



Western Cape
Government

Education



**Strategy for Mathematics and Physical Sciences
for Grades 8 - 12
2012 - 2015**

Index

1.	Aims	1
2.	Context and baseline	1
3.	The five key thrusts:	9
3.1	Schools	9
3.2	Teacher Support and Development	10
3.3	Resourcing	12
3.4	Learners	13
3.5	Monitoring, Evaluation and Advocacy	14

1. Aims of the Strategy

- 1.1 To increase participation rates in Mathematics and Physical Sciences in Grades 10 – 12.
- 1.2 To increase the numbers of those passing Mathematics and Physical Sciences in Grade 12.
- 1.3 To improve the quality of passes at Grade 12 in terms of improved average scores and/or numbers of learners achieving A, B and C symbols.

2. Context and Baseline

2.1 Mathematics

With the introduction of the new National Curriculum Statement, all learners have to offer either Mathematics or Mathematical Literacy.

2.1.1 Learner numbers and quality of passes

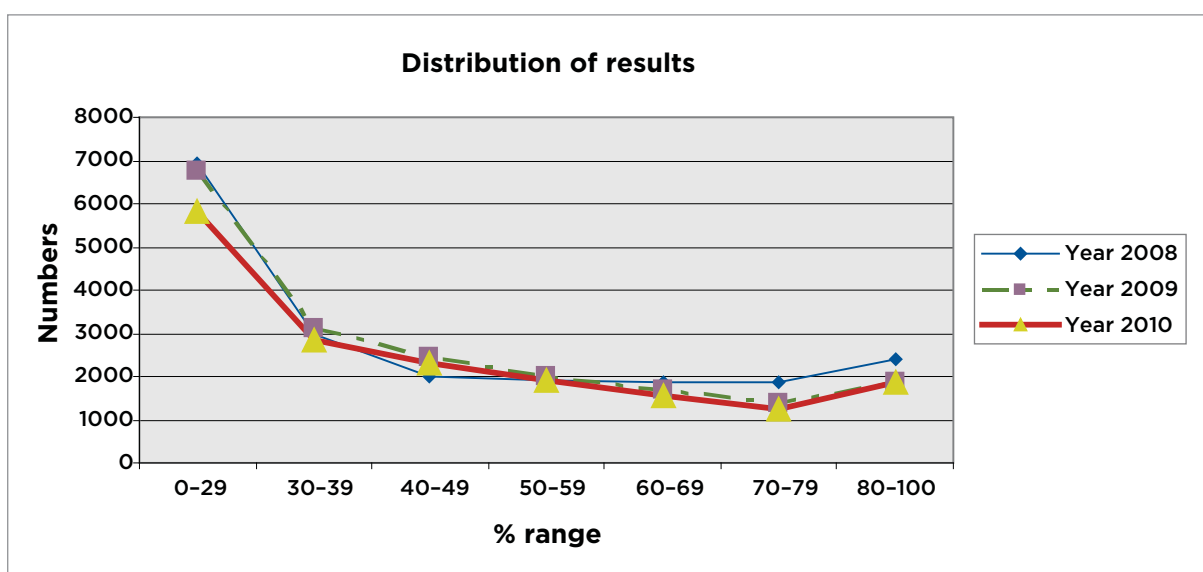
An analysis of the enrolment trends over the last 3 years indicates a downturn in the numbers taking Mathematics, both as an absolute value (2 412 fewer since 2008) and as a percentage of the total enrolment. The reduction in numbers is linked to increases in numbers of those taking Mathematical Literacy.

Table 1

Year	Number that wrote	Number (%) that passed	Targets
2008	19 956	13 003 (65.2%)	
2009	19 204	12 467 (64.9%)	13 003
2010	17 544	11 709 (66.7%)	13 500

In terms of quality, there has been an increase of 1 100 learners who passed at 30% between 2008 and 2010. However there have been 539 fewer learners with a score of >80% over the same interval.

Figure 1



The total enrolment (Grades 10 – 12) pattern for learners offering Mathematics is as follows:

Table 2

Grade 10				Grade 11				Grade 12			
Year	Total Enrolment	Maths Enrolment	%	Year	Total Enrolment	Maths Enrolment	%	Year	Total Enrolment	Maths Enrolment	%
2008	79,133	35,036	44.3%	2008	63,819	29,418	46%	2008	43,470	18,668	42.9%
2009	68,405	29,818	42.1%	2009	60,812	27,122	44.5%	2009	45,692	18,778	41%
2010	70,630	29,513	41.8%	2010	53,799	22,965	42.7%	2010	44,876	16,922	37.7%
2011	73,470	29,893	40.7%	2011	56,995	23,233	40.8%	2011	38,990	13,375	34.3%

Table 3 shows a substantial decline in overall numbers of learners offering Mathematics from 2008 to 2011.

