinations in the subjects they have studied. The secondary education certificate covers all subjects taught in Maltese schools and is a requirement for proceeding to further general education.

Special Initiatives in Mathematics and Science Education

A number of special STEM initiatives to popularize science and mathematics have been planned, developed, and implemented by the DSVP. The initiatives target different cohort groups at both the primary and secondary levels.

X'hemM?, now a popular mathematics and science initiative, was launched in 2014 with an event titled X'HemM? il-Birgu. The event targeted Year 6 students in all primary schools in Malta. The main aim of the event is to engage students in hands-on mathematical and scientific activities and investigations that promote a problem-solving approach, as well as provide students with basic competencies in learning, language, social interaction, and motor function. Following the positive feedback received after this event, other similar events were organized for different primary school cohorts, including the following:

- X'hemM? il-Ġnien (targets Years 3 and 4 students)
- X'hemM? il-Mellieħa (targets Year 6 students)
- X'hemM? l-Imġarr (targets Year 6 students)
- X'hemM? il-Forti (targets Year 6 students)
- X'hemM? Ta' Qali (targets Year 6 students and includes physical education)
- X'hemM? l-Iskola (targets Year 6 students)
- X'hemM? l-Aquarium (targets Year 4 students)

X'hemM? Weekend is another STEM initiative organized by the DSVP that targets primary age students and their parents/guardians. Participants are engaged in a range of activities and workshops related to mathematics and science. During these events, students experience different aspects of science and mathematics through an inquiry-based problem-solving methodology.

Other science initiatives are coordinated throughout the year. The Junior Science Club is an after-school initiative that aims to provide young students in Years 3 to 6 (ages 7 to 11) the opportunity to experience science investigations and practical science-related activities that

extend their learning beyond the classroom environment. The focus is on providing students with practice of science-related process skills and increased potential to develop and practice critical thinking, communication skills, and self-appraisal. The Junior Science Club initiative has been extended further to offer the opportunity to children in kindergarten 1 to Year 2 (ages 3 to 6) and their parents/guardians so they can experience doing quality science together.

The Primary STEM Challenge is a STEM initiative for primary students in Years 3 to 6 (ages 7 to 11). The aim of the initiative is to engage young students and their educators and/or caregivers in doing science while nurturing and developing 21st-century life skills. The Primary STEM Challenge engages students to investigate one of three themes related to the natural sciences and produce a brief video, not longer than 3 minutes, showing the investigation process.

Breakfast STEM PD professional development sessions aim to bring together stakeholders at the primary level (teachers, members of the school leadership team, and parents/guardians) to explore themes relevant to primary mathematics and science and to provide a networking opportunity.

STEM Explorers Parent-Kid Club aims to provide quality STEM opportunities that engage both parent and child in an outdoor setting. STEM Explorers targets children in kindergarten 1 to Year 2. This STEM initiative has been extended further to offer the opportunity to primary-aged students in Years 3 to 6 and their parents/guardians.

The Teen Science Café initiative targets Year 8 students in secondary schools, aiming to offer teenage students opportunities to encounter professionals and experts in STEM careers. Professionals and experts in different fields of science visit schools throughout the first two terms of the school year to share their career insights and experiences related to STEM. The initiative is focused on creating an interactive, informal exchange between students and professionals to engage young students in conversation about relevant STEM themes and career paths, making a positive impact on students' study and career choices. Teen Science Cafés primarily serve as an outreach program for promoting careers in science and technology and facilitate improved career guidance and interest in studying STEM subjects. The Teen Science Café initiative developed further to address the gender gap between males and females in STEM careers. Indeed, a number of Teen Science Café girls' initiatives, including the Teen Science Café girls' festival, have been held and address the issues of the gender gap and gender stereotypes. The Tiny Teen Science Café also evolved from the Teen Science Café initiative. The Tiny Teen Science Café targets primary students and aims to promote young children's interest in areas of STEM and raise awareness of STEM careers among students and parents.

The Science Safari is an annual science popularization event targeting Year 8 students. Students have the opportunity to put science into practice through a treasure hunt activity. The event is open to students from all school sectors, and most secondary schools participate. Science Safari Kids offers primary-aged students and their families the opportunity to engage in an exciting outdoor treasure hunt with clues related to scientific skills and competences.

The Malta Junior Science Olympiad is an annual event for gifted and talented Year 11 science students in the state and nonstate sectors. Students are presented with a 3-hour laboratory task that goes slightly beyond the established curricula. The task uses themes from physics, chemistry, and biology.

Numerous other activities are organized in state and nonstate primary schools to promote inquiry. Mathematics clubs are common and often are facilitated by the primary mathematics support team while a number of schools organize an annual Maths Week or mathematics-themed days. Parents are often invited to participate in these events and in workshops intended to help them support their children at home by developing an understanding of how their children learn. To celebrate these events and other practices and initiatives, an online newsletter called *Maths Matters* is issued monthly by the mathematics support team.

