



## Message from the NSTF Executive Director

### The 2020 matric results and unpacking the implications of the surge towards e-learning

The Department of Basic Education (DBE) has officially saved the academic year, to everyone's relief, not least the matrics and other learners, the teachers and parents. It had to be saved to enable the 2020 matrics to leave school and for the progression of the thousands of learners in schools to be managed efficiently. However, it stands to reason that it is doubtful whether the children are better prepared for further studies and for life than they were in previous years. They are probably nowhere near as prepared, and it has always been pointed out how poorly school leavers are prepared, even before the Covid-19 pandemic. Tertiary institutions will have to support their first year students to acquire the skills they have not mastered at school, in order to succeed at their studies – much as has always been the case, only more so.

The DBE is blamed every year for sugar-coating the matric results, and for not calling attention to what is 'hidden in plain sight', namely the poor quality of our schooling, even when the pass rate looks good. However, the DBE has their job to do, and so do the critics among us. We should also never forget the learners, when we are bandying about the figures, or slamming the education system. Every single year, there are learners who worked hard and deserve their passes or distinctions. They are the heroes. They have succeeded against all odds. The deserving matrics of 2020 especially, should be wildly celebrated.

#### Top performers in science and maths

There are always high performers among those who passed in 'gateway' subjects – even in 2020. It is important to recognise those – every year. Though always a small percentage of those who write the matric exams, there is a substantial number of learners that achieve high marks in maths and science. They had worked hard and known the content well, and had known how to reason within the subject. They are fairly well prepared for tertiary studies requiring maths and science. Let's not forget these learners, and let's encourage and celebrate them.

What has to be criticised (as always) is that the learners celebrated by the Minister and DBE as the 'top learners' in the country in maths and in science, are not the only ones that are right at the top. Because NSTF peruses the top matric marks in both maths and science in every province every year, we are aware that there is always a number of matrics that have obtained 100% for both subjects. You cannot make an exception of any of these learners and claim that they are 'the best in the country'.

(The NSTF celebrates at least 18 of these top performing learners in maths and science every year, a boy and girl from each province, from government schools, and enrolled for first year at a university for STEM-related courses. We call this ongoing programme the *Brilliants* programme.)

#### 2020 matric results in maths and science

In December I wrote here in support of Umalusi that the second papers of maths and science respectively should be re-written to ensure the credibility of these critical exams. I still think that it would have been the correct thing to do, in principle, to rewrite exams when the papers had been leaked. But of course the matric results show that it was irrelevant whether the learners saw the exam papers before writing, and whether they had rewritten these papers or not. The results are as dismal as ever, only more so.

Of the small percentage of learners that wrote the mathematics exam, only 53.8% passed. Although the physical science pass rate was much better, at 65.8%, it came from even a lower base. The number of learners that wrote physical science was 174 310, which is 25% lower than the number that wrote mathematics. (It is a fairly typical year). The number that passed physical science is 10 768 less than the number that passed mathematics.

Let's look at 2020 in comparison with the previous four years:

How many learners wrote mathematics? This year 40.6% of all learners wrote mathematics. The rest wrote mathematical literacy as it is compulsory to do one of these two subjects<sup>1</sup>. In the previous four years the percentage of learners that wrote maths ranged from 42.3 to 44.3. The percentage of learners that wrote mathematics is therefore less than usual.

How many learners passed mathematics? The number of passes for 2020 is lower than that of 2016 to 2018, although it is slightly more than in 2019. The pass rate is lower than that for 2018 and 2019.

How many learners wrote physical science? The number that wrote is slightly higher than in 2018, and about 10 000 more than in 2019, but lower than in 2016 and 2017. In fact, the numbers went down every year until 2019.

How many learners passed physical science? The 2020 number of passes is lower than in any of the past four years. The pass rate is substantially below that of 2018 and 2019. It is slightly higher than 2016 and 2017.

These figures are not impressive, and the slippage of the numbers of students that can do STEM courses at tertiary level has to be turned around.

### **The education system**

To set South Africa on a productive and prosperous path to the future, the success of our education system is all-important. Its failings are well-known. Despite the Minister's celebration of the pass rate every year, this is not a measure of the success of the system. When it comes to the 'gateway' subjects of mathematics and physical science, success is even more evasive. The problems, even before the pandemic lockdown, seem insurmountable.

