South Africa

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Introduction

Overview of the Education System

The national Department of Basic Education in South Africa is responsible for promulgating education policies that guide schooling practices in all nine provinces of the country. According to the National Education Policy Act 27 of 1996, and the South African Schools Act 84 of 1996, the Minister of Basic Education is responsible for defining national standards and norms for education planning, provision, governance, monitoring, and evaluation.[1] Provincial governments are responsible for implementing education policies, and monitoring and evaluating progress in each of the country's nine provinces. This territory includes the Western Cape and Gauteng provinces, which participated in TIMSS 2019 as benchmarking participants.

The South African education system is categorized into three hierarchical phases outlined in Exhibit 1. The curriculum divides the General Education and Training Phase into three sub-phases. Grades 1 to 9 are compulsory in the General Education and Training Phase of basic schooling. Grade R (Reception) is universally available but not compulsory. The transition into the Further Education and Training Phase of schooling culminates in the national matriculation and school leaving examination at the end of Grade 12. The General and Further Education and Training Phases are provided by two types of schools: public schools and independent schools (private schools). Independent schools must be registered with the Department of Education and must maintain standards comparable to public schools. Finally, the Higher Education Phase covers all post-schooling education in various institutions.

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Exhibit 1: Structure of the South African Education System

Phase	Subphase	Grades/Qualifications	Structure
General Education and Training Phase	Foundation Phase	Reception to Grade 3	Primary school
	Intermediate Phase	Grades 4 to 6	Primary school
	Senior Phase	Grades 7 to 9	Grade 7 is typically at primary school; Grades 8 and 9 are at secondary school
Further Education and Training Phase		Grades 10 to 12	Secondary school
Higher Education Phase		Undergraduate and post-graduate degrees, diplomas, higher education certificates, technical and vocational qualifications	Universities, technical colleges, community colleges, and other nonformal post-general education

In 2018, there were 25,154 schools: 92.6 percent public and 7.4 percent independent. The population in these schools was 12.8 million students, with 95.4 percent enrolled in public schools and 4.6 percent in independent schools. In the same year, these schools collectively employed 428,449 teachers and principals, with 91 percent in public schools and 9 percent in independent schools.[2] Exhibit 2 lists data for the Western Cape and Gauteng provinces in comparison to national figures.

Exhibit 2: Schools, Students, and Teachers (Including Principals) in South Africa and the Western Cape and Gauteng Provinces of South Africa (SA)

		South Africa		Western Cape			Gauteng		
		Students	%	Students	%	% of SA	Students	%	% of SA
Schools	Public	23,289	92.6	1,443	84.4	5.7	2,077	73.2	8.3
	Independent	1,865	7.4	267	15.6	1.1	759	26.8	3.0
	Total	25,154		1,710			2,836		
Students	Public	12,230,194	95.4	1,084,111	95.0	8.5	2,109,890	87.8	16.5
	Independent	589,348	4.6	56,946	5.0	0.4	292,686	12.2	2.3
	Total	12,819,542		1,141,057			2,402,576		
Teachers	Public	389,789	91.0	35,681	88.2	8.3	69,180	77.5	16.1
	Independent	38,660	9.0	4,785	11.8	1.1	20,062	22.5	4.7
	Total	428,449		40,466			89,242		

Due to the legacies of the apartheid period and prevailing unequal socioeconomic conditions, two types of public schools have emerged: fee or no-fee paying schools. The general profile of students attending fee-paying school is that they live in middle class neighborhoods and attend better resourced schools where the school climate is better suited to teaching and learning. No-fee schools are located in lower income neighborhoods, and students come from poorer households.

The South African constitution recognizes 11 official spoken languages, in addition to sign language. The Minister of Basic Education determines the general standards of language policy. In public schools, parents decide on the school language policy through school governing bodies. Although the aims of the language in education policies are clear—to further the use of the indigenous South African languages and multilingualism—many schools choose English or Afrikaans as their official language of instruction. In practice, many teachers use code-switching with indigenous African languages during classroom instruction. Some schools teach in an African language in the first three years of schooling. The majority then switch to using English or Afrikaans as the language of instruction from Grade 4 onward. The Incremental Introduction of African Languages in South African Schools policy was implemented in 2017 to strengthen the teaching of African languages.

