

# **Science Engagement Projects: 2022 Talent Development Programme Cohort Report**

**January 2024**

**Sylvia Hannan, Thando Tenza and Petronella Saal  
Human Sciences Research Council**



**science & innovation**

Department:  
Science and Innovation  
REPUBLIC OF SOUTH AFRICA



This report is published by the Human Sciences Research Council (HSRC). The research was commissioned and funded by the Department of Science and Innovation (DSI).

To cite this report: Hannan, S., Thando, T. and Saal, P. (2023). *Science Engagement Projects: 2022 Talent Development Programme Cohort Report*. Report to the Department of Science and Innovation. Pretoria: Human Sciences Research Council.

### **Acknowledgements**

We acknowledge the following institutions and individuals:

- The Department of Science and Innovation, for the funding and support of the Talent Development Programme (TDP).
- The Stellenbosch University Centre for Pedagogy (SUNCEP) for its implementation of the TDP programme and assistance with the provision of data for the study.
- The TDP learners who participated in the HSRC study.
- The TDP provincial coordinators for their planning and support of the TDP in their respective provinces and for their participation in this study.
- The TDP provincial tutors for their dedication to the programme and their participation in the study.

## Table of contents

Abbreviations and Acronyms .....	iv
List of Figures .....	v
List of Tables .....	vi
Executive Summary .....	vii
<b>PART ONE: EVALUATING THE 2022 TALENT DEVELOPMENT PROGRAMME .....</b>	<b>1</b>
1.1.    What is the Talent Development Programme? .....	1
1.2.    An evaluation of the TDP .....	2
1.3.    Key research questions .....	2
1.4.    Methodology .....	3
1.5.    The report .....	4
<b>PART TWO: 2022 TDP ROLE PLAYERS .....</b>	<b>5</b>
2.1.    Introduction .....	5
2.2.    2022 Talent Development Programme learners .....	5
2.2.1.    TDP schools and learners .....	5
2.2.2.    Learner selection .....	6
2.3.    Who were the learner respondents in 2022? .....	6
2.3.1.    Learners' home environments .....	6
2.3.2.    Learners' mathematics and science past, present and future .....	9
2.3.3.    Learners' schooling, out-of-school programmes and prior digital experience .....	13
2.4.    Who were the 2022 provincial tutors? .....	15
2.4.1.    Tutors' roles and responsibilities .....	16
2.5.    Who were the 2022 provincial coordinators? .....	17
2.5.1.    Provincial coordinators' role in the TDP .....	18
2.6.    Summary .....	18
<b>Part THREE: THE 2022 TDP EXPERIENCE .....</b>	<b>20</b>
3.1.    Introduction .....	20
3.2.    TDP mathematics and science lessons .....	20
3.2.1.    Lesson attendance .....	20
3.2.2.    Rating of aspects .....	20
3.2.3.    Provincial tutor sessions .....	21
3.2.4.    Supplementary lessons .....	22
3.2.5.    Holiday schools .....	22
3.3.    Content coverage, career guidance and resources .....	23

3.3.1.	Content coverage.....	23
3.3.2.	Career guidance .....	25
3.3.3.	TDP resources .....	26
3.4.	Impact on learners’ knowledge, understanding and skills .....	26
3.4.1.	Knowledge and understanding of topics .....	27
3.4.2.	Skills gained from the TDP .....	27
3.4.3.	Tutors’ views on learner related aspects before and after the TDP .....	28
3.5.	Engagement in the sessions .....	29
3.5.1.	In-person engagement.....	29
3.5.2.	Online engagement.....	30
3.5.3.	Encouraging engagement .....	30
3.6.	Challenges encountered.....	31
3.6.1.	Barriers to attending the TDP lessons.....	31
3.6.2.	Challenges identified by tutors .....	32
3.7.	Summary.....	33
PART FOUR: THE IMPORTANCE OF THE TDP AND THE WAY FORWARD .....		35
4.1.	Introduction.....	35
4.2.	Value-add of the TDP.....	35
4.3.	Learner views of the TDP.....	37
4.4.	TDP format.....	38
4.5.	Suggested improvements to the TDP .....	40
4.5.1.	Learners’ suggested improvements.....	40
4.5.2.	Tutors’ and coordinators’ suggested improvements.....	43
4.6.	Summary.....	44
PART FIVE: FINDINGS AND RECOMMENDATIONS .....		45
5.1.	Key findings.....	45
5.1.1.	TDP role players .....	45
5.1.2.	Mathematics and science: performance, attitudes, aspirations and experiences .....	45
5.1.3.	Attendance/use and experience of sessions .....	46
5.1.4.	Content coverage, career guidance and resources .....	47
5.1.5.	Impact: knowledge, understanding and skills.....	47
5.1.6.	Engagement .....	47
5.1.7.	Challenges .....	47
5.1.8.	Importance and way forward .....	48

5.2.	Recommendations.....	48
5.2.1.	TDP format .....	48
5.2.2.	Communication.....	48
5.2.3.	Learner selection.....	48
5.2.4.	Flexibility in scheduling and lesson formats .....	49
5.2.5.	Monitoring and encouraging participation.....	49
5.2.6.	TDP content.....	49
5.2.7.	Learner support.....	50
5.2.8.	Tutor support .....	50
5.2.9.	Technical support.....	50
5.2.10.	Stakeholder engagement.....	50
	References .....	51

## Abbreviations and Acronyms

ATP	-	Annual Teaching Plan
BEd	-	Bachelor of Education
BSc	-	Bachelor of Science
BTech	-	Bachelor of Technology
CAPS	-	Curriculum and Assessment Policy Statements
DBE	-	Department of Basic Education
DSI	-	Department of Science and Innovation
DST	-	Department of Science and Technology
FAL	-	First Additional Language
FET	-	Further Education and Training
HL	-	Home Language
HSRC	-	Human Sciences Research Council
LMS	-	Learning Management System
LoLT	-	Language of Learning and Teaching
PDoE	-	Provincial Department of Education
SAICA	-	South African Institute of Chartered Accountants
STEM	-	Science, Technology, Engineering and Mathematics
SUNCEP	-	Stellenbosch University Centre for Pedagogy
TDP	-	Talent Development Programme

## List of Figures

Figure 1: Phases of the TDP .....	1
Figure 2: 2021 TDP schools per province.....	5
Figure 3: TDP learners per province, by grade.....	6
Figure 4: Home resources .....	8
Figure 5: Home language .....	9
Figure 6: Learners' performance expectations in mathematics, science and English .....	10
Figure 7: Attitudes to mathematics and science .....	11
Figure 8: Learners' expected tertiary qualifications .....	12
Figure 9: Grade 12 learners' planned fields of study.....	12
Figure 10: Learner views on their school classes.....	13
Figure 11: Attendance of out-of-school programmes .....	14
Figure 12: Prior digital experience .....	14
Figure 13: Prior experience with online learning.....	14
Figure 14: Tutors' highest qualifications (n=33) .....	15
Figure 15: Tutors' occupations (n=33) .....	16
Figure 16: Tutor's experience in the TDP.....	16
Figure 17: Tutor's roles in the TDP.....	17
Figure 18: Live lessons attended.....	20
Figure 19: In-depth lessons accessed .....	20
Figure 20: Learners' ratings of lesson aspects .....	21
Figure 21: Rating of provincial tutor sessions (4 or 5) .....	22
Figure 22: Rating of supplementary lessons as 4 or 5 .....	22
Figure 23: Rating of holiday schools .....	23
Figure 24: Most useful Grade 11 mathematics and science topics .....	24
Figure 25: Most useful Grade 12 mathematics and science topics .....	24
Figure 26: Career activities during in-person holiday school.....	25
Figure 27: Usefulness of TDP resources.....	26
Figure 28: Improvement in knowledge and understanding .....	27
Figure 29: Skills gained.....	27
Figure 30: Further skills gained .....	28
Figure 31: Tutors' rating of learner-related aspects at the start versus the end of the TDP (4 or 5) ...	29
Figure 32: Barriers to attending lessons .....	31
Figure 33: Challenges encountered by the tutors .....	32
Figure 34: Tutor and coordinator views on the value-add of the TDP .....	36
Figure 35: Learners' views on the benefits of the TDP .....	38
Figure 36: Preferred TDP format.....	39
Figure 37: Positive aspects of in-person vs online lessons .....	40
Figure 38: Learners' suggested improvements.....	42

## List of Tables

Table 1: TDP survey responses.....	4
Table 2: Highest level of household education.....	8
Table 3: Learners' achievement in the previous grade.....	10



## Executive Summary

The Talent Development Programme (TDP) by the Department of Science and Innovation (DSI) aims to increase young people's engagement with science by identifying talented Grade 11 and 12 learners in mathematics and science and nurturing their knowledge and skills. The programme, managed by the Stellenbosch University Centre for Pedagogy (SUNCEP), was delivered through a hybrid model in 2022, incorporating online sessions (live lessons, in-depth recorded lessons, and provincial tutor sessions), as well as an in-person holiday school. The integrated Learner Management System (LMS), developed in 2020, underwent refinement, and ongoing support, including the provision of necessary resources (laptops/tablets and data), was ensured.

The Human Sciences Research Council (HSRC) was responsible for tracking TDP participants and evaluating the programme from 2017 to 2022 (Phase 3). Surveys were completed by Grade 11 and 12 learners who participated in the 2022 TDP (baseline and follow-up), as well as the provincial tutors and coordinators. In addition, focus groups, observations and interviews were conducted in five provinces during the June/July holiday school.

### **TDP roleplayers**

#### ***TDP learners***

Learners were chosen to take part in the TDP from schools across all nine provinces, primarily based on their previous achievements in mathematics and science. Most of these learners were Black African and predominantly hailed from socio-economic backgrounds ranging from poor to medium, facing limited access to educational resources at home. Notably, only around a third of the learners reported frequent use of English, the language in which the TDP is conducted, in their households.

*Learners' past (achievement, out-of-school programmes and digital experience), present (attitudes and schooling experience) and future (aspirations)*

Most of the TDP learners obtained a B or higher in mathematics, science and English in their previous academic year and expected to perform well in the year ahead. A quarter of Grade 11, and more than a third of Grade 12, learners had participated in an after-school science programme, and around a third attended a mathematics programme in the preceding year. A third of learners indicated that they had never worked on a computer and/or tablet prior to the TDP.

Learners expressed high levels of enjoyment of mathematics and science, placed a high value on the subjects in relation to higher education and career opportunities, and were confident in their abilities. Overall, most learners felt they received good support and feedback in mathematics, science and English and were happy with the instruction they received.

TDP participants had ambitious educational goals, with 83% of Grade 11 learners aspiring to attain a Master's or Doctoral degree, and 91% of Grade 12 learners expressing their intention to pursue a STEM-related field of study.

#### ***TDP provincial tutors***

Two thirds of the provincial tutor respondents were male, 70% were Black African, and around two thirds were above the age of 45. Most had completed at least a Bachelor's degree, with many

specialising in STEM or education related fields. All tutors were working in the education field, with many being educators. Three quarters of the tutors had been involved in the TDP before.

### ***TDP provincial coordinators***

Of the seven provincial coordinators that responded to the online survey, four were male and six were Black African. Four were based in provincial offices, while three were based in district offices. All of the provincial coordinators indicated that they had been involved in the TDP for more than four years.

