Exhibit 21: National Policies Regarding Use of Technology in Mathematics and Science Instruction at the Eighth Grade

Reported by National Research Coordinators

Country	Description of the National Policies for Use of Technology	
	Mathematics Instruction	Science Instruction
Armenia	Computers and calculators are used in instruction.	Computers, tablets, and calculators are used in instruction.
Australia	The use of technology is encouraged but not mandated. Curriculum statements refer to "using appropriate digital technologies."	Same
Bahrain	Calculators are only used for Cycle 3 students and prohibited in both Cycle 1 and 2. The policy is prescribed in the Teacher Guide.	Policies for how and when to use technology in science are detailed in the Teacher Guide.
Botswana	The Curriculum Blueprint for the Ten-Year Basic Education Programme and the Three-Year Junior Secondary School Syllabus state that students should develop competence and confidence in the application of computational skills in order to solve day-to-day problems, develop awareness and/or literacy and understanding of the significance of computers in the world of work, and acquire an appreciation of technology and technological skills, including basic skills in handling tools and materials.	Same
Canada	The curricula in most Canadian provinces contain general statements/policies about the use of technology in Grade 8 mathematics instruction, including the importance of developing students' understanding and appreciation of the appropriate use of technology in a mathematics classroom.	The curricula in most Canadian provinces contain general statements/policies about the use of technology in Grade 8 science instruction, including incorporating technology into scientific inquiry activities. Some recommended examples of using technology to support teaching and learning in science include collecting and analyzing data, gathering information, organizing and presenting data, and using simulation or graphics software.
Chile	The national curriculum includes specific recommendations for integrating technology into learning, including searching for information, solving problems, presenting information in charts, and creating and delivering presentations.	Same
Chinese Taipei	After students have learned basic calculation skills, teachers can introduce technological aids into problem-solving tasks. Technology should never replace mathematics skills and the use of calculators and computers should not interfere with teaching other concepts. Calculators/computers are not allowed in high stakes assessments and, therefore, are prohibited in formal school tests. Some teachers may allow students to use calculators/computers on quizzes. In 2001, the Ministry of Education announced the Blueprint for Information Education for Primary and Secondary Schools to encourage the application of information technology in subject area learning for elementary and secondary school students.	Teachers should teach science with various media and resources, including the use of computers and Internet to engage students in using technology to search for information. In 2001, the Ministry of Education announced the Blueprint for Information Education for Primary and Secondary Schools to encourage the application of information technology in subject area learning for elementary and secondary school students.
Egypt	–	No policy
England	The curriculum prescribes that students should be taught to use calculators and other technologies to calculate results accurately and then interpret them appropriately.	No policy
Georgia	In the lower secondary level (Grades 7–9) ICT is integrated in all subjects and is not taught as a separate subject. Yet, use of ICT at this stage is mandatory and such requirements are reflected in educational objectives. According to the mathematics curriculum/standards, students should be able to use ICT when doing operations on numbers, exploring functions, and analyzing and representing data using charts and tables. Moreover, some interactive educational materials and computer programs have been made available in localized state languages (Georgian and Abkhazian). Lastly, teacher trainings in effective use of ICT in the teacher education process have been underway to include all public school teachers at the mentioned level.	In the lower secondary level (Grades 7–9) ICT is integrated in all subjects and is not taught as a separate subject. Yet, use of ICT at this stage is mandatory and such requirements are reflected in educational objectives. According to the science curriculum/standards, students should be able to use ICT when measuring, recording, organizing, and analyzing and representing data. However, only a handful of interactive educational materials and computer programs have been made available in localized state languages (Georgian and Abkhazian). Lastly, teacher trainings in effective use of ICT in the teacher education process have been underway to include all public school teachers at the mentioned level.
Hong Kong SAR	The appropriate use of ICT in teaching and learning mathematics is emphasized in the mathematics curriculum and increased availability of ICT in schools has impacted the mathematics curriculum in terms of content and strategies for teaching and learning mathematics. ICT is used in mathematics classes in many ways, including data analysis, simulations, graphical presentation, symbolic manipulation, and observing patterns. In general, most schools allow secondary students (Grades 7–9) to use calculators in tests and examinations.	ICT is one of the four key resources used to promote learning to learn. Tasks taking advantage of ICT can be adopted and adapted in the Science Education KLA to enliven learning and teaching, and to help learners progress towards the vision of whole-person development and learning to learn.
Hungary	Technology is used in instruction to develop cognitive processes.	Same
Iran, Islamic Rep. of	Calculator and computer use are taught and recommended, but not mandated. Calculators and computers are permitted during examinations at the teacher's discretion.	Same

A dash (–) indicates data not provided.