Use and Impact of TIMSS

TIMSS 2019 marks the sixth time South Africa has participated in TIMSS at the ninth grade and the second at the fifth grade. TIMSS is a trusted measure of South African mathematics and science achievement, and the results have been used extensively by politicians, national and provincial governments, policymakers, the media, researchers, and the public.

TIMSS is the only study that measures changes in education quality over time. In the 2016 State of the Nation address, President Jacob Zuma said, "We are encouraged by recent international test results. The results in the Trends in International Mathematics and Science Study and the Southern and East African Consortium for Monitoring Educational Quality show that the performance of South African students is improving. Among the [TIMSS] participating countries, South Africa has shown the largest improvement of 87 points in mathematics and 90 points in science."[3] The Department of Basic Education (DBE) Action Plan (2015) and the National Development Plan 2030 have used past estimates to set as an achievement target a projected TIMSS score of 420 for 2023 and 500 for 2031 at the Grade 8/9 level.

TIMSS data is widely used to generate knowledge. Researchers from both South Africa and other countries have cited these data in a number of journal articles, books, and book chapters. In addition, a number of university students have used them in dissertations and theses.[b]

TIMSS 2011 and 2015 contextual information and its correlation to mathematics and science achievement have informed education policy directions extensively. For example, in response to the TIMSS 2015 analysis highlighting an increase in student bullying, the Department of Basic Education developed the National School Safety Framework (2015).

The TIMSS SA website (http://www.timss-sa.org.za/) was created in 2015. It provides information and resources in the form of data and periodic newsletters that cover various education issues in the country. Many of these newsletters have included blogs, op-eds, or infographics. The website houses TIMSS SA publications, including reports, journal articles, and policy reviews. The website provides links to TIMSS International.

[b] See http://www.timss-sa.org.za/ for repository.

The South African TIMSS team participated in the DBE's Provincial Engagements for 2017 across all nine provinces. The DBE Director-General's meetings were held with provincial senior managers (Chief Directors, District Directors, Chief Education Specialists for Management and Governance, Curriculum Coordinators, and Circuit Managers) as well as school principals. The TIMSS team presented the National TIMSS 2015 results, as well as provincial-specific results to the provinces at these sessions. This platform reached a total of 28,547 participants (4,979 provincial officials and 23,568 school principals), broadening the awareness of TIMSS research.

The Mathematics Curriculum in Primary and Lower Secondary Grades

The mathematics curriculum in primary and lower secondary grades is set out in the National Curriculum Statement (NCS).[4] The NCS is based on the principles of social transformation, human rights, inclusivity, environmental justice, and social justice.

According to the NCS, to develop essential mathematical skills, students should develop the correct use of the language of mathematics and build an awareness of the important role that mathematics plays in real life situations, including the personal development of each student. The skills that students should gain include calculation, application, listening, communicating, logical reasoning, and problem solving. Exhibit 3 provides a very brief overview of key content areas in the curriculum.

Exhibit 3: Overview of the Mathematics Curriculum in the Intermediate (Grades 4 to 6) and Senior (Grades 7 to 9) Phases5

Content Area	Intermediate Phase Grades 4 to 6	Senior Phase Grades 7 to 9
Numbers, Operations, and Relationships	▪ 9-digit whole numbers ▪ Decimal fractions to two decimal places ▪ Common fractions and fractions written in percentage form	▪ Representation of numbers in a variety of ways and moving flexibly between representations ▪ Recognizing and using properties of operations with different number systems; solving a variety of problems, using an increased range of numbers and the ability to perform multiple operations correctly and fluently
Patterns, Functions, and Algebra	▪ Numeric and geometric patterns with a special focus on the relationships between terms in a sequence between the number of the term (its place in the sequence) and the term itself	▪ Investigation of numerical and geometric patterns to establish the relationships between variables ▪ Analysis of situations in a variety of contexts; representation and description of situations in algebraic language, formulas, expressions, equations, and graphs