### **2022 TDP experience**

#### ***Rating lessons and holiday schools***

Overall, learners rated the presentation of the lessons, lesson content, resources used, tutor's knowledge of the subject, and impact on their learning, positively. Learners were also predominantly positive about these aspects of the provincial tutor sessions. Engagement with tutors and other learners was rated somewhat lower, which is unsurprising given the online nature of these sessions.

A considerably higher proportion (almost three-quarters) of learners rated the in-person June/July holiday school as excellent, in comparison to 40% for the online October sessions, suggesting that learners preferred the in-person interactions.

#### ***Content coverage***

Learners identified the three most useful topics for mathematics and science, in each grade. It was stressed that participants enter the programme with varying levels of readiness and cover different curriculum topics in their respective schools. Consequently, tutors had to adapt the programme to align with the diverse needs of learners.

#### ***Career guidance***

Learners were provided with an array of career guidance activities during the TDP, as well as tablets comprising applications and websites with extra-curricular information, and data to research and learn more about career pathways.

#### ***TDP resources***

Learners found the resources supplied by the TDP, such as workbooks, university and bursary application links, and career booklets, to be beneficial for their learning, university readiness, and career guidance. At least 86% of learners reported each of the resources as being useful.

#### ***Impact on knowledge, understanding and skills***

Grade 12 learners reported that the TDP had improved their performance in the previous year. For both mathematics and science, half of the learners reported an excellent improvement in their knowledge and understanding attributed to the TDP, while a further third rated the improvement as very good. Furthermore, learners reported gaining a range of technical and social skills.

Tutors also found significant improvement in learners' understanding, ability to answer higher order questions, problem-solving skills, confidence, enjoyment and engagement, over the course of the year.

### ***Engagement***

Different engagement strategies were employed during the lessons, with the online sessions facilitated more as information-giving lessons. Learners found aspects of each type of lesson (in-person versus online) useful but, again, valued the in-person interactions with the tutors and their peers. Tutors found various ways to encourage engagement during both lesson formats.

### ***Challenges encountered***

The learners encountered some barriers to attending the TDP sessions, including other school activities being scheduled at the same time, internet connectivity issues, and their amount of schoolwork. Around a fifth also reported a lack of data as a barrier.

The tutors also faced obstacles, including connectivity and technology related challenges, low attendance and scheduling conflicts, limited face-to-face interaction, low engagement, a mismatch between the ATP and what is taught at schools, and teaching learners from different backgrounds with different ability levels.

### **Importance of the TDP and the way forward**

#### ***Value-add of the TDP***

The provincial tutors and coordinators recognised the value-add of the TDP with respect to learners' performance, future focus, interactions, support, resources and technology, and learners' growth. The tutors highlighted that they also benefitted from being involved in the TDP through being challenged and refining their skills.

#### ***Learner views of the programme***

Learners emphasised the role of the programme in improving their knowledge and performance, providing access to resources, making them proud of being selected, increasing their confidence, enabling friendships and being part of a community, promoting self-reflection and growth, and empowering them to help others.

#### ***TDP format***

Of the four TDP formats implemented during Phase 3, the two including at least some in-person engagement, were preferred by both the tutors and the coordinators: the in-person format in 2019 and earlier, and the 2022 format. This highlights the importance of in-person engagement.

#### ***Suggested improvements***

The learners, tutors and coordinators made several suggestions for ways to improve the TDP, including addressing the content, scope, communication, engagement, support, connectivity, career guidance, resources, learner attendance and assessment.

### **Recommendations**

The report concludes with a set of recommendations to enhance the TDP, in relation to:

- The TDP format,
- Communication,
- Learner selection,
- Flexibility in scheduling and lesson formats,

- Monitoring and encouraging participation,
- TDP content,
- Learner support,
- Tutor support,
- Technical support, and
- Stakeholder engagement

# PART ONE: EVALUATING THE 2022 TALENT DEVELOPMENT PROGRAMME

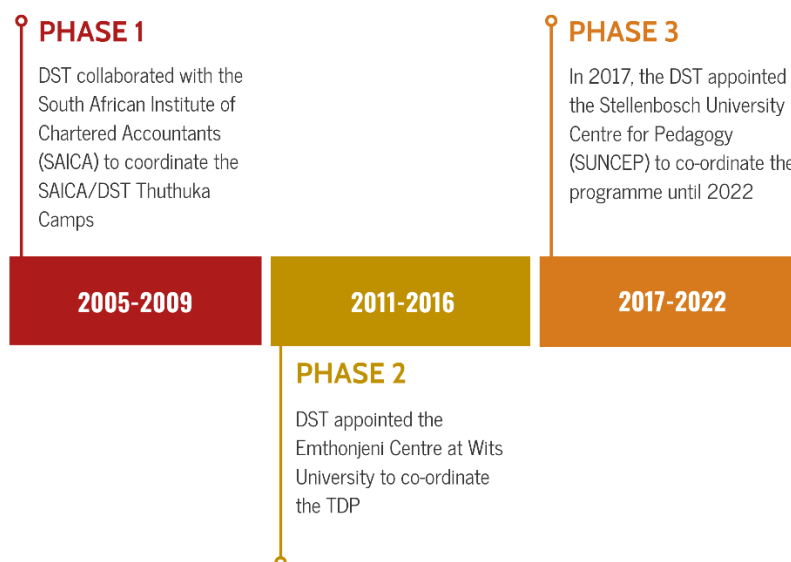
## 1.1. What is the Talent Development Programme?

In 2005, the Department of Science and Innovation (DSI)<sup>1</sup> launched the Talent Development Programme (TDP) as part of its Youth into Science Strategy<sup>2</sup> suite of projects. The primary objective of the TDP is to increase young people's access to science by identifying learners with exceptional talent and potential in mathematics and science. These identified learners are then provided with comprehensive support to nurture their knowledge and skills.

The TDP specifically targets learners in the final years of secondary school, with the ultimate goal of enhancing their academic performance, encouraging active engagement in extra-curricular mathematics and science activities, and fostering their pursuit of Science, Technology, Engineering, and Mathematics (STEM) studies, leading to potential STEM careers. Furthermore, the programme aims to equip school leavers with the necessary skills and preparation for higher education, including assisting them with university and bursary applications, while also offering guidance on various STEM-related career paths.

This report presents findings from the 2022 cohort of TDP learners, which was the cohort of Phase 3 of the TDP which began in 2017. The three TPD phases are outlined in Figure 1.

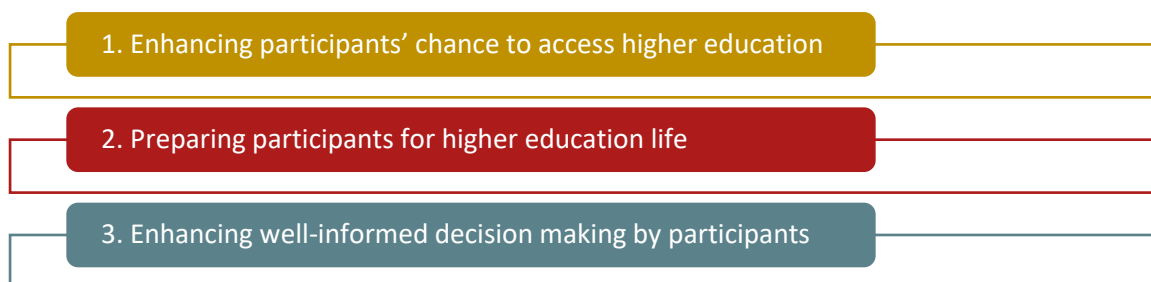
**Figure 1: Phases of the TDP**



<sup>1</sup> Previously the Department of Science and Technology (DST).

<sup>2</sup> This was later expanded to the Science Engagement suite of projects.

The TDP has three key focus areas:



For the TDP, schools and learners are carefully selected based on a set of criteria including the school's proximity to a science centre or activity, and involvement in the DSI's programmes<sup>3</sup>, learner's performance in mathematics and science in Grade 10 and their involvement in STEM activities. The selection of learners is managed by the provincial departments of education (PDoE), working with the schools in their respective provinces. In 2022, 722 learners took part in the TDP: 362 in Grade 11 learners and 360 in Grade 12.

As a result of the Covid-19 pandemic, the model of the TDP shifted from in-person to fully online in 2020, with the introduction of the TDP Smart Classroom, the online platform for learners. In 2021, the TDP remained an online intervention, with some updates and the introduction of provincial tutor sessions. In 2022, the programme transitioned to a hybrid model, incorporating both online (learner sessions, provincial tutor sessions and an online Holiday school in October) and face-to-face sessions (June/July holiday school). The programme followed the Department of Basic Education's (DBE) Annual Teaching Plan (ATP).

## 1.2. An evaluation of the TDP

The Human Sciences Research Council (HSRC) was appointed to evaluate the TDP's impact on participants in terms of their experiences, knowledge and skills gained, and their educational aspirations and career choices. This is achieved through collecting data each year from the current TDP learners and tracking the learners for two years following their exit from the programme upon completing Grade 12. This report provides an evaluation of the 2022 TDP.

## 1.3. Key research questions

The key research questions that framed this study were:

- Who attends the TDP?
- What are the attitudes of learners towards mathematics and science?
- What are the educational attainment and aspirations of learners?
- What are the learners' experiences of the TDP?
- What are the provincial tutors' views of the TDP?
- What are the provincial coordinators' views of the TDP?

