Districts with exceptional mathematics improvements up to 2017 with respect to black African and coloured Grade 12 learners

24 March 2018

1 Introduction

The legacy of apartheid is particularly serious in the case of black African and coloured learners, who account for around 84% and 9% of learners in schools (public and independent), so 93% of all learners, according to Annual Survey of Schools data¹. For many years only 5% of all black African and coloured Grade 12 learners have achieved 60% in mathematics, against a figure of around 25% for whites and Indians. The figures for Africans and coloureds drop rather substantially if one considers these achievers relative to a whole age cohort of youths. For instance, it drops to 2.7% (as opposed to 5%) in the case of black Africans². There are thus good reasons to focus on the ability of the schooling system to raise the attainment levels of black African and coloured learners, and thus close the gap relative to the other two population groups.

Mathematics receives attention because, together with physical science, it is prioritised by government's Medium Term Strategic Framework (MTSF) and *Action Plan to 2030*. A mark of 60% is considered important here as this is what is required by several universities for several mathematically-oriented programmes. For instance, a 60% mark in mathematics is required for engineering studies at the University of Witwatersrand and Tshwane University of Technology, and medicine and natural sciences at University of Pretoria. Thresholds of 50% also exist (for economics in Fort Hare, for instance) and 70% (the most demanding engineering programmes in Pretoria, Cape Town and KwaZulu-Natal).

This report³ provides details which lead to a set of statistics gauging the success of education districts in growing the number of black African and coloured Grade 12 learners who perform well enough in mathematics to enter mathematically-oriented programmes in university, such as engineering. The focus of the report is on public ordinary schools.

These statistics are needed to determine top districts for the 'Ministerial Award', a new award added to the National Education Excellence Awards in 2017 (which considered performance up to the 2016 examinations).

Many methodological details included in the previous year's issue of this report (which was also the first issue) are not included in the current report. Readers may want to refer back to the previous report⁴.

2 The indicator dealt with in the current report

The annual indicator covered in the current indicator can be described as follows:

¹ Whites account for 4% and Indians for 2%. These percentages are applicable up to Grade 9 in recent years. Beyond Grade 9 figures change a bit, in particular due to high levels of dropping out amongst coloured learners.

² Gustafsson, 2016.

³ Produced for the Department of Basic Education by Martin Gustafsson (mgustafsson@sun.ac.za).

⁴ Report titled *Districts with exceptional mathematics improvements up to 2017 with respect to black African and coloured Grade 12 learners*, date 5 April 2017.

The number black African and coloured full-time learners in Grade 12 achieving a mark of 'around 60' out of 100 in mathematics, where the annual mark threshold may differ a little from 60 if difficulty levels in the examinations were clearly different in a particular year.

The adjustments to the mark threshold were necessary largely because it is clear that the 2008 mathematics examinations were less difficult, meaning that if one does not make adjustments, it can appear as if there has been a *downward* trend in the number of high-level achievers, even if this is not actually true. It is important to clarify the non-comparability of unadjusted mark thresholds in part because these thresholds have been used to conclude that mathematics performance has worsened in schools, when clearly it has not⁵.

The threshold of 'around 60' was exactly the following marks in the ten years 2008 to 2017. These thresholds were calculated by comparing trends in a sub-sample of well-performing schools with stable demographics over time⁶. Thus a mark of 70 in 2008 was about as difficult to obtain as a mark of 59 in 2017.

Year	Threshold
2008	70
2009	63
2010	62
2011	58
2012	60
2013	60
2014	59
2015	59
2016	60
2017	59

Table 1: Mark thresholds used

Importantly, whilst using adjusted mark thresholds helps to avoid the appearance of a deterioration when in fact there has been an improvement with respect to the actual mathematics skills produced, the adjustments do not affect the rankings of districts in a specific year, and barely affect across-district comparisons with respect to the trend over time.

The annual indicator described above is used to calculate a percentage annual improvement per year statistic. In the previous round of the awards, this was the annual slope for a district in the number of high-level achievers (coloured and black African) for the period 2008 to 2016, divided by the average number of achievers across the nine years. This method is explained in more detail in the previous issue of the report. For the 2018 awards, the same method was applied, but for the nine years 2009 to 2017.

3 Related developments in the monitoring of Grade 12 performance

The intention is to use the annual indicator described above for a *school*-level analysis and ranking process which will be reported on separately. There are other Grade 12 monitoring initiatives under way which, like the current one, are aimed at moving away from a sole reliance on the overall 'pass rate' (Grade 12 passes over those who wrote), an indicator which can be deceptive in a context of different dropping out patterns across provinces, districts and schools.