Table 3

Overall Mathematics Enrolment				
	Grade 10	Grade 11	Grade 12	Total
2008	35,036	29,418	18,668	83,122
2009	29,818	27,122	18,778	75,718
2010	29,513	22,965	16,922	69,400
2011	29,893	23,233	13,375	66,501

2.1.2 Schools that offer Mathematics per district

354 High Schools per district per grade offer Mathematics as indicated in Table 4 below:

Table 4

District	Schools	Grade 10	Grade 11	Grade 12
Cape Winelands	57	56	57	56
Eden and Central Karoo	44	44	44	43
Metro Central	60	59	57	55
Metro East	43	43	41	40
Metro North	58	58	57	53
Metro South	51	51	51	49
Overberg	19	19	19	17
West Coast	22	22	22	22
	354	352	348	335

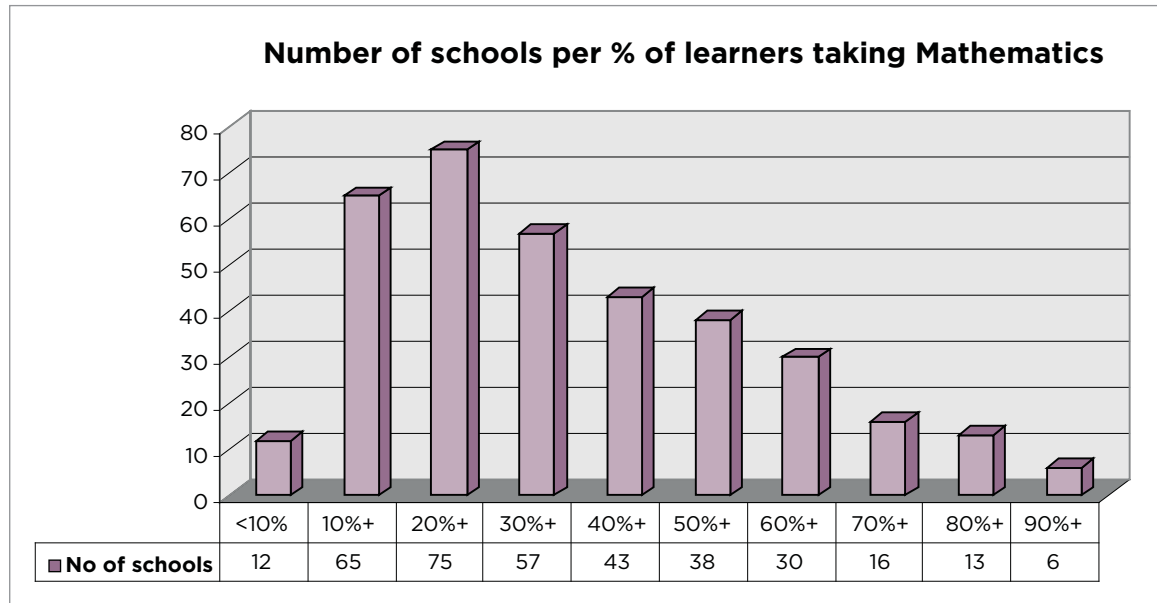
These schools accommodate learners offering Mathematics in 2011 as indicated in the table below:

Table 5

	Grade 10 2011	Grade 11 2011	Grade 12 2011
Total number of learners	29 893	23 233	13 375
Total number of schools	352	348	3 35
Ave	85	67	40