Exhibit 21: National Policies Regarding Use of Technology in Mathematics and Science Instruction at the Eighth Grade (Continued)

Country	Description of the National Policies for Use of Technology	
	Mathematics Instruction	Science Instruction
Ireland	The Junior Certificate Mathematics Curriculum highlights the importance of enabling children to think and communicate quantitatively and spatially, to solve problems, to recognize situations in which mathematics can be applied, and to use appropriate technology to support such applications. Strand 1, Section 1.5 (Finding, collecting, and organizing data) states that students should be able to generate data, or source data from other sources including the Internet, and summarize data in diagrammatic form including spreadsheets. Strand 2 of the mathematics curriculum envisions students will engage with dynamic geometry software. The Mathematics Curriculum provides for the introduction and use of calculators from Grade 4 onward. By Grade 8, students are expected to be able to use calculators to help develop their problem-solving skills by allowing them to focus on the structure of a problem and by exploring different methods to solve problems. Students are permitted to use calculators in state examinations.	The science curriculum includes statements on the use of ICT in science instruction in primary school, noting that students' investigations and explorations can be enhanced through the use of ICT. For example, ICT can help students record and analyze information, simulate investigations and perform tests that support scientific topics, communicate scientific information and findings, work collaboratively on science projects with students in other schools, and access and use a range of scientific and technological information. Computer-based simulation may be particularly helpful when students are conducting investigations difficult to organize in real-life contexts.
Israel	The current curriculum contains only general statements advocating the use of computers in the different processes of learning, both in Algebra and Geometry. Calculators are allowed in instruction and testing.	The current curriculum contains only general statements about integrating computers into science learning activities.
Italy	The latest national guidelines often refer to the importance of developing digital competencies (based on European key competencies) across all school subjects. Beginning in the 2015–2016 school year the Piano Nazionale Scuola Digitale (National Plan for Digital School) was implemented, providing a strategy for digital innovation for the whole school system.	Same
Japan	In teaching each content area, consideration should be given to properly using tools like the soroban (Japanese abacus), calculators, computers, and ICT to improve the learning results. This should especially be taken into account for the instructional content related to numerical calculations, as well as in teaching through activities such as observation, manipulation, and experimentation.	For instruction in each field of science, consideration should be given to ensure the proactive and appropriate use of tools like computers and ICT in areas such as searching for information in the course of observations and experiments, conducting experiments, processing data, and taking experimental measurements.
Jordan	No policy, but current education reforms towards developing a knowledge economy emphasize the use of ICT in the teaching and learning of mathematics.	Current education reforms towards developing a knowledge economy emphasize the use of ICT in the teaching and learning of science. The science curriculum includes content available only in electronic form for both teachers and students.
Kazakhstan	According to the mathematics curriculum for Grades 7-9, the students should have to carry out calculation with particularly long numbers, approximation, or multiplication of numbers with the help of calculators.	The science curriculum for Grades 7– 9 includes electronic resources, such as books and other learning materials.
Korea, Rep. of	The Teaching Methods Curriculum states that a diverse and appropriate set of educational materials should be employed by teachers to promote the effective learning of mathematics. Tools such as calculators, computers, and educational software help students perform complex computations when the aim is not to nurture students' computational skills. These tools can help to develop a deeper understanding of mathematical concepts, principles, and laws, and enhance problem solving-skills. Depending on the content and methods being evaluated, evaluation of learning in mathematics should provide students with opportunities to use these tools.	The curriculum states that science instruction should "give priority to hands-on activities, and utilize appropriate computer-based labs, the Internet, and multimedia resources."
Kuwait	No policy, but it is customary for schools to allow calculator use in simple mathematics problems or for verification of answers. Calculators are not allowed during tests. The public and private Arabic schools do not include formal computer instruction in the curriculum, but there are some integrated lessons taught by ICT teachers to train students on how to use and apply mathematics using computers.	No policy, but it is customary for schools to allow calculator use in simple mathematics problems, or for verification of answers and scientific rules in the classroom. Calculators are not allowed during tests.
Lebanon	Non-scientific calculators are required.	No policy
Lithuania	The curriculum contains guidelines for incorporating ICT into instruction. Computer programs can be used during lessons to introduce new material to students. Grades 7–8 have integrated lessons that include ICT together with various other subjects.	Same
Malaysia	The use of ICT is to be integrated in teaching and learning activities creatively and innovatively. Calculators can be used in the classroom beginning in Grade 7 (the first year of secondary level); however, there are restrictions on their use. Only non-programmable scientific calculators are allowed during examinations.	Same