Two other initiatives stand out. One is the Department of Basic Education's 'inclusive basket of performance indicators', a composite indicator drawing from seven annual values:

⁵ See Cronje (2016), writing for the South African Institute of Race Relations, and further analysis by Gustafsson (2016).

⁶ Gustafsson (2016).

overall pass percentage; mathematics pass percentage; physical Sciences pass percentage; bachelor attainment percentage; distinction percentage; mathematics participation rate; throughput rate. This has been used to publish alternative provincial rankings⁷.

A second initiative is the **Data Driven Districts (DDD) initiative**, which currently provides traditional indicators, such as the overall pass rate, for around a third of secondary schools via an online 'dashboard'. Only schools which have sufficient data across a range of indicators (not just Grade 12 indicators) and are in provinces where DDD has implemented, have Grade 12 statistics. DDD is currently exploring alternative indicators for Grade 12 using various statistics in relation to *the number of non-repeating Grade 10 learners two years previously*. This is an important development, as this approach would largely overcome problems seen in, for instance, the 'overall pass rate'.

4 The completeness of the data used

The current round of work informing the 'Ministerial Award' paid considerable attention to improving the coverage of the data. For various reasons, the data are not perfect. There are differences in terms of school name and school ID between the main schools database of the DBE, the 'EMIS data', and the examinations data. In fact, EMIS data use a 13-digit school ID whilst the examination system relies mainly on a 7-digit examination centre ID. Special tables linking the two IDs must be maintained. These tables do have gaps.

Table 2 indicates the number of *public ordinary schools* over the years with Grade 12 learners, according to the Snap Survey data within the larger EMIS data source. This was used as a point of departure. Only schools counted in Table 2 were used in the indicator calculations, meaning for instance independent schools and adult centres were excluded.

	2009	2010	2011	2012	2013	2014	2015	2016
EC	864	863	864	869	872	868	869	879
FS	300	299	301	302	304	306	306	306
GP	541	554	568	575	580	598	611	617
KN	1,599	1,617	1,632	1,640	1,645	1,652	1,663	1,667
LP	1,347	1,350	1,348	1,351	1,355	1,356	1,358	1,357
MP	495	499	498	499	499	504	507	507
NC	127	129	129	129	128	128	130	130
NW	362	357	357	356	355	357	364	381
WC	350	351	350	356	359	363	367	370
SA	5,985	6,019	6,047	6,077	6,097	6,132	6,175	6,214

Table 2: Schools with Grade 12 in the EMIS data

To provide a sense of the data problems, of the 6,214 schools in 2016 with Grade 12, only 6,103 could be linked to the examinations data using an incomplete list of 13-digit school IDs in the examinations data. However, programmatic linking using school name, plus some manual work, resulted in 6,185 schools being linked. 29 of the 6,214 remained unlinked to the examinations data. Table 3 indicates how many schools could and (in the last row) could not be linked to the examinations data. The link was best for 2013 to 2016 and 2011, with fewer than 30 schools remaining unlinked for these years. This is largely because manual matching occurred in the case of 2011 and 2016. For the other years, only programmatic fixing was employed. The degree of linking is not ideal, yet it is better than it was for the previous Ministerial Award calculations. In fact, initiatives such as the Ministerial Awards assist in strengthening the focus on cleaning and linking data. One reason why linking to EMIS was deemed important is that this would allow for mapping and spatial analysis which will help to throw more light onto which parts of the country, and which types of schools, are making the most progress. Moreover, because EMIS represents *the* official source of what schools exist,

⁷ Department of Basic Education, 2017.

contains the most widely used school ID, and contains the official classification of schools (as public, for instance), it seemed important to describe schools in terms of what exists in EMIS. (For Table 3 and for 2017, 2017 examinations data were compared to 2016 EMIS data as 2017 EMIS were not available in time.)