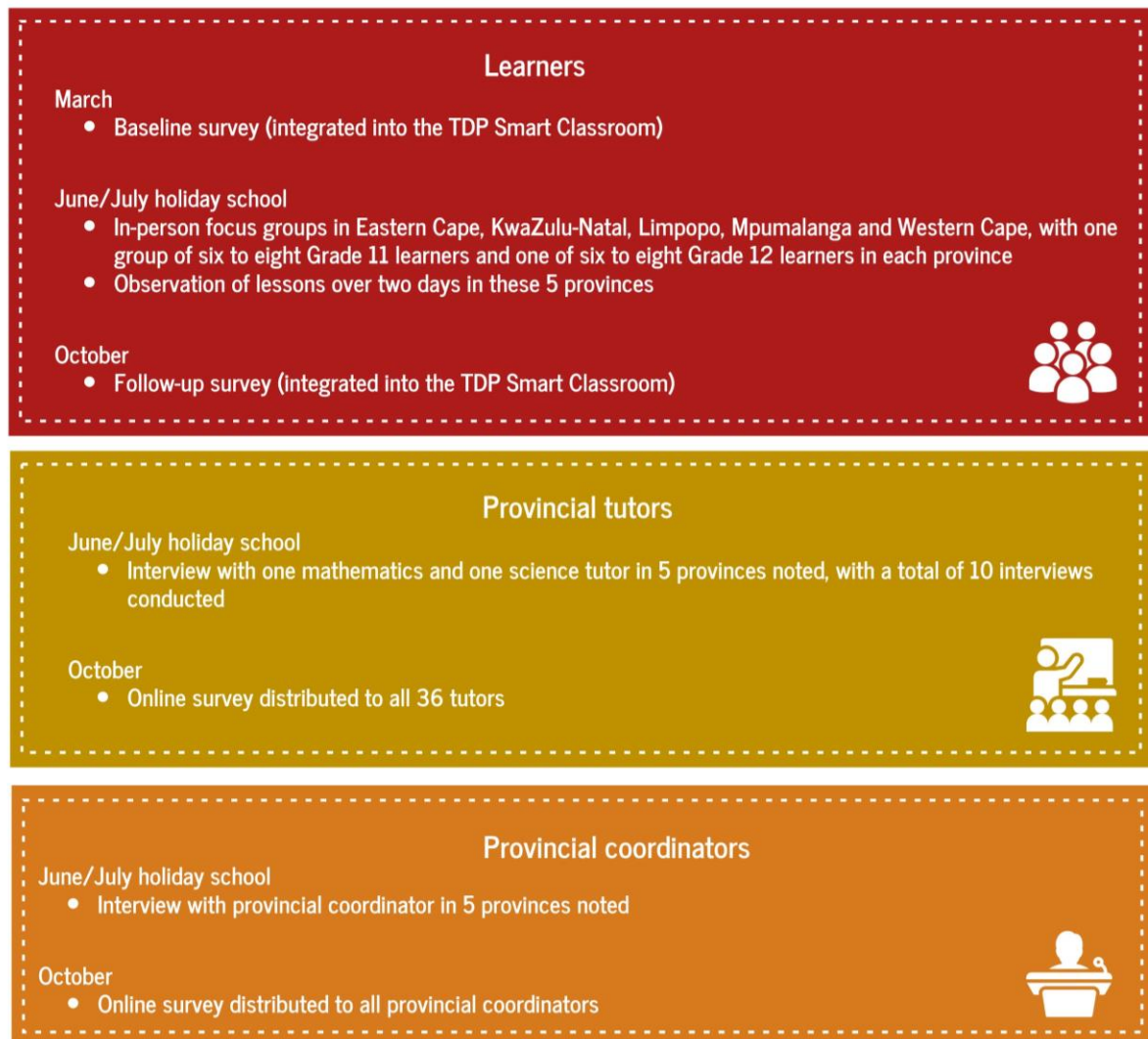
---

<sup>3</sup> For further information on the selection criteria, see Hannan, S., Arends, F. and Reddy, V. (2021). *Science Engagement Projects: Talent Development Programme Report on the 2020 Cohort*. Report submitted to the Department of Science and Innovation.

## 1.4. Methodology

Due to the reintroduction of the face-to-face holiday school for learners in 2022, the evaluation includes the completion of online surveys by learners, provincial tutors and coordinators, as well as learner focus groups, and qualitative interviews with the tutors and coordinators conducted during the June/July holiday school in five provinces (Eastern Cape, KwaZulu-Natal, Limpopo, Mpumalanga and Western Cape).

The evaluation of the 2022 TDP consisted of several components:



The baseline and follow-up surveys were loaded directly onto the TDP Smart Classroom platform by SUNCEP, and completion by the learners was tracked. The link to the tutor survey was sent to all 36 tutors and a 92% response rate was received. The online provincial coordinator survey was completed by seven coordinators, resulting in a 78% response rate. Table 1 presents the number of responses to each online survey and the corresponding response rates.

**Table 1: TDP survey responses**

		<b>Number of responses</b>	<b>Response rate</b>
<b>Learners</b>	<b>Baseline surveys</b>	585 (324 Grade 11 and 261 Grade 12)	82%
	<b>Follow-up survey</b>	612	86%
<b>Tutors</b>		33	92%
<b>Coordinators</b>		7	78%

## 1.5. The report

Part Two of the report focuses on the backgrounds of the key TDP role players: the learners, the provincial tutors and the provincial coordinators. Learners' attitudes to mathematics and science, their performance and aspirations are also presented. Part Three reflects on the 2022 TDP experience from the point of view of the learners and the tutors. Part Four explores the importance of the TDP and the way forward, in terms of the value-add of the programme, the preferred format and suggestions for improvement. Part Five presents key findings and recommendations from the study.



## PART TWO: 2022 TDP ROLE PLAYERS

### 2.1. Introduction

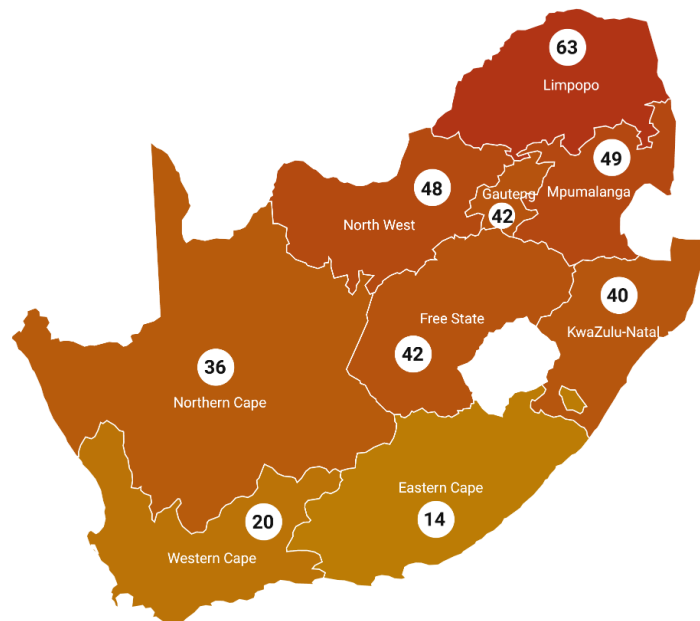
Part A introduces the key role players in the TDP. The information presented was obtained predominantly from several online surveys, focus groups (learners) and interviews (provincial tutors and coordinators). Learners were asked about their backgrounds, such as their gender, race, the province they live in, their parents' education levels, and resources available at home, as well as their attitudes to mathematics and science and their educational aspirations. They also indicated their views on their schooling, involvement in out-of-schools programmes and their levels of digital experience. The tutors were asked about their demographics, qualifications and jobs, as well as their involvement and expected roles in the TDP. The provincial coordinators provided their demographics, the period of their involvement in the programme and a description of their responsibilities.

### 2.2. 2022 Talent Development Programme learners

#### 2.2.1. TDP schools and learners

A list of schools in each province that the 2022 TDP learners attended was provided by SUNCEP. Figure 2 shows the number of schools from which learners participated in the TDP in each province.

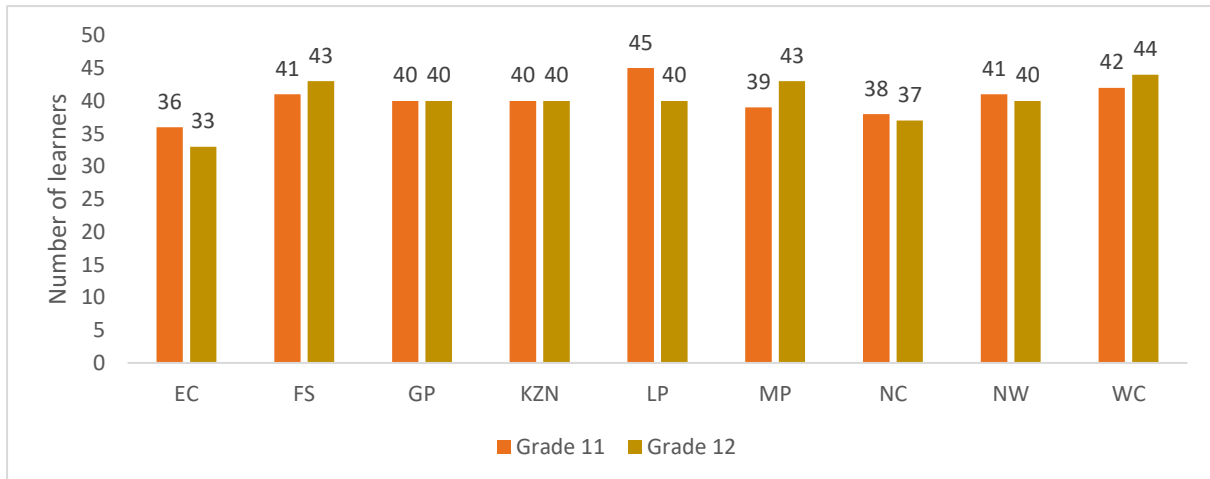
**Figure 2: 2021 TDP schools per province**



Learners were selected from 354 schools for the 2022 TDP. The provinces with the highest number of participating schools were Limpopo ( $n=63$ ), Mpumalanga ( $n=49$ ) and North West ( $n=48$ ), while learners were selected from fewer schools in the Western Cape ( $n=20$ ) and Eastern Cape ( $n=14$ ) provinces.

The number of learners that participated in each province ranged from 69 in the Eastern Cape to 86 in the Western Cape (Figure 3). Therefore, although the Western Cape selected learners from the second lowest number of schools, they included the highest number of learners.

**Figure 3: TDP learners per province, by grade**



### 2.2.2. Learner selection

To understand how learners came to attend the TDP, they were asked about their knowledge of the programme and their application process during the holiday school focus groups. Some learners had heard about the TDP from the previous cohort and had asked their educators to assist them in applying to be part of the programme. However, most learners were unaware of the TDP and did not apply to participate in the programme, but were selected by their educators, principals in conjunction with heads of departments, and district officials, based on their Grade 10 mathematics and science results.

## 2.3. Who were the learner respondents<sup>4</sup> in 2022?

In order to understand the learners who are participating in the TDP, Grade 11 learners were asked a set of background questions in the first survey, including aspects related to their home environments, their attitudes to mathematics and science, and their aspirations for the future.

### 2.3.1. Learners' home environments

The home environment plays a critical role in learning. There are various factors that contribute to the promotion of a conducive learning environment, including the socioeconomic status of the home (available resources, parental education) and the learners' home language.

#### *Access to resources at home*

The extent of resources available at home has an impact on learners' performance. Research has shown that learners with access to more assets and educational resources at home achieve higher scores in subjects such as mathematics and science (Reddy et al., 2022). Families with more socioeconomic resources are better able to provide their children with material resources to support

<sup>4</sup> In this section of the report, we predominantly present the baseline information collected from the respondents: we use the terms "learners" or "participants" in the rest of the report.

schooling (Roksa and Potter, 2011), while children from high poverty homes are less likely to get assistance with schoolwork (Caro, McDonald and Willms, 2009). Some studies have shown that socioeconomically disadvantaged parents can be effectively engaged in their children's schooling (Watt, 2016); however, high achievers from lower socioeconomic contexts remain the exception rather than the rule, due to the additional challenges that these learners face (Harris and Robinson, 2016).