Maths Family Connect sessions invite families to do mathematics together. During these after-school sessions, Years 5 and 6 students, accompanied by a parent/guardian, are invited to take part in engaging, challenging, hands-on maths tasks, puzzles, and games. Through these sessions, participants have an excellent opportunity to develop a range of skills such as perseverance, decision-making, and problem-solving. During the Maths Family Connect sessions, students are introduced to the idea of a growth mindset and using the word "yet" to help them not give up. This idea is practiced while solving different puzzles and brainteasers and while carrying out graded hands-on tasks.

The *tikka* MATEMATIKA two-day seminar for mathematics educators (from primary to postsecondary) promotes quality mathematics teaching and learning for all. The seminar aims to disseminate examples of sound pedagogical practices in teaching mathematics.

Students in Years 5 and 6 are nominated by their class teachers to participate in the High 5 Junior Mathematicians Challenge, a program designed to create opportunities for gifted and talented primary students to develop their talent through practice with stimulating mathematical problems. Five 2-hour training seminars are held after school hours, during which students are

- presented with rich tasks that require skills beyond computation, through which they reinforce their spatial, as well as analytic, abilities;
- given the opportunity to enrich their heuristic skills;
- further challenged to create questions;
- encouraged to explore and develop mathematics that may be new to them;
- given access to a wide range of resources, including assistive technology;
- asked to participate in individual and group challenges; and
- requested to keep a portfolio.

The Mathematics Without Borders international tournament challenges gifted students in both primary and secondary schools, divided into different age groups, and provides them with an adequate platform to showcase their exceptional abilities. This tournament encourages a competitive spirit among participants and a collaborative team approach. The tournament, which is organized by the Pedagogical Association Education Without Borders, Bulgaria,

consists of three rounds, the autumn, the winter, and the spring round, and a final tournament that is held in July. The three rounds that are held in each respective country consist of a test for each age group. The test consists of 20 open-ended questions to be answered in 60 minutes. The final tournament is held in Bulgaria and consists of two different contests, the individual contest and the team contest, held over the course of 2 days in Bulgaria.

The Maths Venture activity targets Year 9 students. This annual event consists of a maths trail that integrates history and mathematics in one activity. It aims to give students the opportunity to experience mathematics outside the classroom. Students work in groups of four and tackle problem-solving tasks applying mathematical skills learned in the classroom. In addition to exercising the students' mathematical abilities, the event also provides the students with an opportunity to discuss solutions to the set of problems and collaborate as a team.

Mathematics Activities for the Gifted and Talented consist of four hands-on activities held throughout the school year. These activities are intended for Year 10 students with an interest and keen aptitude in mathematics. Throughout these activities, students discuss and experience the importance of mathematics in history, art, nature, and the world around us.

Around 140 Year 10 students participate in a biannual Mathematics Olympiad. The contest offers the chance for students to compete both on an individual and on a team-based level. The Mathematics Olympiad aims to foster an interest in mathematics and improve the mathematical skills of participants who are chosen by their respective schools based on their interest and aptitude in mathematics.

The Thematic STEM Debate is an initiative that provides a setting for secondary students to use arguments and rebuttals on a particular theme. The first edition of this initiative was held in 2019 for Year 11 students. The aim of this initiative is to engage students to become active critical thinkers and skilled debaters. Participating students are given reports, audiovisual materials, and policies on the theme ahead of the event to help them plan their arguments. The material includes national, European, and international positions and opinions on the theme. Since 2019, this initiative has continued to evolve and is being organized for other year groups, namely Year 6 (primary school) and Year 8 (middle school) students. Each group would have a different socio-scientific theme to debate.

Girls4STEM Summer Camp seeks to promote STEM engagement among 12-year-old female students through diverse STEM-related activities. The summer camp aims to eliminate gender disparity in STEM education and is aligned with Sustainable Development Goal 4 (SDG 4), Targets 4.3 and 4.5.[d] SDG 4 aims to ensure inclusive and equitable quality education and to promote lifelong learning opportunities for all. The summer camp also serves to promote the crucial 21st-century skills of critical thinking, collaboration, communication, and creativity. During the summer camp, girls work collaboratively in small groups under the guidance of STEM professionals acting as mentors. In some activities, the students are challenged to be creative and use critical thinking to solve problem-solving investigations. The students learn to

d For more information about Malta's Sustainable Development Goal, see https://uis.unesco.org/sites/default/files/country-profile/Malta_SDG4-Profile.pdf

communicate with their group colleagues through active listening and conveying their thoughts in diverse ways. The students also learn to present their work in a formal manner at the end of the summer camp.

Suggested Reading

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