	2009	2010	2011	2012	2013	2014	2015	2016	2017
EC	854	855	860	858	868	864	864	863	856
FS	297	299	301	300	304	306	306	306	306
GP	530	542	561	558	578	597	610	616	616
KN	1,588	1,608	1,624	1,617	1,638	1,646	1,658	1,660	1,660
LP	1,332	1,345	1,345	1,345	1,354	1,355	1,355	1,353	1,353
MP	489	495	494	481	497	501	506	507	507
NC	125	128	128	128	128	128	130	130	130
NW	344	343	356	353	352	355	360	380	380
WC	347	349	350	349	358	363	367	370	370
SA	5,906	5,964	6,019	5,989	6,077	6,115	6,156	6,185	6,178
Diff.	79	55	28	88	20	17	19	29	36

Table 3: Schools with successful EMIS-examinations linking

5 Indicator calculations

Figure 1 below illustrates the national trend for the indicator in question, namely the number of black African and coloured learners obtaining a mark of around 60, using the equivalent marks shown in Table 1, and counting only learners in the public ordinary schools – see the green points. Three other trends cover learners of all population groups. The first two series of points overlap in those years where the adjusted mark is exactly 60 (meaning there was no adjustment). What is important to note is the fact that the grey trendline has a steeper upward slope than the black trendline. This is due to the adjustments to the thresholds. The difference is not dramatic if the years 2009 to 2017 are considered. However, the 2008 to 2016 difference is striking, as the one points to a deterioration whilst the other points to an improvement (reporting on the supposed deterioration in the media during 2016 is in fact what prompted the examination of the comparability of unadjusted mark thresholds).

The slope for the fourth set of points (the green points) is 1,177 learners, meaning the general trend was for an additional 1,177 black African and coloured high achievers to emerge from public schools each year. This 1,177 over the average across the nine years, of 17,379 learners, gives an annual percentage increase of 5.5%.



Figure 1: National trends

It is this 5.5% which is broken down by district in Table 4 below – see column 'Annual %'. No district displays a negative value, so all districts were growing the number of achievers in these two population groups, but the rate of growth varies to a large degree, from 0.2% (Bojanala Platinum) to 16.8% (Alfred Nzo East). The columns headed 2009 to 2017 display the number of achievers from the two population groups. District rankings are shown in the second-last column. The top three districts are then:

First place	Alfred Nzo East
Second place	Xhariep
Third place	Chris Hani East

The last column of Table 4 provides an alternative ranking which uses only schools with data in every year. Thus newly opened schools would not be considered, nor closing schools. These alternative a rankings serve as a check on whether changing school numbers plays a large role in determining the ranking. Clearly, this does not play a large role, as district rankings remain largely unchanged, especially at the top end, the end the Ministerial Award focusses on.

											Annual		
	District	2009	2010	2011	2012	2013	2014	2015	2016	2017	%	Rank	Alt. rank
EC	Alfred Nzo East	50	63	87	77	137	125	151	165	235	16.8	1	4
EC	Alfred Nzo West	68	68	95	73	118	81	124	144	144	9.8	15	16
EC	Amathole East	109	89	134	112	189	123	153	134	179	5.7	48	46
EC	Amathole West	41	31	44	35	44	39	32	38	47	1.1	69	67
EC	Buffalo City	228	217	258	310	359	305	307	266	304	3.2	64	61
EC	Chris Hani East	65	77	126	122	174	187	213	225	242	14.6	3	2
EC	Chris Hani West	92	91	106	129	133	120	122	145	164	6.4	40	35
EC	Joe Gqabi	75	68	78	60	80	70	81	63	87	1.1	68	66
EC	Nelson Mandela	187	195	205	180	237	292	258	227	260	4.5	54	50
EC	OR Tambo Coastal	105	139	118	130	193	184	177	203	274	10.2	13	9
EC	OR Tambo Inland	164	229	305	294	347	344	345	359	386	7.6	31	29
EC	Sarah Baartman	24	31	45	30	49	44	46	29	40	3.3	63	59
FS	Fezile Dabi	97	53	69	129	132	145	192	197	205	13.9	4	3
FS	Lejweleputswa	112	106	123	150	213	217	203	245	250	11.1	9	7
FS	Motheo	192	151	208	273	330	320	371	321	358	9.2	20	14
FS	Thabo Mofutsanyana	170	135	245	354	427	360	420	427	459	12.0	8	5
FS	Xhariep	16	3	11	6	9	12	13	31	25	15.5	2	1
GP	Ekurhuleni North	200	231	276	341	418	403	427	422	428	8.8	23	24
GP	Ekurhuleni South	202	233	275	355	448	457	480	476	490	10.5	12	15
GP	Gauteng East	145	128	131	154	263	243	212	265	276	9.8	16	17
GP	Gauteng North	21	25	54	58	50	44	68	57	50	7.9	28	37
GP	Gauteng West	92	102	139	190	238	182	276	253	267	12.2	6	12
GP	Johannesburg Central	149	165	193	248	327	305	291	280	266	7.2	35	42
GP	Johannesburg East	219	215	239	301	375	334	315	306	360	5.8	47	49
GP	Johannesburg North	204	187	200	256	319	263	250	257	278	4.2	57	60
GP	Johannesburg South	81	102	113	110	149	152	185	175	172	9.3	19	26
GP	Johannesburg West	177	141	147	201	250	196	213	213	218	4.3	56	65
GP	Sedibeng East	74	39	46	64	86	91	81	59	83	4.6	52	55
GP	Sedibeng West	128	106	109	146	191	155	172	167	173	5.5	50	45
GP	Tshwane North	201	194	161	244	299	260	236	214	284	4.0	60	62
GP	Tshwane South	246	248	308	326	385	389	390	445	422	7.2	34	43
GP	Tshwane West	168	186	183	269	346	302	254	260	287	5.8	46	58
KN	Amajuba	223	213	232	317	412	300	309	358	350	6.0	44	40
KN	Harry Gwala	71	93	107	88	150	106	108	140	149	7.0	36	38
KN	iLembe	75	92	107	85	146	110	83	131	188	8.1	27	23
KN	Pinetown	223	244	227	304	425	357	313	330	379	5.9	45	44