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

Exhibit 21: National Policies Regarding Use of Technology in Mathematics and Science Instruction at the Eighth Grade (Continued)

Country	Description of the National Policies for Use of Technology	
	Mathematics Instruction	Science Instruction
Malta	Teachers are encouraged to integrate mathematical software, such as Excel, Logo, and Cabri Geometry into their lessons. Calculators are allowed in examinations.	No policy, but the science national curriculum suggests that Internet resources be used as a part of the pedagogy in the classroom. These statements are complemented by websites that education officers of science subjects promote during professional development sessions for teachers.
Morocco	ICT is incorporated into instruction according to pedagogic guidelines and ministerial circulars.	Same
New Zealand	No policy, but the use of technology is addressed generally within mathematics: "Schools should explore not only how ICT can supplement traditional ways of teaching, but also how it can open up new and different ways of learning."	Same
Norway	Using digital tools in mathematics involves using such tools for games, exploration, visualization, and publication. It also involves being aware of, using, and evaluating the role of digital tools for problem solving, simulation, and modeling. It also is important to find information, analyze, process, and present data with appropriate tools, and to be critical of sources, analyses, and results.	Digital tools are used in science for exploration, measurement, visualization, simulation, registration, documentation, and publication when performing experiments and fieldwork. Digital animations, simulations, and games are good aids for stimulating creativity, and demonstrating and visualizing natural science problems and research questions. Critical assessment of Internet-based information reinforces the work in this subject. Digital communication systems make it possible to discuss natural science problems and research questions.
Oman	No policy	No policy
Qatar	All teachers use learning management system in classes to present activities and assess student learning.	Same
Russian Federation	The standards require three levels of ICT use in general education–ICT in the curriculum and school resources, ICT in real teacher practice, and student achievement in ICT use in learning. Activities include constructing charts and graphs as well as mathematical modeling and data presentation.	The standards require three levels of ICT use in general education–ICT in the curriculum and school resources, ICT in real teacher practice, and student achievement in ICT use in learning.
Saudi Arabia	Teachers are required to use the most modern technology available.	Same
Singapore	Teaching should connect learning to the real world, harness ICT tools and emphasize 21st century competencies. Teachers should consider the affordances of ICT to help students learn. ICT tools can help students understand mathematical concepts through visualizations, simulations and representations. They can also support exploration and experimentation and extend the range of problems accessible to students. The ability to use ICT tools is part of the 21st century competencies. It is also important to design learning in ways that promote the development of other 21st century competencies such as working collaboratively and thinking critically about the mathematical solution.	In science, ICT supports the inquiry process and also facilitates student collaboration and self-directed learning. For example, online collaborative tools allow students to share and discuss their ideas or findings within the school, and also extend their learning through consulting field experts. Internet-enabled devices facilitate data collection and analysis in situated learning. Students also explore and visualize abstract concepts using simulation tools.
Slovenia	There are general recommendations to use ICT as much as possible in all forms for many purposes, including teaching demonstrations, routine development of students' skills, help with calculations, and researching new ideas. Calculators can also be used in assessments.	The general use of computers is expected to be taught in subjects other than science. The use of computers should be taught in computer laboratory, but teachers may decide to use computers in the classroom for demonstrations or to have students practice their skills.
South Africa	The Clarification Notes for Teaching Guidelines provides teachers with direction about whether a calculator should be used when students are solving mathematical problems.	No policy
Sweden	The national curriculum states that the school is responsible for ensuring that each student can use modern technology as a tool in the search for knowledge, communication, creativity, and learning. Specifically for mathematics, one of the aims described in the syllabus is that students should be given opportunities to develop knowledge in using digital technology to explore problems, make calculations, and to present and interpret data. Syllabi also prescribe core content, and for Grades 7–9, the only explicit reference to technology is the use of calculators in numeric calculations. Students should also learn about tables, diagrams, and graphs, and how they can be interpreted and used to describe the results of the students' own and others' investigations using digital tools.	The national curriculum states that the school is responsible for ensuring that each student who completes compulsory school can use modern technology as a tool in the search for knowledge, communication, creativity, and learning. There are no specifics about this for science.