Content Area	Intermediate Phase Grades 4 to 6	Senior Phase Grades 7 to 9
Space and Shape (Geometry)	▪ Classification and more detailed description of characteristics and properties of two-dimensional shapes and three-dimensional objects	▪ Drawing and constructing a range of geometric figures and solids ▪ Descriptions and classification of geometric figures and solids ▪ Solving a variety of geometric problems drawing on known properties of geometric figures and solids
Measurement	▪ Enable students to formally and informally measure angles, area, perimeter, and capacity/volume; discuss and describe the historical development of measuring instruments and tools	▪ Using formulas for measuring area, perimeter, surface area, and volume of geometric figures and solids ▪ Selecting and converting between appropriate units of measurement ▪ Using the Pythagorean theorem to solve problems involving right-angled triangles
Data Handling	▪ Reporting on data ▪ Critical analysis of data ▪ Probability (perform repeated events to list, count, and predict outcomes)	▪ Collecting, summarizing, representing, and analyzing data to interpret, report, and make predictions ▪ Probability of outcomes including both single and compound events

The Science Curriculum in Primary and Lower Secondary Grades

The purpose of acquiring proficiency in the field of natural sciences is to develop scientific knowledge and understanding; science processes skills; and an understanding of the roles of science in society. As their introduction to the natural sciences, South African students are first taught natural sciences and technology in Grades 4 to 6 (Intermediate Phase). The focus at this stage is to promote science and technology, their history, and their benefit to society. The different cultural contexts in which indigenous knowledge systems were developed are also illustrated, as they can have substantially different beginnings and histories. From Grade 7 onward (Senior Phase), students are taught natural sciences, which deepens the above areas and includes the teaching of the practical and ethical consequences of decisions based on science.[9,10] The teaching and learning of natural sciences involves the development of a range of process skills that may be used in everyday life, the community, and the workplace.

South Africa follows an integrated science curriculum that is set out in the National Curriculum Statement (2012). A very brief overview of the content areas is presented in Exhibit 4.

Exhibit 4: Overview of the Science Curriculum in the Intermediate (Grades 4 to 6) and Senior (Grades 7 to 9) Phases6

Content Area	Intermediate Phase Grades 4 to 6	Senior Phase Grades 7 to 9
Life and living	▪ Living and nonliving things	▪ The biosphere ▪ Variation within a species; photosynthesis and respiration; interactions and interdependence within the environment ▪ Systems in the human body
Matter and materials	▪ Materials ▪ Metals and nonmetals ▪ Solids, liquids, and gases ▪ The water cycle ▪ Mixtures ▪ Dissolving	▪ Properties of materials and impact on environment ▪ Separating mixtures ▪ Acids and bases ▪ Periodic table of elements ▪ Compounds ▪ Atoms ▪ Change of state ▪ Density, mass, and volume ▪ Chemical reactions; reaction of metals with oxygen ▪ Reactions of nonmetals with oxygen
Energy and change	▪ Energy and energy transfer ▪ Sound ▪ Electric circuits	▪ Energy ▪ Potential and kinetic energy; law of conservation of energy ▪ Series and parallel circuits ▪ Visible light ▪ Forces
Planet Earth and beyond	▪ Objects in the Solar System ▪ Planet Earth ▪ Movement of the moon	▪ The Solar System ▪ The Earth ▪ Beyond the Solar System, including the Milky Way and the history and development of astronomy

To assess that the above learning content has been acquired, a variety of tasks are used, including reading, writing, drawing, and practical tasks.

Professional Development Requirements and Programs

In South Africa, teachers are expected to educate and train the students and commit themselves to do all within their power, and to act in accordance with the ideals of their profession, as expressed in the South African Council of Educator's Code of Professional Ethics. It is therefore important for teachers and those training to become teachers to take seriously the attitude, dedication, self-discipline, ideals, training, and conduct of the teaching profession as it determines the quality of education. This approach applies to teachers in all fields, including those specializing in mathematics and the sciences.

The Continuing Professional Teacher Development (CPTD) system is overseen by the South African Council for Educators, which monitors the quality of teacher professional development and records teachers' professional development points to incentivize continuing education.[7] The Integrated Strategic Planning Framework for Teacher Education and Development in South Africa 2011–2025 was also launched with the aim of improving the quality of teacher education and development to improve the quality of teachers and teaching.