Perhaps schools can learn from those schools who managed to achieve success in 2020 despite the lockdown and other effects of the pandemic. One such school is Roosevelt Park High School in Johannesburg, which is in a fairly well-off suburb north of the city. Even this school experienced challenges during lockdown, as learners did not all have access to computers and affordable connectivity.

In the *Northcliff/Melville Times*, for the week ending 5 March 2021, it is reported that the school produced a 99% pass rate, 95% passes for degrees and diploma admission, and 69% bachelor degree passes. Four matriculants passed with 6-7 distinctions. The principal, Willie de Wet, says "We could not do all the google classes or any of technological things as many of our kids come from disadvantaged backgrounds". Other schools in the area could do so because the learners came from

wealthier households. The school coped with lockdown by using email and getting parents to pick up work and textbooks from the school. As happened elsewhere, the teachers put in many extra hours.

There are many more schools like this, that have helped their learners to succeed by sheer force of effort and will-power.

### **e-learning**

However, online and computer assisted learning is here to stay, and every effort should be made to make these accessible to every learner in the country. For years already, schools in privileged areas have encouraged e-learning, and even required it.

When my daughter was in school at a very good ex-model C high school (she matriculated in 2016), tasks and projects were set in such a way that assumed the learners had access to computers and internet. Most of the learners did not have such access, nor was there an education department or school policy regarding the use of computers for school work. We were among the privileged few families that had uncapped wifi and laptops. My daughter did her homework tasks and projects by looking up a variety of information on the internet, typing up her final product, and achieved good marks. Every time. I was baffled that the tasks and projects obviously required such resources to be available. Even at a non-fee paying school I more recently discovered the same assumptions, and that learners who had access to the right resources had a distinct advantage.

Advantages of e-learning, besides lessening social contact during a pandemic, include:

- Learners experience self-learning. This enables at least some of the learners to become more self-sufficient in learning environments in general. Where this is successful, it also has the advantage of more effective learning and critical thinking. In the process learners may be better equipped for future studies and careers.
- Cost savings, particularly in learner transport.
- No need for (hardcopy) textbooks – saving the education departments money, and making distribution more efficient.
- Engaging in an online environment prepares learners for the world they live in. Learners who grow up with digital technologies develop fluency in the basic uses of computers. This may prepare them better for the learning of technologies of the 4IR.
- Enabling the finding of information, making project work feasible.

The disadvantages, however, are myriad, e.g.:

- Every learner needs hardware (such as a tablet).
- Every learner needs connectivity at an affordable price to the education system.
- Currently connectivity is subject to unreliable internet signals and the uninterrupted availability of electricity. It also depends on coverage, which is by no means 100 percent in SA.
- Owning sought-after electronic gadgets are a security risk to the learners (whereas no thief would even consider stealing a textbook).
- Electronic gadgets might be sold when learners or their families are in dire financial need and where the basics such as rent and food have to be prioritised over education, or an addict in the family could regard their need as the greatest need of all.
- Electronic gadgets break, so every school needs a feasible plan for replacement and repairs.
- Software must be updated regularly and cyber-security has to be ensured.

- Software is currently mainly provided by mega-companies in the US. It has to be paid in dollars, making the price dependent on fluctuations in the Rand-dollar exchange rate. As every computer user knows, this makes the costs of essential software prohibitive.
- Although many young people have the mental agility and motivation to learn how their gadgets work, it cannot be assumed to be the case for every learner. There has to be a support system, a competent and reliable person to consult, and/or a school 'help desk' to assist learners remotely.
- Etc.

## **Pedagogy**

Then there is the challenge of identifying and practicing suitable pedagogies for e-learning.

Jonathan Jansen says that teachers determine children's futures, in [JONATHAN JANSEN | What SA's kids need are top-notch teachers. This is how to get them \(timeslive.co.za\)](#):

"Here's a frightening reality: the life chances of your child depend almost entirely on the quality of the teacher in the classroom.

"...the impact of the pandemic lockdown on long-term learning outcomes and the concomitant loss of instructional time will demonstrate, more than ever, the difference between smart, agile and effective educators — and the rest of them."