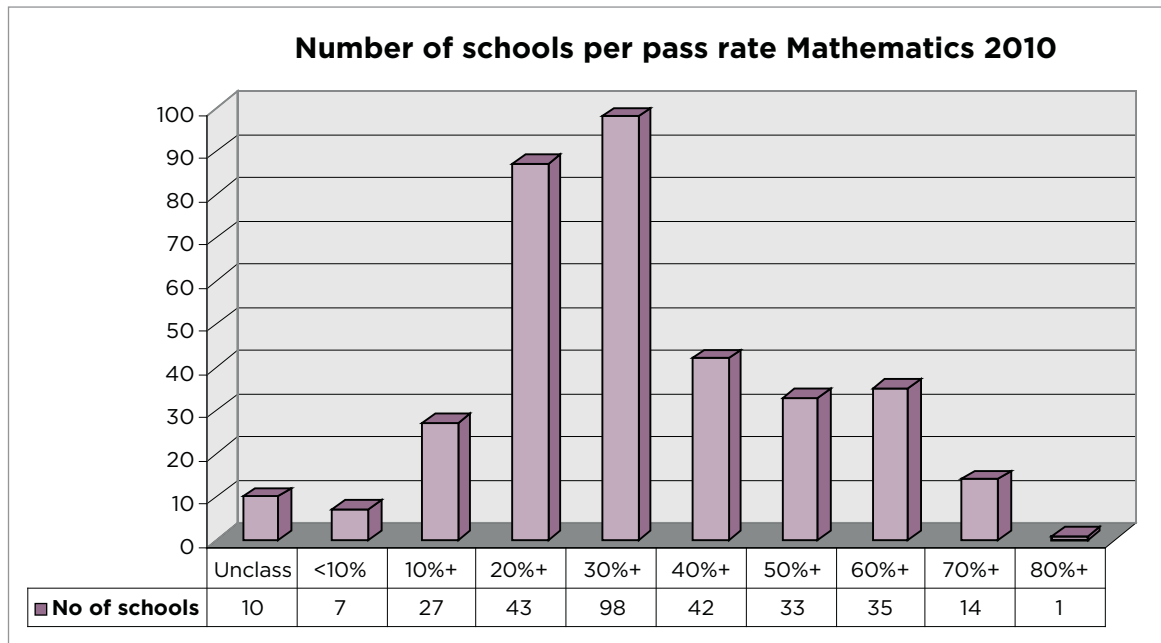
- There are 34 schools where over 400 learners in Grades 10 – 12 take Mathematics in 2011.
- Figure 2 shows the classification of schools according to the percentage of learners taking Mathematics.
- There are 152 schools where fewer than 20% of the learners offer Mathematics (Grades 10 – 12).
- This is almost half the number of schools offering Grades 10 – 12 in the province.
- At the other end of the continuum, there are 19 schools where over 80% of the learners offer Mathematics.
- 35 schools have fewer than 70 learners in Grades 10 – 12 (inclusive).

Figure 2



- Of concern are the schools where a significant number of learners are enrolled for Mathematics but the results are poor. Using 2011 Grade 12 enrolment figures, there are 21 schools where more than 30% of the learners overall (i.e. in Grades 10 – 12) are taking Mathematics but the schools had a pass rate of under 30% in Mathematics in 2010. These schools could be targeted to improve their performance in Mathematics before they aim to enrol more learners for the subject.
- There were 83 schools where over 50% of the learners taking Mathematics passed in 2010. There are 5830 learners enrolled for Mathematics in these schools in Grade 12 in 2011; 7530 in Grade 11 and 9531 in Grade 10. These schools could be particularly targeted to increase the numbers taking Mathematics and to improve the quality of performance.

Figure 3



2.2 Physical Sciences

2.2.1 Learner numbers and quality of passes

National Senior Certificate Results 2008 - 2010 have been as follows:

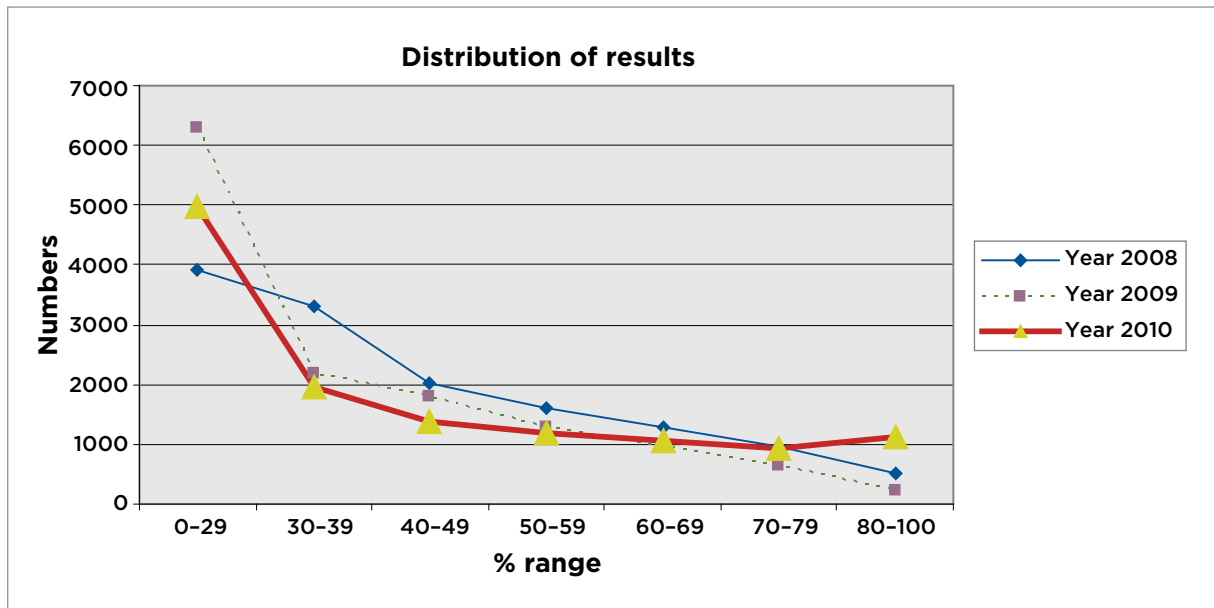
Table 6

Year	Number that wrote	Number that passed	Target
2008	13 612	9 691 (71,2%)	
2009	13 347	7 064 (52,9%)	9 690
2010	12 626	7 524 (59,6%)	10 000

The numbers writing are dropping annually – down by 986 in 2 years.

- In terms of quality, the low pass rate of 52.9% in 2009 was reversed in 2010 with an improvement of 460 in the number of candidates passing and an average rate of 59.6%.
- In a further positive development, the numbers scoring between 80 - 100% more than doubled in this period, from 519 in 2008 to 1139 in 2010, with a low of only 209 in 2009.
- The national results in Physical Sciences in 2009 were abnormally low and this seems to have been corrected in 2010.

Figure 4



Total enrolment (Grades 10 - 12) of learners offering Physical Sciences is made up as follows:

Table 7

Grade 10				Grade 11				Grade 12			
Year	Total Enrolment	Physics Enrolment	%	Year	Total Enrolment	Physics Enrolment	%	Year	Total Enrolment	Physics Enrolment	%
2008	79,133	19,960	25.2%	'08	63,819	17,846	27.9%	'08	43,470	12,997	31.4%
2009	68,405	18,381	26.9%	'09	60,812	16,793	27.6%	'09	45,692	12,741	29.9%
2010	70,630	18,385	26%	'10	53,799	14,956	27.8%	'10	44,876	11,986	26.7%
2011	73,470	16,921	23%	'11	56,995	14,512	25.5%	'11	38,990	10,225	26.3%

Table 8 shows a decline of 9 145 in overall numbers of learners offering Physical Sciences from 2008 to 2011.

Table 8

Overall Physical Sciences Enrolment				
	Grade 10	Grade 11	Grade 12	Total
2008	19,960	17,846	12,997	50,803
2009	18,381	16,793	12,741	47,915
2010	18,385	14,956	11,986	45,327
2011	16,921	14,512	10,225	41,658

2.2.2 Schools that offer Physical Sciences

302 schools offer Physical Sciences as follows:

Table 9: Total Schools per District Circuit that offer Physical Sciences – Grade 12 2011

District	1	2	3	4	5	6	7	8	Total
Cape Winelands	9	10	6	4	6	8	3	4	50
Eden and Central Karoo	6	7	5	5	3	4	6		36
Metro Central	13	12	4	10	5	3			47
Metro East	8	6	8	7	6	8			43
Metro North	7	4	5	9	7	4	10		46
Metro South	6	11	6	2	8	10			43
Overberg	4	7	5						16
West Coast	4	4	5	4	4				21
	57	61	44	41	39	37	19	4	302

In terms of current enrolments, the figures indicate an average school enrolment figure for Physical Sciences as follows.

Table 10

	Grade 10 2011	Grade 11 2011	Grade 12 2011
Total number of learners	16 921	14 512	10 225
Total number of schools	307	306	301
Ave	55	47	34

- There are 147 schools (almost half the total number of schools offering Grades 10 – 12 in the province) where there are fewer than 100 learners taking the subject overall (Grades 10 – 12 inclusive).
- Of these, 22 have fewer than 25 learners (i.e. across the 3 grades), a further 39 have fewer than 50 learners across the 3 grades and 56 have fewer than 75.