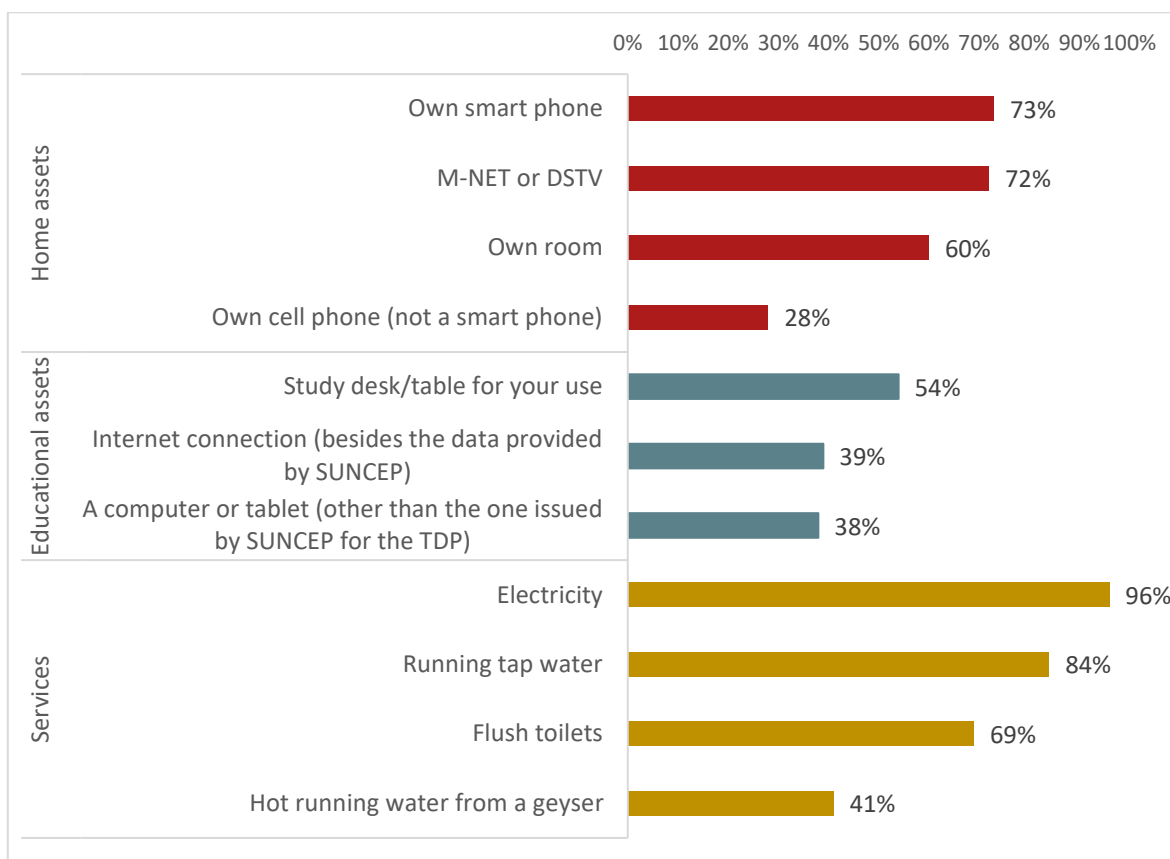
The Grade 11 participants were asked about their access to a set of resources in their homes (Figure 4), including: 1) home assets, which most learners would have access to; 2) educational assets, used for educational purposes; and 3) services provided externally by another party (for example, water and electricity supply).

Figure 4 highlights that nearly three quarters of the learners reported that they had their own smartphone (73%), while just over a quarter indicated that they owned a cell phone (not a smart phone) (28%). Around three quarters of learners reported that they had M-NET or DSTV (72%) at their homes and 60% had their own room. These indicators (home assets) are all resources that learners have at their disposal at home and reflects their socioeconomic environment.

The availability of educational assets beyond those offered by SUNCEP was another question learners were asked. SUNCEP provided the TDP participants with a computer or tablet, along with data, to facilitate their participation in the programme. Just over half of the learners reported that they had a study desk/table (54%). What is concerning is that less than half indicated they had access to an internet connection (39%) or a computer or tablet (38%). This finding also highlights the need for educational technology, especially in the light of the hard lock down phase of the Covid-19 pandemic (which began in March 2020), which forced many learners to switch to digital or remote learning methods.

With regards to basic services at home, almost all learners reported having electricity (96%) and running tap water (84%), while less than half had hot running water from a geyser (41%). Additionally, while almost 70% of the learners reported having flush toilets, there was still a notable portion of the sampled learners that lacked this facility. Access to electricity (Dube & Moyo, 2020) and running tap water (Oskam et al., 2021) are considered basic necessities in many parts of the world and may not provide a clear indication of socioeconomic status on their own. However, the limited availability of hot running water from a geyser and flush toilets could suggest a lower to medium socioeconomic status for a portion of the surveyed learners. The findings regarding learners' access to home resources highlight important insights into the challenges and opportunities for the TDP and learning. For instance, having a personal room may provide a conducive uninterrupted learning environment but the absence of a study desk might hinder effective learning. Additionally, the effort by SUNCEP to give participants in the TDP a computer or tablet as well as data highlights the significant assistance of external support in closing the technological divide. These provisions ensured that participants could actively engage in the TDP regardless of their home resources. A lack of basic amenities could affect learners' morale and health, as well as their overall wellbeing which could, in turn, influence learner performances and their overall engagement with the TDP.

**Figure 4: Home resources**



**Level of parental education**

The level of education attained by a parent indicates a learner’s access to educational capital and the level of support they receive for learning at home. Studies have found that learners tend to perform better when their parents have higher levels of education (Branson and Zuze, 2012).

Table 2 illustrates the highest degree of education attained by the mother (or stepmother or female guardian) and father (or stepfather or male guardian) of the Grade 11 learners. Less than a quarter had fathers (17%) with a first degree or higher, with the corresponding figure for mothers being 15%. On the other hand, a third of learners’ mothers (34%) and about 21% of their fathers had completed matric. Findings also showed that 13% of these learners’ parents/guardians, respectively, only completed Grade 9, or less, or did not attend school. Overall, the findings suggest that a significant proportion of learners have parents or guardians who have not attained education beyond matric.

**Table 2: Highest level of household education**

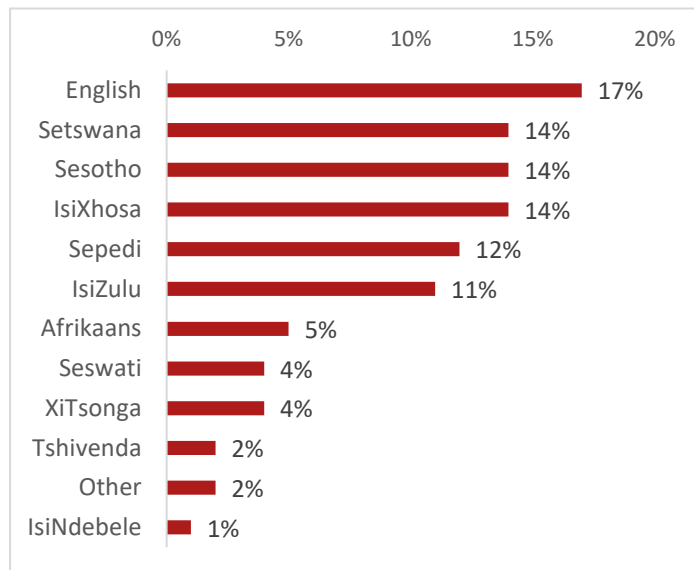
Highest level of household education	Mother	Father
Completed Grade 9 or less	13%	13%
Completed Grade 12 (Matric)	34%	21%
Completed post-matric certificate/diploma	16%	8%
Completed first degree or higher	15%	17%
Do not know	22%	42%

*\*Information provided by learners about parental education levels must be read with caution, as it may be inaccurate.*

### Home language

Language proficiency has consistently been shown to be related to learning and achievement scores (Howie, 2003; Prinsloo, Rogers & Harvey, 2018). The Trends in International Mathematics and Science Studies have found that learners speaking the language of the test more frequently achieved higher scores in mathematics and science (Reddy et al., 2022; Zuze et al., 2017). The Grade 11 learners were therefore asked about their home language (Figure 5) and the extent to which they spoke English (the language in which the TDP is delivered) at home.

Figure 5: Home language



Although English was the most common home language; followed by Setswana, Sesotho and isiXhosa; only 17% of learners spoke English as their home language. Just over a third of learners indicated that they spoke English at home “always” or “almost always”; while more than half spoke English at home only sometimes, and 9% never spoke it at home. This has implications in terms of learners’ abilities to successfully participate in the TDP as it affects the support they receive at home in terms of their learning.

### 2.3.2. Learners’ mathematics and science past, present and future

This section focuses on the TDP learners’ performance in their previous grade in key subjects, their attitudes to mathematics and science at school and experience of these school subjects, and learners’ aspirations for the future.

#### Past performance in mathematics and science

We asked all learners to provide their mathematics and science examination results from the previous academic year, either Grade 10 or 11 (Table 3).

As shown in Table 3, most of the learners obtained a B or higher in mathematics, science and English. Higher results in mathematics than science and English were reported, with around three quarters of learners obtaining an A in mathematics, half in science and around 40% achieving an A in English. The strong performance in mathematics and science, suggests that there is a potential pool of learners with the aptitude and interest to pursue STEM tertiary studies and careers. Providing support, resources, and opportunities to enhance their skills in these areas can help foster a future workforce in STEM fields.

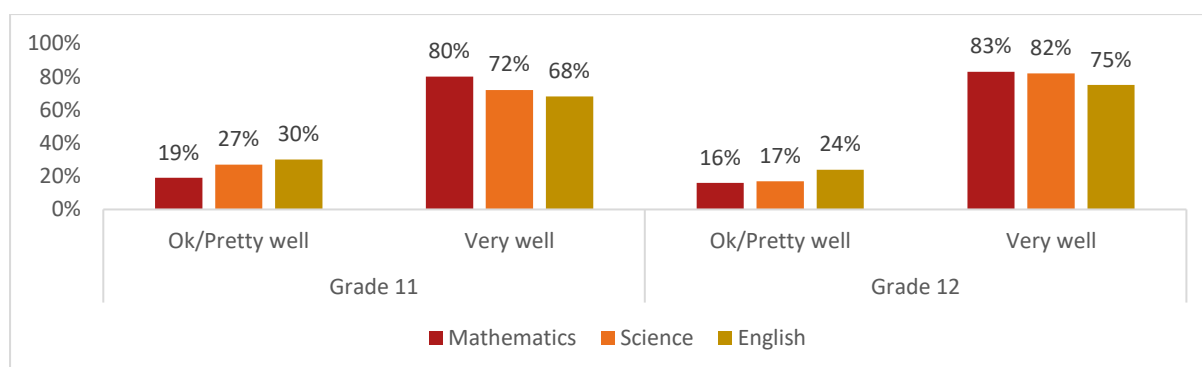
**Table 3: Learners' achievement in the previous grade**

	Mathematics		Science		English	
	Grade 11 (Grade 10 results)	Grade 12 (Grade 11 results)	Grade 11 (Grade 10 results)	Grade 12 (Grade 11 results)	Grade 11 (Grade 10 results)	Grade 12 (Grade 11 results)
<b>A (80-100%)</b>	72%	71%	51%	50%	42%	40%
<b>B (70-79%)</b>	22%	19%	38%	29%	39%	39%
<b>C (60-69%)</b>	4%	5%	10%	14%	16%	16%
<b>D (50-59%)</b>	2%	3%	1%	4%	2%	4%
<b>E (40-49%)</b>	0%	1%	0%	2%	1%	0%

### Performance expectations

All learners were asked to report on their performance expectations in mathematics, science and English for 2022 (Figure 6).

**Figure 6: Learners' performance expectations in mathematics, science and English**



Most learners expected to do “very well” in all three subjects, particularly mathematics: around 80% for each grade. A lower percentage felt they would do very well in science, and there was a further decrease in the percentage for performance expectations in English (Grade 11: 68%; Grade 12: 75%). Even though almost three quarters of the learners expected to do “very well” in English, one must note that English is a second language for many learners. The lower expectations in English could be attributed to the challenges learners face in mastering a second language. The significance of the results should consequently be emphasised in the context of the TDP being presented in English.