So, how should a teacher play his/her role without daily contact time? Each teacher will have to make a bigger impression on their learners every time they meet, and the quality of human interaction across the barriers inherent in remote learning has to be excellent. Teachers are being challenged as never before. Those who are able to project their strong characters, warmth and caring across the divide will best be able to influence and support their learners.

In particular subjects, the very instilling of content and understanding is challenging. In mathematics and science teaching and learning, effective learning in each grade enables learning at the subsequent grades and levels. This is partly why these subjects are difficult to master. Gaps in previous learning hamper further learning. Thus it is important to get the learning in maths and science right in every grade. Disruptions like the pandemic are disastrous for effective learning in these subjects. The logistical problems of providing every learner with hardware and connectivity have serious consequences, and there are bound to be continual disruptions to learning in our context.

Some consensus has been built around sound pedagogy in STEM subjects over the decades.

Principles of sound pedagogy include:

- The teacher should be a facilitator of learning, as the skills and insights in these subjects cannot simply be transferred from teacher to learner.
- These subjects are about the mastery of skills. Although knowledge remains important, you cannot be successful as a learner if you can't DO what is required by the subject matter. This includes reasoning in the manner of the particular discipline. It means being able to solve problems typical of the discipline.
- Hands-on involvement of the learners is essential. In science they should be doing the experiments themselves.
- Learning includes learning by example, in that the teacher models the actions needed, and the learners learn through seeing the skills and reasoning of the teacher. It is not enough for

the teacher to go through the motions – he/she must also be able to demonstrate what it means to grapple with a problem and working towards a solution.

- A sound pedagogy includes setting the learners tasks where they have to solve problems. This includes solving problems in context, where principles and processes of the subject are applied to the problems. Some approaches to pedagogy advocate for problems to be presented first, so that the learners learn the tools for solving the problem as they grapple with the problem itself.
- The facilitation of the teacher is all-important. He/she is there to guide the learners, either in mastering methods (the most common approach) or ideally, guiding the self-discovery process where learners explore and grapple with constructing meaning for themselves.

All the above (among other requirements) mean that most learners are severely challenged when they are left to learn by themselves in subjects like maths and science in particular.

### **Mathematics**

Maths anxiety as a phenomenon is well documented. Even before the pandemic, it has been shown to affect performance in the subject. Of all the subjects, maths can easily engender feelings of inadequacy in learners, because success in the subject entails solving of problems, usually without the benefit of a realistic context. Its content is abstract, and so are most of the contexts. There is pressure from the teachers, schools, tertiary education and even from parents for learners to succeed in this subject. It is often regarded as a measure of intelligence, to such an extent that those who tried and failed, experience themselves as failing an intelligence test. This can happen on a daily basis as learners try and fail to find the correct answers, or solutions to more complex problems.

One study - [\*Understanding Mathematics Anxiety: Investigating the experiences of UK primary and secondary school students\*](#), described on 14 March 2019, compared the mathematics learning experiences of a relatively large sample of students identified as mathematics anxious with similar children that are not mathematics anxious. More than 2 700 primary and secondary students in the UK and Italy were interviewed to examine maths anxiety and general anxiety. It is reported: “the findings indicate that the mathematics classroom is a very different world for children that are mathematics anxious compared to those that are not”. Teachers need to be conscious that an individual’s maths anxiety likely affects their mathematics performance. Teachers and parents also need to be aware that their own maths anxiety might influence their child’s maths anxiety.

Josh Hillman, Director of Education at the Nuffield Foundation [that funded the study], said: “Mathematical achievement is valuable in its own right, as a foundation for many other subjects and as an important predictor of future academic outcomes, employment opportunities and even health. Maths anxiety can severely disrupt students’ performance in the subject in both primary and secondary school. But importantly - and surprisingly - this new research suggests that the majority of students experiencing maths anxiety have normal to high maths ability. We hope that the report’s recommendations will inform the design of school and home-based interventions and approaches to prevent maths anxiety developing in the first place.”

Maths teachers have the task of minimising maths anxiety, and to support learners by their presence and guidance. Leaving learners to grapple with this subject on their own is a recipe for extreme anxiety for those learners who are trying their best without succeeding.