Figure 5

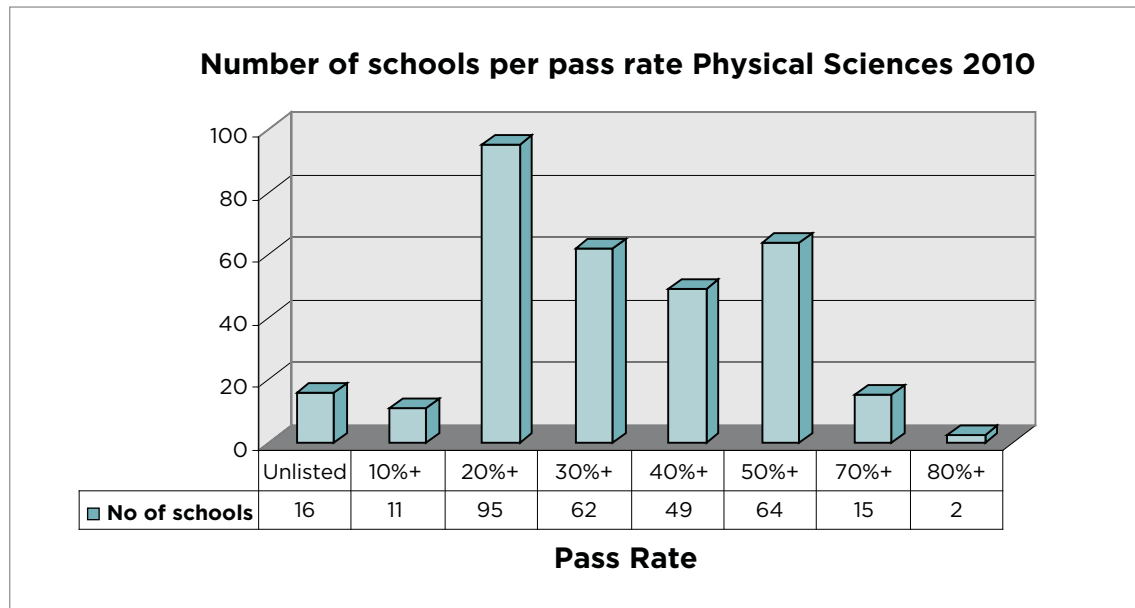
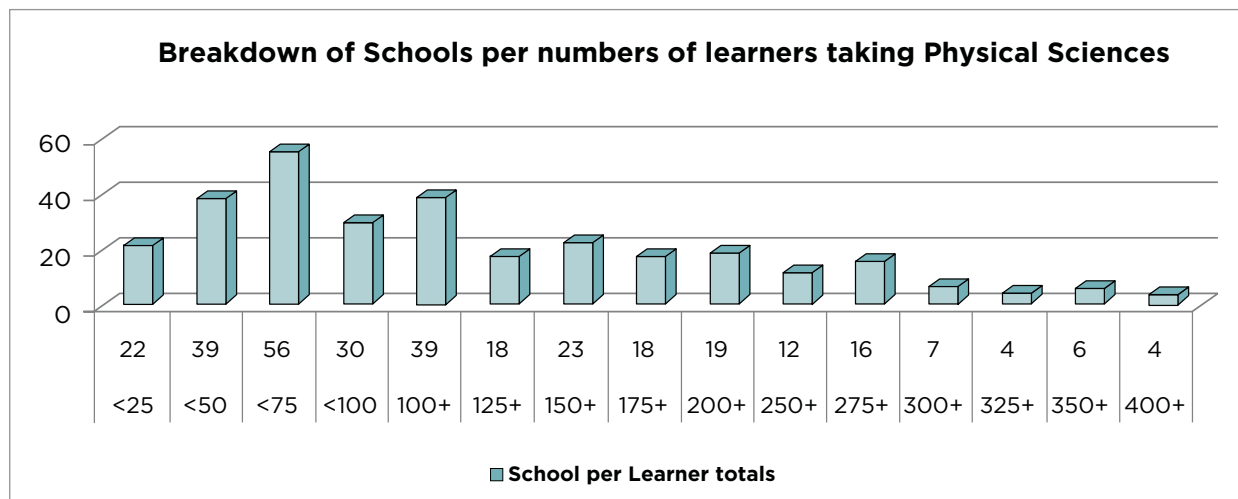


Figure 6



- There were 95 schools producing an average pass rate of between 20 – 30%. Many of these have small classes. There are 1 800 learners involved in these schools (Grades 10 – 12) and an average of 29 learners per school.
- Of concern are the cases where a high proportion of the grade overall is enrolled for Physical Sciences but the results are very poor.
- 22 of the schools where over 30% of learners are enrolled for Science had pass rates for Physical Sciences between 10% and 30%.
- In 2011 there were 1 664 learners enrolled in these schools with an average of 75 per school. These schools should be encouraged to focus on improving their pass rates.
- There were 81 schools with pass rates of over 50%.
- There were 3 676 learners enrolled in Grade 12 in those schools for Physical Sciences in 2011.
- In that set of schools there were 4 477 currently enrolled for Physical Sciences in Grade 11 and 5 378 enrolled for Physical Sciences in Grade 10. These schools should be encouraged to improve throughput and enrolment, as well as improve performance, where appropriate.