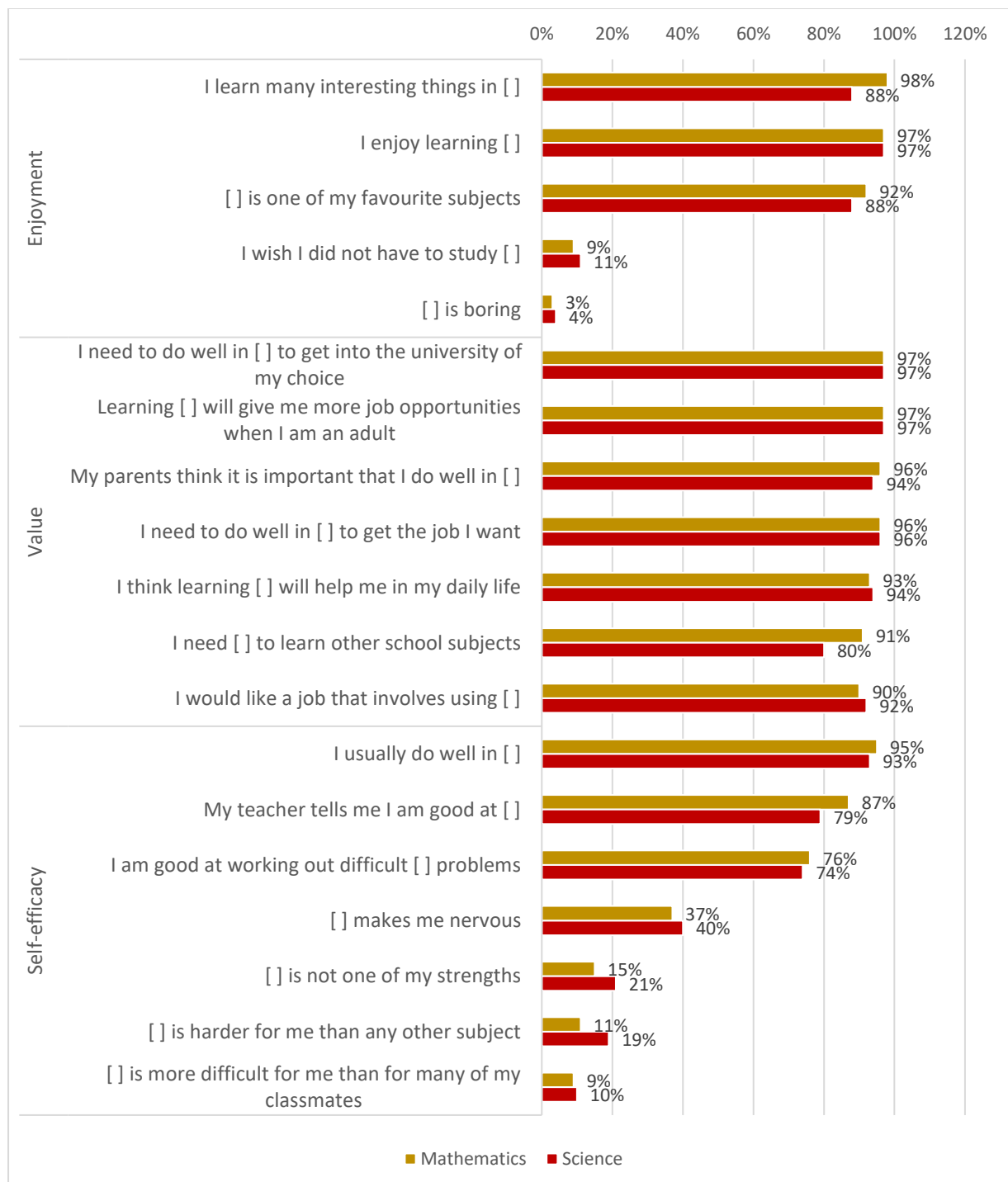
### Attitudes to mathematics and science

Attitudes to a subject include learners' enjoyment of the subject, the value they place on it for themselves and society, and the confidence they have in their ability to perform well (self-efficacy) in the subject (Juan et al., 2018). Attitudes are associated with learner achievement: learners with more positive attitudes generally perform better (Reddy et al., 2022).

The learners expressed high levels of **enjoyment** of mathematics and science, with 98% and 88% respectively, reporting that they learn interesting things in these subjects. Similarly, learners placed a high **value** on the subjects in relation to higher education and career opportunities, and the expectations of their parents. Nearly all learners (97%) reported that learning mathematics and

science would assist them to access a university. Similarly, 97% showed interest in pursuing jobs involving mathematics and science. Learners also reported high levels of **confidence** in their mathematics and science abilities. Although 37% of learners stated that mathematics made them nervous and 40% were nervous about science, around three quarters of learners (mathematics: 76%; science: 74%) were confident that they could solve difficult problems in these subjects. It is also noteworthy that less than 10% of learners experienced mathematics as a difficult subject. Overall, it appears that learners' attitudes about mathematics were slightly more favourable than those towards science.

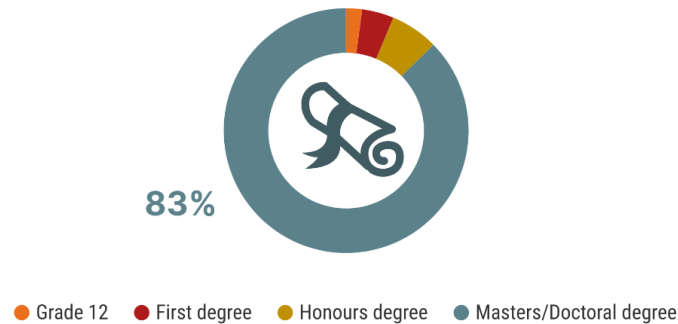
**Figure 7: Attitudes to mathematics and science**



### Future educational aspirations and plans

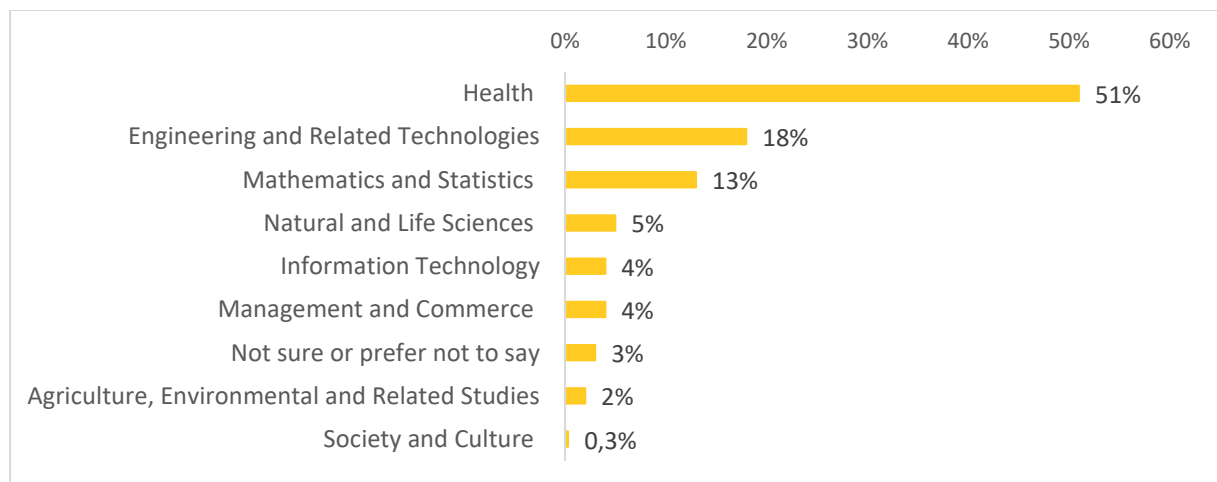
Learners in Grade 11 were questioned about the highest level of education they planned to pursue, while Grade 12s were asked about their post-secondary goals. Eighty three percent of Grade 11 learners planned to complete a Master's/Doctoral degree, with a further 11% aiming to finish an Honours degree and 4% planning to pursue a first degree only (Figure 8).

Figure 8: Learners' expected tertiary qualifications



Learners were also asked which fields of study they would like to pursue after Grade 12 (Figure 9). Just over half of the learners were interested in studying Health (medicine, nursing, dentistry, nursing, pharmacy, physiotherapy and occupational therapy and radiology). The second most popular field of study was Engineering and Related Technologies, followed by Mathematics and Statistics. The top five fields of interest were STEM related, with 91% of learners planning to pursue tertiary studies in one of these fields. This highlights the high level of interest TDP learners have in STEM related pathways.

Figure 9: Grade 12 learners' planned fields of study



During the June/July holiday school focus groups, most learners also revealed that they would like to pursue STEM careers due to challenges facing society such as climate change, food security and the changing demands in Agri-science. Others wanted to become surgeons and gynaecologists involved in building local clinics to mitigate risk behaviour and sexual reproductive health challenges. In contrast, others were interested in engineering and actuarial sciences. One learner stated that they wanted to become the president of South Africa. Learners showed that they have high aspirations and many aim to make a difference in society through their chosen career pathways.

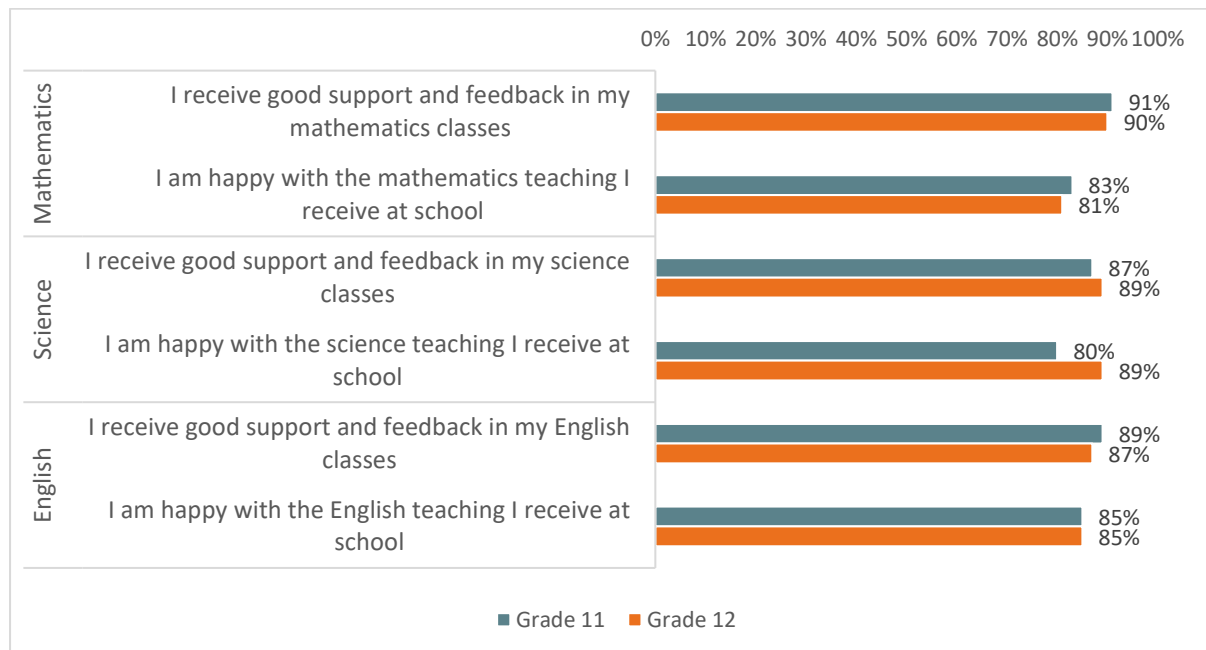


### 2.3.3. Learners' schooling, out-of-school programmes and prior digital experience

#### *Views on mathematics, science and English at school*

We asked Grade 11 and 12 learners to express their views on the support, feedback and teaching they received at school in relation to mathematics, science and English in order to better understand how they experienced these learning areas in schools. Figure 10 depicts to what extent learners agreed or strongly agreed with each statement linked to the three subjects.