Table 4: District rankings on the indicator

											Annual		
	District	2009	2010	2011	2012	2013	2014	2015	2016	2017	%	Rank	Alt. rank
KN	Ugu	171	203	200	264	332	240	217	232	306	4.4	55	51
KN	uMaunaundlovu	204	252	241	316	432	348	316	364	386	6.5	38	34
KN	uMkhanvakude	179	144	136	222	346	241	265	237	378	9.4	18	22
KN	Umlazi	563	601	490	716	933	707	716	750	771	4.1	59	54
KN	uMzinvathi	105	119	125	125	255	120	215	233	251	10.7	11	10
KN	uThukela	173	190	200	228	411	285	327	336	424	10.2	14	11
KN	uThungulu	339	347	432	448	666	402	469	500	605	5.5	51	57
KN	Zululand	323	292	377	419	629	447	398	416	504	4.6	53	48
LP	Capricorn	775	808	888	998	1.210	1.035	1.051	1.141	996	3.8	61	56
LP	Greater Sekhukhune	303	335	395	521	636	622	740	693	759	11.1	10	8
LP	Mopani	341	394	431	514	574	477	592	557	609	6.2	41	41
LP	Vhembe	944	984	965	1,222	1,604	1,227	1,394	1,294	1,249	4.2	58	52
LP	Waterberg	136	166	155	206	250	185	257	220	233	6.1	42	47
MP	Bohlabela	140	196	222	219	276	217	305	338	352	9.5	17	13
MP	Ehlanzeni	313	432	501	473	690	483	668	669	698	7.9	29	25
MP	Gert Sibande	239	294	346	419	506	432	527	477	564	8.8	25	20
MP	Nkangala	283	310	376	407	572	436	676	555	516	8.3	26	21
NC	Frances Baard	52	84	84	94	92	110	112	113	118	7.4	33	27
NC	John Taolo Gaetsewe	14	39	36	37	59	53	79	56	69	12.7	5	6
NC	Namakwa	5	18	21	13	19	13	14	13	15	1.3	66	64
NC	Pixley Ka Seme	5	19	15	8	15	8	34	16	18	8.8	24	18
NC	ZF Mgcawu	16	29	30	21	26	39	29	34	34	6.0	43	39
NW	Bojanala Platinum	281	234	241	284	367	245	232	267	279	0.2	70	69
NW	Dr Kenneth Kaunda	227	216	212	233	280	227	215	254	259	1.7	65	68
NW	Dr Ruth Segomotsi Mompati	138	134	128	183	256	198	207	244	238	7.8	30	30
NW	Ngaka Modiri Molema	185	176	178	208	256	217	202	200	188	1.2	67	70
WC	Cape Winelands	86	98	80	112	141	133	127	141	143	6.7	37	33
WC	Eden and Central Karoo	50	56	69	96	105	91	105	96	72	5.6	49	53
WC	Metro Central	291	273	280	318	360	339	403	366	324	3.4	62	63
WC	Metro East	93	134	121	126	259	236	240	274	251	12.1	7	19
WC	Metro North	158	179	184	236	288	230	289	310	275	7.4	32	32
WC	Metro South	236	258	258	312	426	374	501	442	443	8.9	22	31
WC	Overberg	13	12	14	16	21	16	23	23	25	9.1	21	28
WC	West Coast	29	34	42	36	34	55	37	61	47	6.5	39	36

References

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