**What does this mean in the context of online learning and teaching?**

The methods of teaching have to change, and as soon as possible. Teachers should be advised and trained on their continuing role as mentors, and on sound pedagogy in a new and challenging environment. They will have to go through a process of self-learning, gradually improving their practice. Whereas this has always been the case, it becomes even more urgent. Perhaps this is a window of opportunity where teachers can enhance their pedagogical knowledge greatly, and make the necessary changes to their teaching to improve the understanding of the learners?

A variety of online teaching methods can be used, within a blended learning model (where the children are present in classes for part of the time).

Ways should be found to do group work. Group work allows the various strengths of the learners in a group to be pooled and the learners can learn from each other, and by tackling the challenges together. With a good mix of group members this can be stimulating and good for learners' emotional well-being. Online group work is possible (where the connectivity is adequate). Learners can meet as a group in a teleconference environment like MS Teams, with the teacher present. An alternative is online breakaway groups, but not every online platform provides this functionality.

Demonstrations by the teacher can happen live, or in video recordings. These two modes of presenting lessons by the teacher are also called: synchronous (where the learners are online with the teacher) and asynchronous (where the lesson is recorded by the teacher and the video made available to the learners to watch in their own time). Given the variability of internet coverage, connectivity and electricity supply in SA, asynchronous lessons seem to be the better option.

In maths and science, teachers and learners have to acquire the skills to write the symbols and expressions with a keyboard. Alternatively, learners can write by hand, and photograph/scan their work to send to the teacher. The means to do so must be provided to all learners.

### **Assessment**

It is more important than ever for teachers to learn how to set tests and exams in a way that measures that actual mastery of skills and problem solving. There are ways to set multiple choice questions that do so, but it is something that teachers have to learn – how to decide whether a question or task is a good measure of the desired skills.

One should also realise that multiple choice tests are not enough. Part of tests and exams should still assess learners' problem solving abilities directly. It is important for some of the learners' methods of solving problems to be visible to the teacher, and to assess their levels of insight.

There should be a database that teachers can tap into, providing good test questions for every section of all curricula, as well as classroom tasks. This is easier than ever to create and populate, and a 'low hanging fruit' for effecting improvement of teaching.

### **Hands-on learning**

Ways should be found for learners to do science experiments themselves. Contact lessons should ideally be used for this, while demonstrations can be provided by videos that learners can access from home. As always, the lack of well-equipped school laboratories is a debilitating factor. Every science teacher should have the materials and equipment to do demonstrations, and to allow learners to do experiments. These have to be stored securely and stocked up when necessary. The many schools that are poorly resourced have always struggled with security of materials and equipment, but there are methods where commonly available household materials can be used. Again, teacher training is of the essence.

## Support for teachers

Teachers require the support of colleagues, their schools and their districts. This has always been the case but it does not happen sufficiently in all schools. However, it is more feasible than ever to provide the necessary support on online platforms. The provision of talks and training for teachers is easier than ever before, and can be provided in the form of videos. Meeting and interacting are also easier (if connectivity is adequate).

Teachers are dependent on support, guidance and good materials. The internet makes it possible to have access to materials and mentorship online, but education departments must support such efforts to empower teachers, put incentives in place for teachers who do online courses, and find ways to enable mentorship.

## Conclusion

- ✓ The rapid move to e-learning is an ideal opportunity to make the education system more efficient and effective.
- ✓ Connectivity has to be provided to all learners and teachers as soon as possible. There are methods of doing so, but the education departments have to ensure that this happens. Internet service providers and other companies will have to continue to sponsor and support such efforts.
- ✓ Ways have to be found to provide learners and teachers with the required supplies and hardware, make provision for maintaining and replacing them, and keeping them as safe as possible.
- ✓ Teacher training must be provided in a variety of ways, and not just talking through the content of curriculum documents. They should be advised and assisted with the actual teaching methods and content knowledge in a very practical way, in the context of providing quality e-learning.
- ✓ Teachers should be taken seriously. The pandemic has demonstrated that learning cannot take place without teachers. They are the most precious resource of the education system. They should be enabled, supported and equipped. They should also be listened to – they are the ones that can best describe the challenges they are dealing with and the struggles of their learners.

***The opinions expressed above are those of the Executive Director, Ms Jansie Niehaus, and do not necessarily reflect the views of the [Executive Committee](#) or [members](#) of the NSTF.***