**Figure 10: Learner views on their school classes**



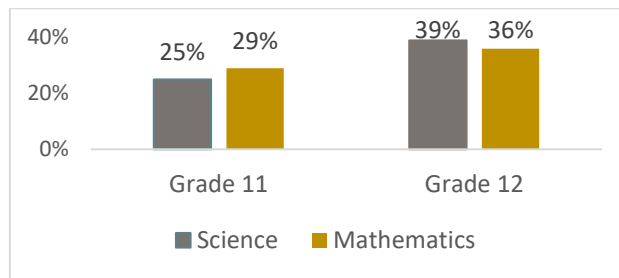
Overall, most learners were of the view that they received good support and feedback in mathematics, science and English and were happy with the instruction they received. Slightly more learners agreed that they received good support and feedback in mathematics than in science and English. In terms of the instruction received at school, the lowest overall satisfaction was for mathematics. These findings indicate that there are areas for improvement in instruction, which could be determined from an examination of the reasons behind the satisfaction levels. This could then be used to enhance the overall learning experience in the TDP, compared to learners' schooling.

#### *Out-of-school programme attendance*

Learners were also asked whether they had attended any out-of-school mathematics or science programmes (Figure 11) besides the TDP in the 12 months preceding the survey, which was administered in March 2022.

A quarter of Grade 11 and more than a third of Grade 12 learners claimed to have participated in an after-school science programme, and around a third attended a mathematics programme. The majority, however, did not attend any other out-of-school programmes, and the TDP therefore has a crucial role to play as the only programme providing support to these learners.

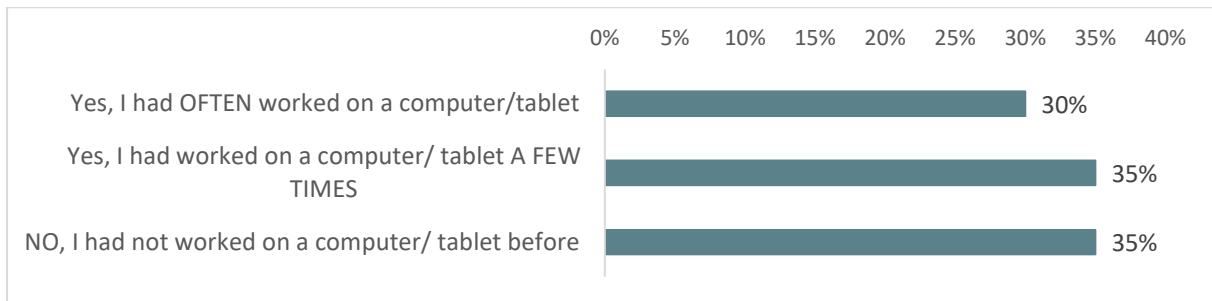
**Figure 11: Attendance of out-of-school programmes**



**Prior digital experience**

To assess the digital literacy skills of the learners, they were asked about their prior experience with computers and/or tablets (Figure 12).

**Figure 12: Prior digital experience**

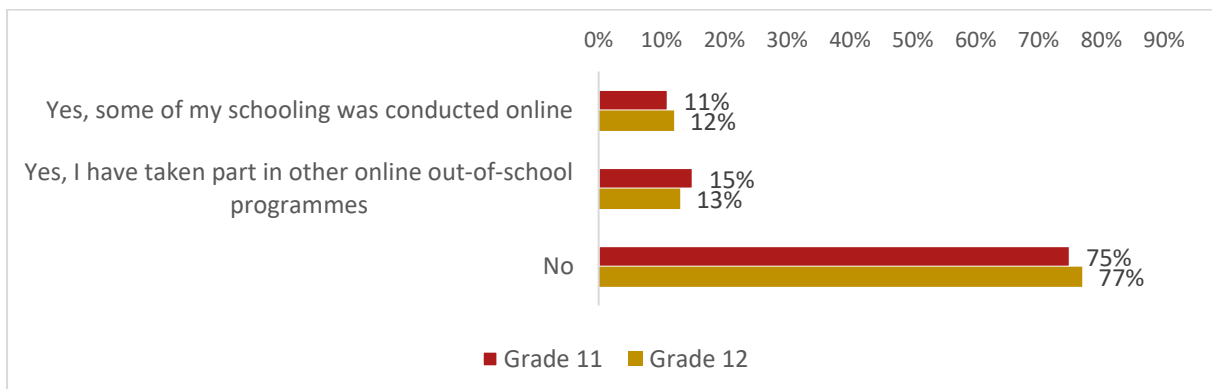


Thirty percent of the learners indicated that they often worked on a computer and/or tablet, while a further third had worked on a computer and/or tablet a few times, with the remaining third having never worked on these devices. Additional support was provided to these learners to effectively engage with the TDP. Through this, they would have gained valuable digital skills that are becoming increasingly important in the 21<sup>st</sup> century.

**Previous online learning experience**

In addition to the TDP, learners were asked to report on their prior online learning experience (Figure 13). This was done to determine learners’ level of experience when entering the TDP, which would have impacted their readiness to engage effectively in the programme.

**Figure 13: Prior experience with online learning**



More than three quarters of learners indicated that they did not have prior online learning experience, while around 10% highlighted that some of their schooling was conducted online, or they had participated in other online out-of-school programmes. This is an important indicator of the amount of assistance that learners would have needed to use the TDP Smart Classroom and participate successfully in the 2022 TDP.

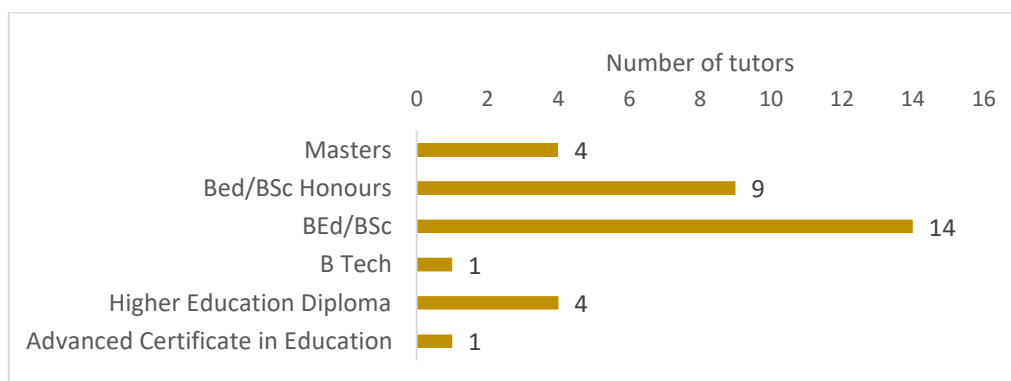
#### 2.4. Who were the 2022 provincial tutors?

Of the 33 tutors that responded to the online survey, approximately two thirds were male (64%), with the remaining third being female (36%). Seventy percent of the respondents were Black African; with 15% being coloured, 9% White and 6% Indian.

Around two thirds (64%) of the tutors were above the age of 45, a quarter (24%) were between the ages of 36 and 45, and 12% were aged between 25 and 35. This reveals a high level of experience for most of the provincial tutors.

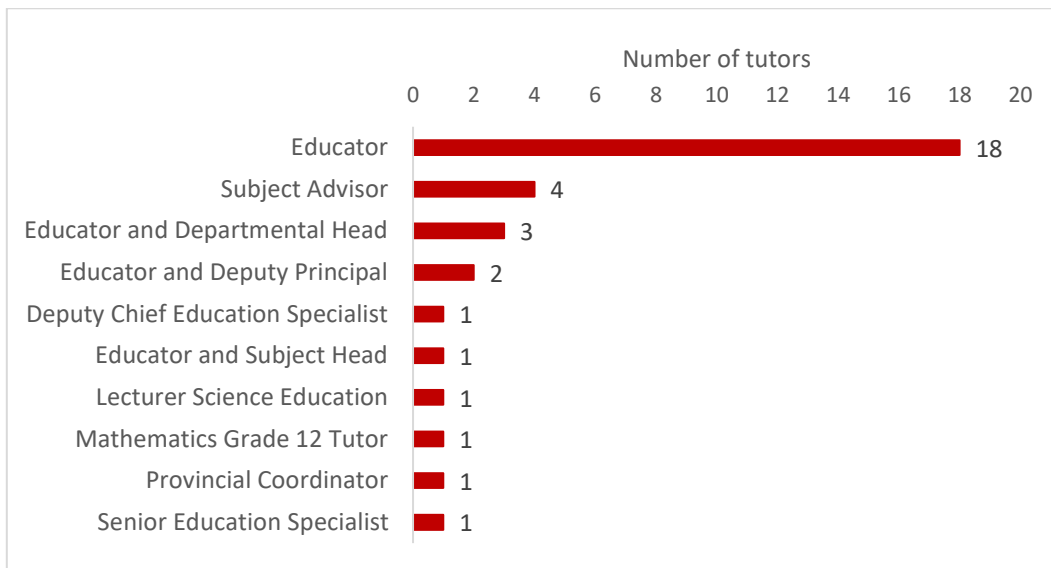
Further evidence of the tutors' experience is shown in Figure 14. Fourteen of the tutors had completed either a Bachelor of Education (BEd) or Bachelor of Science (BSc), with nine having an Honours degree and a further four having completed a Master's degree. The disciplines studied included Mathematics and Statistics, Physical Science, Life Science, Chemistry, Microbiology, Biochemistry and Education, with one tutor having pursued Chemical Engineering and another Business Administration.

**Figure 14: Tutors' highest qualifications (n=33)**



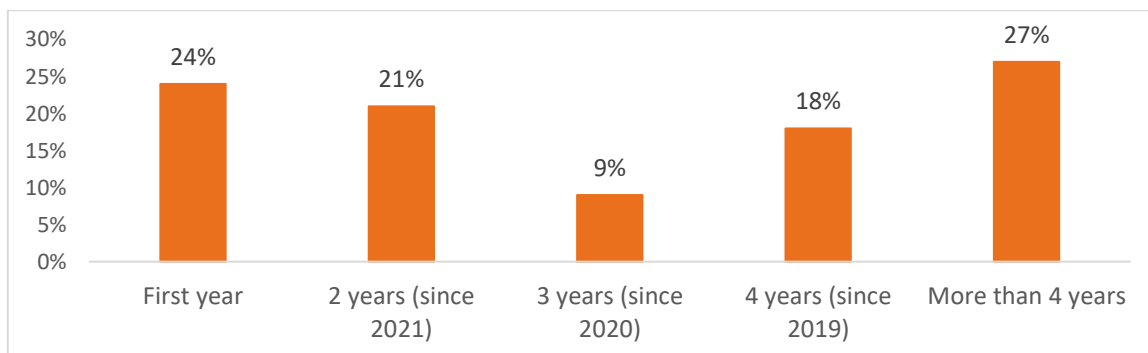
Furthermore, many of the 2022 tutors indicated educators as their profession (Figure 15), with several holding an additional role as Departmental Head, Deputy Principal and Subject Head. Four of the respondent tutors were subject advisors, one was a Deputy Chief Education Specialist for Chemistry, one a Provincial Coordinator, one a Senior Education Specialist, one a Science Education lecturer, and one a Mathematics tutor.