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Exhibit 21: National Policies Regarding Use of Technology in Mathematics and Science Instruction at the Eighth Grade (Continued)

Country	Description of the National Policies for Use of Technology	
	Mathematics Instruction	Science Instruction
Thailand	The national curriculum includes references to ICT and a chapter is devoted to occupations and technology.	Same
Turkey	Access to technology is increasing rapidly and is providing new opportunities for teaching meaningful mathematics. Educational software is increasingly being integrated into instruction.	Incorporating ICT into science instruction provides opportunities for developing and applying scientific knowledge that can simplify science learning. ICT can support student participation in research and learning by facilitating obtaining, analyzing, and presenting data.
United Arab Emirates	No policy, but there are tips regarding online materials in teachers guides.	No policy, but there are tips regarding online materials in teachers guides.
United States	Varies by state, and many states have standards for technology literacy requiring computer use in mathematics instruction. Many school districts and schools have chosen to integrate technology (computers, tablets, interactive whiteboards) with their mathematics instruction. States are increasingly providing or enabling digital devices and digital content for students and faculty to use in school and at home. Some states also have standards for use of calculators in instruction. Most states include calculator use in the Grade 8 curriculum. In general, it is common for students to progress from no calculators, to four-function calculators, to scientific calculators, to graphing calculators as they advance through the grade levels. Individual districts may give guidelines regarding calculator usage during instructional time.	Varies by state, and many states have standards related to the use of technology (computers, calculators and other scientific laboratory equipment) to collect, record, and analyze data for conducting scientific investigations. For example, some science standards and local curricula include mastery of spreadsheet or database software as necessary for data analysis. Many school districts and schools have chosen to integrate technology (computers, tablets, interactive whiteboards) with their science instruction. States are increasingly providing or enabling digital devices and digital content for students and faculty to use in school and at home.
Benchmarking Participants—Responses Pertain to Benchmarking Provinces/Emirates/States		
Buenos Aires, Argentina	The curriculum proposes the use of software such as Geoalgebra and statistical programs, as well as calculators to solve problems.	No policy
Ontario, Canada	Although students must develop basic operational skills in mathematics, calculators and computers can help them extend their capacity to investigate and analyze mathematical concepts and reduce the time they might otherwise spend on purely mechanical activities. Students can use calculators or computers to perform operations, make graphs, and organize and display data that are lengthier and more complex than those that might be addressed using only pencil-and-paper. Students can also use calculators and computers in various ways to investigate number and graphing patterns, geometric relationships, and different representations to simulate situations and to extend problem solving. When students use calculators and computers in mathematics, they need to know when it is appropriate to apply their mental computation, reasoning, and estimation skills to predict and check answers.	ICT provides a range of tools that can significantly extend and enrich teachers' instructional strategies and support students' learning in science and technology. Computer programs can help students collect, organize, and sort the data they gather and to write, edit, and present reports on their findings.
Quebec, Canada	The use of information and communications technologies is compulsory, though activities involving ICT are included at the teacher's discretion.	The use of information and communications technologies is compulsory, though activities involving ICT are included at the teacher's discretion. These activities include information processing; locating, organizing, and storing information; creating and using databases; and developing models. Students work in virtual scientific communities and share information, communicate with experts online, exchange information, present the results of their work and compare them with those of their classmates.
Abu Dhabi, UAE	No policy, but in government schools the use of calculators and technological aids in tests and examinations as well as technological accommodations for students with special needs are outlined in the examination administration guidelines. Private schools' curricula may differ according to their program of study (e.g., UAE National Curriculum, English National Curriculum).	–
Dubai, UAE	No policy, but there are tips regarding how to use online materials in teacher guides (e.g., Smart Learning Initiative by H. H. Sheikh Mohammed Bin Rashid for iPad).	Same
Florida, US	By 2015–2016, each district in Florida is required to use at least 50 percent of the annual allocation for the purchase of digital or electronic instructional materials included on the list of state-adopted instructional materials. In Grade 8, scientific calculators or provided on-screen calculators are allowed on the Florida Standards Assessments (FSA).	Same

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