2.3 Targets

In December 2009, Grade 12 ten year NSC expansion targets were set as follows:

Table 11

	2009 (Current)	2010	2012	2014	2019
Number passing Gr 12	34 577	36 000	39 000	43 000	50 000
Maths passes	13 003	13 500	15 000	17 000	22 000
Science passes	9 690	10 000	11 500	13 500	16 000

The following stretch targets are set for expansion of:

- the numbers taking Mathematics and Physical Sciences,
- passing Mathematics and Physical Sciences, and for
- achieving better average results for Mathematics and Physical Sciences.

Table 12

	30% as minimum	50% as a minimum	80% as a minimum	Overall Target	Current 2011 enrolment
Mathematics					
Current (NSC 2010) Total 17 544	5835 < 30%	2829 < 40% 2311 < 50% 1930 > 50%	1848 > 80%	11 571 passed 17 544 wrote (59.6%)	
2011				11200	12872
2012				15000	23057 (Grade 11)
2013				16000	29826 (Grade 10)
2014				17000 pass	
2015				18000 pass	
2016				19000 pass	
Physical Sciences					
Current (NSC 2010) Total	4969 < 30%	1960 < 40% 1383 < 50% 1296 > 50%	1139 > 80%	7524 passed 12 626 wrote (66.7%)	
2011				7 800	10225 (currently in Grade 12)
2012				11 500	14484 (currently in Grade 11)
2013				12 500	16898 (currently in Grade 10)
2014				13 500 pass	
2015				14 125 pass	
2016				15 150 pass	

3. Five Thrusts of the Strategy

The Strategy will consist of five key thrusts. These are:

- (i) Schools,
- (ii) Teacher Support and Development,
- (iii) Resources and Support,
- (iv) Learners and
- (v) Monitoring, Evaluation and Advocacy

3.1 Schools

Given the context depicted above and the goals of expansion in terms of numbers and quality in both Mathematics and Physical Sciences a clear, explicit, advertised and focused strategy is required that is both generic and school-specific.

To this end a differentiated approach will be followed that includes:

Identifying **48 schools** that potentially produce large numbers of learners in both Mathematics and Physical Sciences, as well as produce high quality results. These schools will form part of the national **Dinaledi Schools Strategy** and will be expected to strive to improve enrolment in these subjects, as well as improve their performance, according to individually identified targets. They will receive targeted support and be specifically monitored by the WCED Head Office and districts.

3.1.1 Mathematics

Schools will be categorized according to participation rates in the subject expressed as a % of the enrolment in Grades 10 – 12, as follows:

Category 1: Already good Mathematics participation (60%+)

Focus: Focus on improving both pass rate and quality of passes

Category 2: Fair Mathematics participation (40% – 60%)

Focus: Focus on increasing participation rate and pass rate

Category 3: Some Mathematics participation (20% – 39%)

Focus: (a) If pass rate is high: focus on increasing participation, **OR**
(b) If pass rate is low: focus on increasing pass rate

Category 4: Low Mathematics participation rates (<20%)

Focus: (a) If pass rate is over 60%: 3 year leeway in which to improve participation rates to set targets, **OR**
(b) If pass rate is <60%: 3 year leeway in which to both increase participation and pass rates

3.1.2 Physical Sciences

Schools will be categorized according to participation rates in the subject expressed as a % of the enrolment in Grades 10 – 12, as follows:

Category 1: Already good Physical Sciences participation (40%+)

Focus: Focus on improving pass rate and quality of passes

Category 2: Fair Physical Sciences participation (30% – 39%)

Focus: Focus on increasing participation rate and pass rate

Category 3: Some Physical Sciences participation (20% - 29%)

- Focus:** (a) If pass rate is high: focus on increasing participation, **OR**
(b) If pass rate is low: focus on increasing pass rate

Category 4: Low Physical Sciences participation rates (<20%)

- Focus:** (a) If pass rate is over 60%: 3 year leeway in which to improve participation rates, **OR**
(b) If pass rate is <60%: 3 year leeway in which to both increase participation and pass rates **or consider phasing out the subject**

All schools will be expected to provide five year **Mathematics and Physical Sciences Development Plans**, as part of their School Development and School Improvement (SIP) Plans, consulted with their Circuit Team Managers. These will include targets, teacher development needs, resource needs and action steps to achieve the targets.

The WCED will use the options at its disposal e.g. norms and standards funding; educator provisioning; site-based and other support (both training and other resources/facilities and equipment) to support and incentivize schools where appropriate.

3.2 Teacher Support and Development

The teacher support and development programme is intended to improve the competency of Mathematics and Physical Sciences teachers to ensure that they have the potential to deliver learner-centred, expert teaching founded on sound educational principles.