**Figure 15: Tutors' occupations (n=33)**



The tutors' qualifications and professions reveal that they were well positioned to teach the TDP learners and provide them with support in participating successfully in the programme. In addition, more than half had been involved in the TDP for at least three years, with just over a quarter (27%) having been TDP tutors for more than four years (Figure 16).

**Figure 16: Tutor's experience in the TDP**



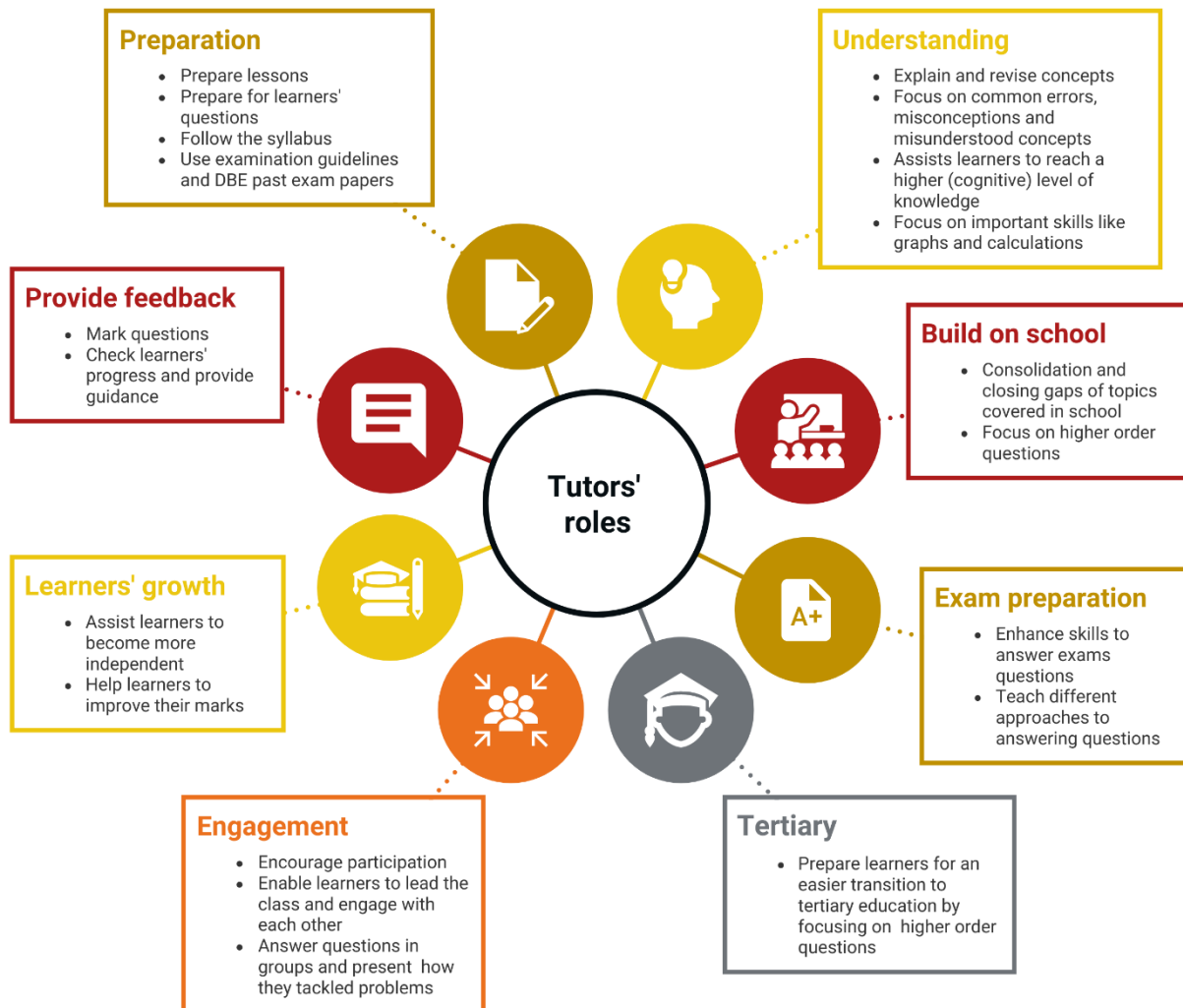
### 2.4.1. Tutors' roles and responsibilities

In the interviews conducted during the June/July school holidays, tutors were asked about their roles and responsibilities. The tutors reported meeting at the beginning of the year, with tutors from all nine provinces, to discuss the content for the lessons, the programme for the holiday schools and the materials to be used. The tutors then have the freedom to develop their own lesson plans.

Tutors noted that they attended the Saturday Zoom classes to assist them in preparing for their sessions during the week. The online lessons were identified more as information sharing sessions, where tutors facilitated learning; while the in-person lessons were more rigorous as they allowed tutors to check learners' progress and intervene where required, providing an opportunity for continuous assessment of the learners. Tutors administered a pre-test at the in-person holiday school to assess the knowledge level of learners and enable them to prepare the necessary interventions.

Tutors also reported meeting at the end of each day to discuss challenges, areas of improvement, how to accommodate those learners who were struggling, and ways of further encouraging those that were performing well. Figure 17 outlines some of the key roles of the TDP tutors.

**Figure 17: Tutor's roles in the TDP**



**Materials and technology used by tutors**

The tutors were asked about the material and technology that they used their lessons. Projectors emerged as the dominant technology used during the TDP lessons, followed by smartboards, laptops, tablets and flipcharts. Calculators were part of the learning materials for learners who engaged in mathematics and physics, while a few tutors leveraged resources such as past exam papers, YouTube videos and textbooks. One tutor had even made their own visualiser which was faster than the Zoom pen.

**2.5. Who were the 2022 provincial coordinators?**

Of the seven provincial coordinators that responded to the online survey, four were male (57%) and six were Black African. Four were based in provincial offices, while three were based in district offices.

All of the provincial coordinators indicated that they had been involved in the TDP for more than four years.

### 2.5.1. Provincial coordinators' role in the TDP

The provincial coordinators identified the following elements in their role in the programme:

- a) Interact with the project sponsor and department;
- b) Facilitate the selection of the learners for the TDP with the help of subject advisors and the districts;
- c) Identify the venue for contact sessions with the learners and dealing with the travel, resources and other logistical requirements
- d) Select suitably qualified and competent tutors for the programme;
- e) Attend to the challenges encountered by the tutors and the learners; and
- f) Monitor and support the implementation of the TDP.

## 2.6. Summary

Learners were selected from 354 schools from across all nine provinces for the 2022 TDP. Learners were asked to report on their home environments, attitudes towards mathematics and science, and future aspirations. Most of the participants had access to basic utilities such as electricity and tap water. However, a third of the participants lacked flushed toilets and many did not have access to hot running water, indicating disparities in basic amenities. Furthermore, there was a concerning digital divide, with less than half of the learners having access to internet facilities and digital devices, other than those provided by SUNCEP. The effort of SUNCEP to give learners access to computers and the internet highlights the urgent need to bridge this technology divide to promote successful participation in the TDP.

A notable portion of the participants had parents who had not pursued education beyond Grade 12, which could potentially influence their academic achievement, aspirations and experiences. Yet, a considerable portion of these learners showcased high performances in mathematics and science, hinting at future STEM-related studies and careers. Besides high learner achievement, learners also displayed positive attitudes towards mathematics and science, with high levels of enjoyment, value, and self-confidence. These learners also shared a common belief that proficiency in mathematics and science could open doors for better higher education and employment prospects. An overwhelming majority indicated that they wished to pursue Master's and Doctoral degrees.

Learners also reported their involvement in out-of-school programmes and their prior digital experience. The vast majority of learners did not attend any other out-of-school programme, and more than three-quarters indicated that they did not have prior online learning experience. This indicates the need for additional support to help learners effectively engage with the TDP.

Approximately two thirds of the tutor respondents were male. A significant proportion were Black African with many being above 45 years old. Many of them had completed a Bachelor of Education or Bachelor of Science degree, with some holding additional leadership roles such as Departmental Head, Deputy Principal, and Subject Head. These tutors had been associated with the TDP for various years,

thereby being aptly poised to guide the learners. Regarding teaching aids, projectors emerged as the primary tool, followed by other technological devices like smartboards and laptops.

Lastly, the provincial coordinators, approximately half of who were male and mostly Black African, had been involved in the TDP for over four years. Their roles included interacting with the project sponsor and department, facilitating the selection of learners, identifying contact sessions, selecting competent tutors, addressing challenges, and monitoring and supporting the TDP implementation.

The next section of the report presents findings on the 2022 TDP experiences of the learners and provincial tutors.

## Part THREE: THE 2022 TDP EXPERIENCE

### 3.1. Introduction

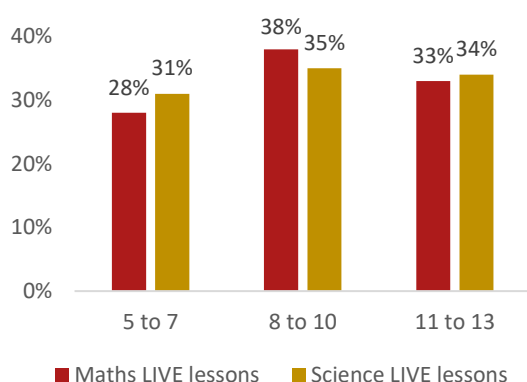
Part Three focuses on the learners' experience of the 2022 TDP, as well as the tutors' views of the programme. The findings presented are from the follow-up online learner survey and learner focus groups, as well as the tutors' survey and in-person interviews.

### 3.2. TDP mathematics and science lessons

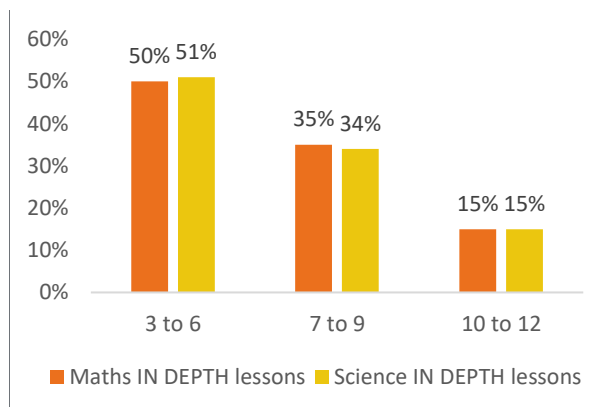
#### 3.2.1. Lesson attendance

Learners were asked to indicate the number of mathematics and science lessons they had attended at the time of the follow-up survey (October 2022) to assess their level of engagement with the TDP. Figure 18 and Figure 19 show that learners had engaged to a greater extent in the live lessons which were held online, with more than two thirds having attended at least 8 of the 13 lessons, and a third attending 11 or more. Conversely, only around half of the respondents had accessed more than seven of the in-depth lessons, which were pre-recorded and available for learners to access on the TDP Smart Classroom platform, with the other half making use of between three and six sessions.