Monitoring Student Progress in Mathematics and Science

At the international level, South Africa has participated in a number of large-scale assessments in science and mathematics, most notably TIMSS 1995, 1999, 2003, 2011, 2015, and now, TIMSS 2019. In TIMSS 2015, South Africa was among the five lowest performing countries for both mathematics and physical sciences, with a mean score of 372 for mathematics[8] and 358 for science.[9]

At a regional level, the country participated in the UNESCO-coordinated Monitoring Student Achievement studies for Grade 4 students in 1999, in addition to the Southern and East African Consortium for Monitoring Educational Quality (SACMEQ), which tests literacy and mathematics at the Grade 6 level, in 2000, 2007, 2011, and 2017. Nationally, there were systemic studies in 2001 and 2007 at Grade 3, and in 2004 at Grade 6.[10]

At the country level, the Annual National Assessments (ANAs), a national standardized testing of literacy and numeracy conducted from Grades 1 to 9, were introduced in 2011. These assessments were intended to monitor student learning over time, and to measure improvements in the quality and levels of education outcomes in the schooling system by tracking student performance in literacy and numeracy. These assessments were population-based and designed to provide feedback to teachers. The ANAs have since been discontinued due to teacher union pressure claiming overtesting. They have been replaced with the National Integrated Assessment Framework, a systemic evaluation that will be conducted once every three years with a sample of students in Grades 3, 6, and 9.

The national Grade 12 examination pass rate is a good measure of student progress in mathematics and sciences. In 2018, 51.5 percent of the students passed their mathematics examination, while 62.2 percent passed the physical science examination. A concern is that there is poor student progression from Grade 9 to Grade 12.

At the provincial level, the Western Cape Province conducts population-based assessments in language and mathematics in Grade 3, 6, and 9, annually. The results from the tests are used to streamline curriculum delivery and pinpoint areas for policy intervention in the education system.

Special Initiatives in Mathematics and Science Education

South Africa has achieved success in ensuring access to primary school education for all children irrespective of poverty status or location. No-fee schools, scholar transport, and school nutrition, as well as other policies and programs for the poor, have contributed to improved access.[11]

With reference to mathematics and science education, many special initiatives have been implemented at the national, provincial, and local levels by the government, as well as nongovernmental organizations.

At the national government level, the Mathematics Teaching and Learning Framework was introduced in 2018. It is centered on teaching mathematics for understanding and does not replace the National Curriculum and Assessment Policy Statement (CAPS) for mathematics but is designed to frame a new way of teaching and learning in the classroom. The methodology is designed to help teachers, in both basic and higher education, to address the challenges associated with the teaching and learning of mathematics, so that student outcomes are improved.[12] The national government also provides a conditional grant to provinces to use for special programs for mathematics, science, and technology initiatives.

Gauteng has introduced the Mathematics, Science, and Technology (MST) Strategy. The strategy seeks to improve student participation and success in MST subjects; teacher demand, supply, utilization, and support; provisioning of resources; partnerships; and monitoring, evaluation, qualitative research, and quantitative research that informs the preceding four pillars.[13]

The MST Strategy includes:

- The Secondary School Improvement Programme, which provides supplementary tuition in MST subjects, mainly to students in Grades 10 to 12 in priority schools, using customised materials and resources
- The Literacy and Numeracy strategy implemented in Grades 1 to 7, which aims to strengthen the teaching of mathematics and languages in primary schools
- Introducing schools of MST specialization
- MST Enhancement Programmes, such as competitions, Olympiads, science clubs, and other events that focus on academic support as well as nonacademic activities

In the Western Cape, the NumLit Strategy was also introduced. It focuses on numeracy and literacy development, particularly in the Foundation Phase. These interventions include the systemic testing of students in Grades 3, 6, and 9 to assess literacy and numeracy performance. The results of these tests inform the province's literacy and numeracy strategy and assist in identifying schools and areas where corrective action is needed.[14]

Each year, the Western Cape Department of Education sets out a number of initiatives in a Provincial Improvement Plan aimed at improving mathematics and science performance and participation. The initiatives include:

- A Family Numeracy Campaign
- Resources kits for mathematics and science educators
- Software for mathematics and science instruction (e-learning)
- Professional development training for mathematics and science educators
- Targeted participation in mathematics and science Olympiads

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