The teacher development offered will be determined by perceived needs identified via: research, international comparative studies, analyses of the National Senior Certificate (NSC) examinations and by teachers themselves.

Development will focus on subject content knowledge and skills as well as pedagogy.

Extended courses, short workshops that focus on a single aspect of the curriculum or single technique, but linked to the broader knowledge and skills of the teachers, as well as the broadcast of science and mathematics Telematics lessons will be offered.

District-based subject groups will be formed in these subjects where teachers learn from teachers. These study groups will be teacher-led and facilitated by subject advisers. The agenda will be dominated by subject content, teaching practice and classroom strategies.

The WCED will elicit the support of Universities, NGOs, excellent practitioners and other experts in Mathematics and Physical Sciences to offer training aligned to the activities and strategies of the department. This could include the Schools Development Unit (SDU) at the University of Cape Town, the Institute of Maths Science and Technology at the University of Stellenbosch (IMSTUS) and subject organisations such as the Association of Mathematics Educators of South Africa (AMESA). Aligned professional development by teacher unions will also be explored.

The strategy also encompasses recruitment and deployment as follows: as funds and suitable applications permit, candidates will be awarded pre-service bursaries to become teachers of Mathematics and Physical Sciences. Similarly, depending on the availability of suitable candidates, graduates among the Fundza Lushaka bursars will be deployed in schools most in need of their services.

3.2.1 The Teacher Development Model:

3.2.2 Teachers teaching Grades 8 and 9

To ensure that more learners are stimulated and inspired to take Mathematics and Physical Sciences in the FET band, teaching in Grades 8 and 9 must be good and exciting. The Lit/Num Strategy aims to improve the basic knowledge and skills of learners entering high school. This will still take a number of years. Teachers of Grades 8 and 9 will receive focused courses at the Cape Teaching and Leadership Institute (CTLI) to improve content and pedagogy. The courses will also focus on the practical skills that learners need, as well as strategies to make learning fun and exciting in these grades. Knowledge of careers in Mathematics and Science will also form part of the training.

3.2.3 Teachers in the FET Band

Teachers at high schools will be exposed to targeted training:

The training and support will be provided to identify Mathematics and Physical Sciences educators in Category 2, 3 and 4 schools.

The focus in category 3 and 4 schools will be basic content and teaching pedagogy.

The focus in category 3 schools will shift towards improving performance thereby increasing quality of passes.

Initially identified schools must have at least 40 learners offering Mathematics and at least 35 learners offering Physical Sciences at the beginning of the FET phase. The course will be designed in association and consultation with practitioners and mathematics and physical sciences experts and funded supplementary providers where relevant or possible.

The intervention and training will address:

- Content knowledge and conceptual understanding
- Teaching strategies and methodology
- Effective use of ICT to enhance teaching and learning
- Planning to ensure effective curriculum-completion
- Motivation and interest for both students and teachers

3.2.4 Development of Content Knowledge

The following content areas will receive initial focused attention:

Mathematics	Physical Sciences
2012 - 2013 <ul style="list-style-type: none">• Module M1 (2 Topics)	2012 - 2014 <ul style="list-style-type: none">• Module S1 (4 Topics)
2014 - 2015 <ul style="list-style-type: none">• Module M2 (2 Topics)	2014 - 2015 <ul style="list-style-type: none">• Module S2 (5 Topics)
2016 - 2017 <ul style="list-style-type: none">• Module M3 (3 Topics)	2016 - 2017 <ul style="list-style-type: none">• Module S3 (3 Topics)

3.2.5 Development of Pedagogical Skills

Development of pedagogical skills will include training in:

- appropriate methodology
- effective planning to ensure the curriculum is managed and completed - including interpretation of the scope of the curriculum
- learning strategies - knowledge of how learning happens
- integrating effective use of ICT
- developing effective problem-solving strategies - including support programs to enable teachers to prepare learners for participation in Olympiads and Mathematics and Science competitions
- designing and implementing effective assessment - including effective diagnosis of learner misconceptions and feedback
- addressing differential needs of learners
- classroom culture and management
- managing dual-medium classes
- the language register in Mathematics and Science
- how to stimulate and motivate learners

3.2.6 Training timeframes

Teachers will attend two 5-day training courses per year (1 week in January before schools reopen and a week in the July vacation).




Afternoon and/or Saturday workshops will be arranged between training courses for reflection, feedback, further support and to illustrate best practice lessons.

2012 – 2013 – 600 Mathematics Teachers; 300 Physical Sciences Teachers

2014 – 2015 – 600 Mathematics Teachers; 300 Physical Sciences Teachers

2016 – 2017 – 600 Mathematics Teachers; 300 Physical Sciences Teachers

3.2.7 Training and mentoring schedule

Subject	2012 January	2013 July	2014 January	2015 July	2016 January	2017 July
Mathematics	600 teachers • Module M1 		600 teachers • Module M2 		600 teachers • Module M3 	
Physical Sciences	300 teachers • Module S1		300 teachers • Module S2		300 teachers • Module S3	

Curriculum Advisers, district and head office officials will monitor progress and implementation and provide mentoring.

Institutional Management and Governance and Circuit Team Managers must monitor time tables to ensure that the prescribed numbers of hours per week are allocated for Mathematics and Physical Sciences in all schools.

3.3 Resourcing

3.3.1 Subject: Mathematics

Teachers: 1 Casio calculator, 1 textbook, National Senior Certificate (NSC) papers and memos

Learners: Grade 10: 2012: One textbook per learner per school

Grade 11: 2013: One textbook per learner per school

Grade 12: 2014: One textbook per learner per school

3.3.2 ICT:

Supply relevant software and hardware

Make use of digital resources already at schools

Broadcast Telematics lessons to schools

Integrate teaching and learning with WCED and University of Stellenbosch websites and Moodles

Use radio broadcasts and media for advocacy

3.3.3 Subject: Physical Sciences

Teachers: 1 scientific calculator; 1 textbook; NSC papers and memos

Learners: Grade 10: 2012: One textbook per learner per school

Grade 11: 2013: One textbook per learner per school

Grade 12: 2014: One textbook per learner per school

Equipment: Supply new stock to teach CAPS

Replenish existing stock supplies

Make labs functional: conduct repairs and install fittings

Roll out Interactive white boards and digital projectors incrementally

3.3.4 ICT:

Supply relevant software and hardware

Make use of digital resources already at schools

Broadcast Telematics lessons to schools

Integrate teaching and learning with WCED and University of Stellenbosch websites and Moodles

Use radio broadcasts and media for advocacy

3.4 Learners

3.4.1 To encourage more learners to take Mathematics and Physical Sciences:

- offer targeted career guidance to Grades 8 and 9, with various career options
- conduct advocacy with parents
- work with the Cape Town Science Centre through the WCED Mobile Science Centre at targeted schools to conduct exciting science experiments and demonstrations
- encourage category 1 and 2 schools to take learners on selected excursions showcasing mathematics, science and technology and careers in these fields

3.4.2 To improve the pass rate as well as the quality of passes:

- supplementary tuition (Saturday or holiday classes)
- utilise the WCED Mobile Science Centre operated by the Cape Town Science Centre to do practical demonstrations of all the practical science experiments in the curriculum at all Category 2, 3 and 4 schools
- broadcast Telematics lessons to poorly performing schools
- supply past papers and other resources and teacher training as required
- expose learners to high-level problem-solving exercises, including participation in Olympiads and competitions

Districts and CAs will work consciously and explicitly to ensure that learners that have enrolled for these subjects do not drop out once they have started on the 3-year course. In the short term this means a concerted effort to ensure enrolments in these subjects are maintained over the last three years of every school.

3.5 Monitoring, Evaluation and Advocacy

Monitoring, support and evaluation of any strategy are essential elements to ensure effective service delivery.

Officials will monitor curriculum delivery in the classroom to ensure that the content, level and pace of the CAPS curriculum in these subjects are met. Teachers needing support will be identified for appropriate support and training.

The progress towards achieving a school's targets will be monitored and schools will be expected to report on progress and delivery of their development plans every year and in-year.

The approach will include:

- a) site visits and interaction
- b) deployment of effective monitoring and evaluation officials
- c) customised monitoring, evaluation and reporting instruments

Actions:

- a) Provide guidelines to schools in regard to the Monitoring and Evaluation process
- b) Development of checklists and reporting forms
- c) Policy regarding the process of feedback to schools and districts
- d) Support to schools to be able to interpret results and to develop strategies for improvement

The WCED will also embark on public and community advocacy for this strategy through our communications directorate.

The strategy will be driven and coordinated by the Branch: Curriculum and Assessment Management and the Branch: Institution Development and Coordination will be responsible for implementation in schools.

The strategy will be driven and coordinated by the Branch: Curriculum and Assessment Management and the Branch: IDC will be responsible for the implementation in schools.

Western Cape Education Department
Director Curriculum Further Education and
Training (FET): Phumla Satyo
Lower Parliament Street, Cape Town, 8001
tel: +27 21 467 2622/3 **fax:** +27 21 467 2620
E-mail: Phumla.Satyo@westerncape.gov.za



**Western Cape
Government**

Education