**Figure 18: Live lessons attended**



**Figure 19: In-depth lessons accessed**



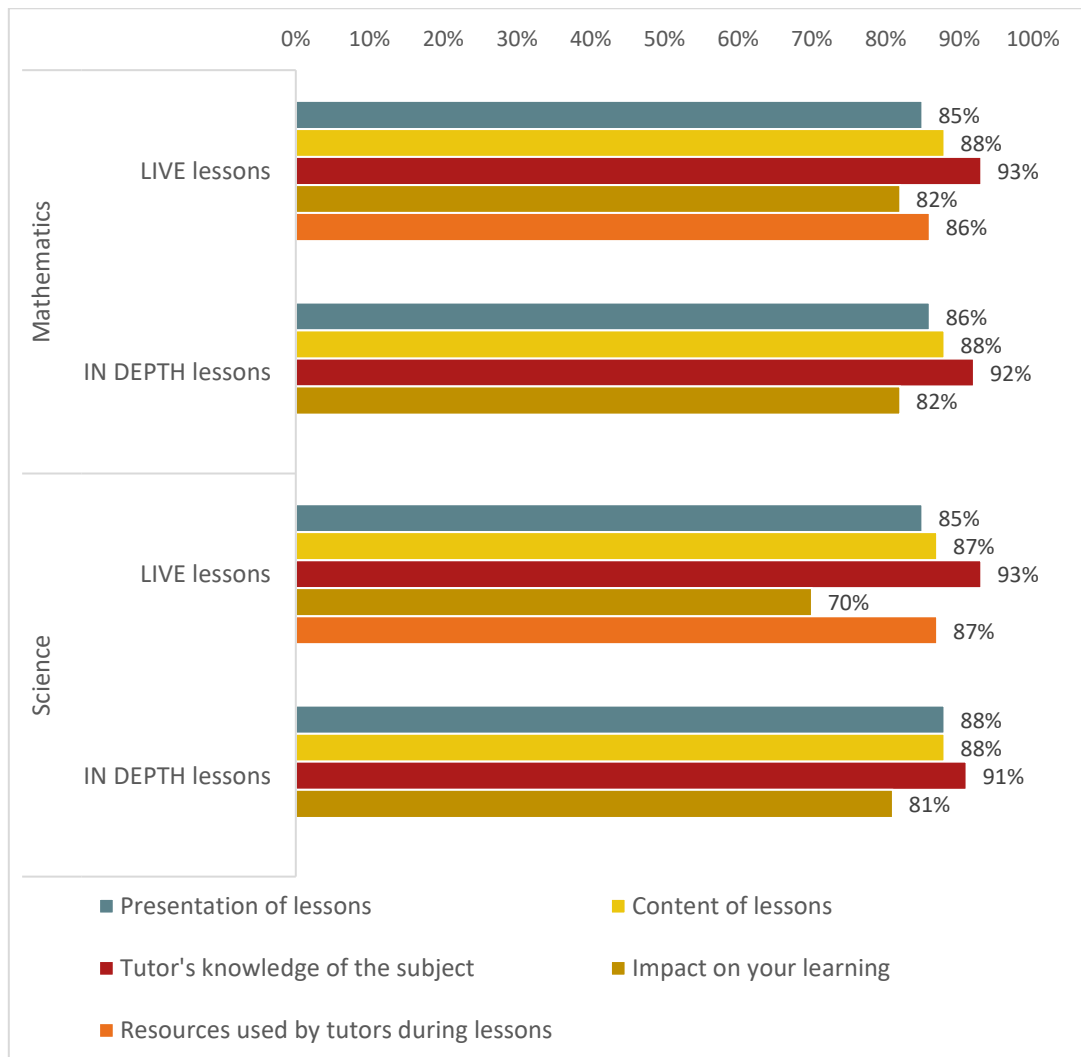
#### 3.2.2. Rating of aspects

Learners were asked to rate five aspects of their mathematics and science lessons, in relation to the live lessons and the pre-recorded video sessions: presentation of the lessons, content of the lessons, resources used during lessons, tutor's knowledge of the subject, and impact on their learning. Figure 20 shows the percentage of learners that rated each aspect as a 4 or 5 (on a scale from 1 to 5, where 1 is the lowest and 5 is the highest).

More than 70% of the respondents rated all aspects for each lesson as one of the top two scores: 4 or 5 (Figure 20). The tutors' knowledge of each subject in both live and in-depth lessons was rated a 4 or a 5 by over 90% of the learners. The impact on the respondents' science learning was rated slightly lower than mathematics, particularly for the live lessons. The resources used by tutors in live lessons were also rated highly by learners. In terms of the presentation of lessons, in-depth sessions in both subjects received slightly higher ratings than live lessons, while almost 90% of the learners rated the content of the lessons in both subjects as a 4 or a 5.



**Figure 20: Learners' ratings of lesson aspects**



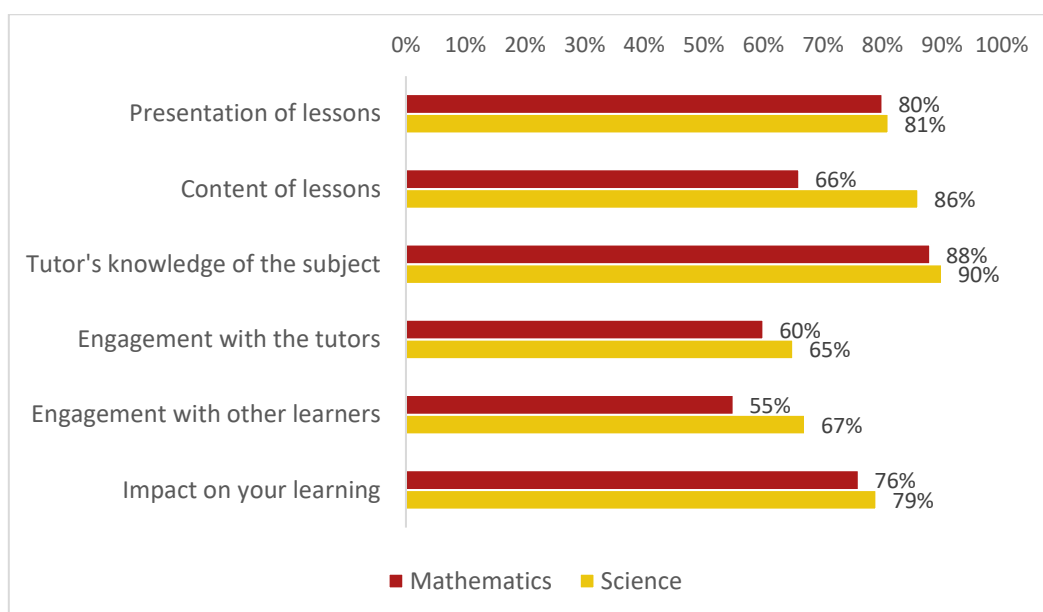
### 3.2.3. Provincial tutor sessions

Around a third (35%) of learners reported attendance of at least 11 provincial tutor sessions, a further third (35%) attended between 8 and 10, with the remaining 30% participating in between five and seven sessions. They were again asked to rate several aspects of the sessions they attended.

Figure 21 shows the percentage of learners rating each aspect as a 4 or 5, on a scale from 1 to 5. The highest rated aspects for both subjects were the lesson presentation and the tutors' subject knowledge, with science lesson content also receiving a high rating. For all aspects, the science sessions were rated higher than the mathematics sessions, with the biggest difference being in the lesson content and engagement with other learners. The reasons for this should be explored in order to enhance the mathematics sessions.

Engagement with the tutors and other learners received the lowest rating, which is to be expected in virtual sessions. Learners rated the impact of the sessions on their learning largely positively. The provincial tutor sessions form an important component of the TDP and improvements in the aspects identified would ensure that these sessions have a greater impact.

**Figure 21: Rating of provincial tutor sessions (4 or 5)**

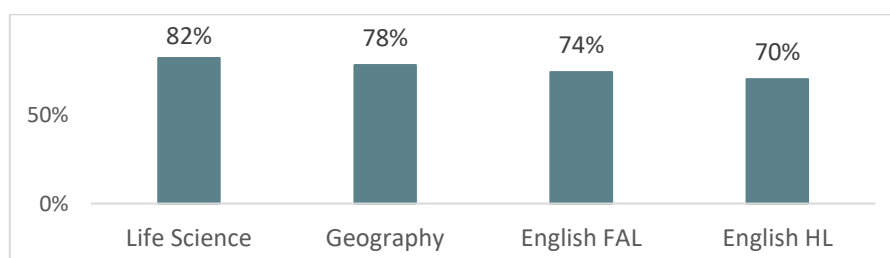


### 3.2.4. Supplementary lessons

Learners were provided with access to supplementary lessons in several subjects other than mathematics and science. We asked them to indicate which of these subjects' material they had accessed during the year: three quarters (73%) had accessed the Life Science lessons, while around a third made use of the resources provided for English First Additional Language (FAL) (35%) and English Home Language (HL) (30%). Twenty nine percent of learners accessed the supplementary lessons for Geography.

Of those learners who accessed the lessons, Figure 22 highlights the percentage that rated the lessons as 4 or 5, on a scale from 1 to 5, where again a score of 1 is low and 5 is high. The highest rated subject was Life Science, which was also the most accessed. Although Geography was the least accessed subject, it was the second highest rated. Understanding why learners accessed the particular subjects and what aspects of each subject they found most useful may lead to encouraging more learners to use these resources and making them more accessible and helpful to learners.

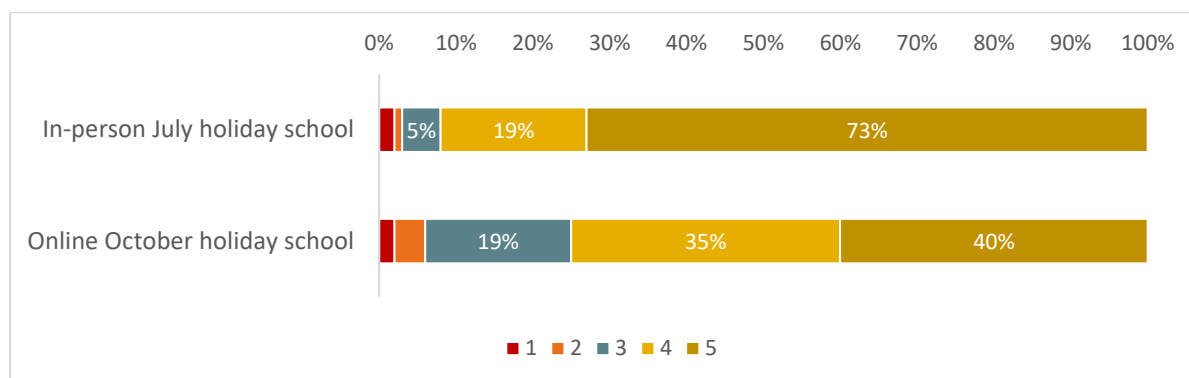
**Figure 22: Rating of supplementary lessons as 4 or 5**



### 3.2.5. Holiday schools

Learners were asked to rate the in-person mid-year holiday school and the online October holiday school on a scale from 1 to 5, with 1 representing poor and 5 excellent (Figure 23).

**Figure 23: Rating of holiday schools**



A considerably higher proportion (almost three-quarters) of the learners rated the in-person July holiday school as excellent (5), whereas less than half of the learners rated the online October sessions as excellent. The findings suggest that learners preferred the in-person holiday school experience over the online one. Several explanations such as technical difficulties, access or the nature of the engagements could account for the difference in ratings between the two holiday schools.

### 3.3. Content coverage, career guidance and resources

#### 3.3.1. Content coverage

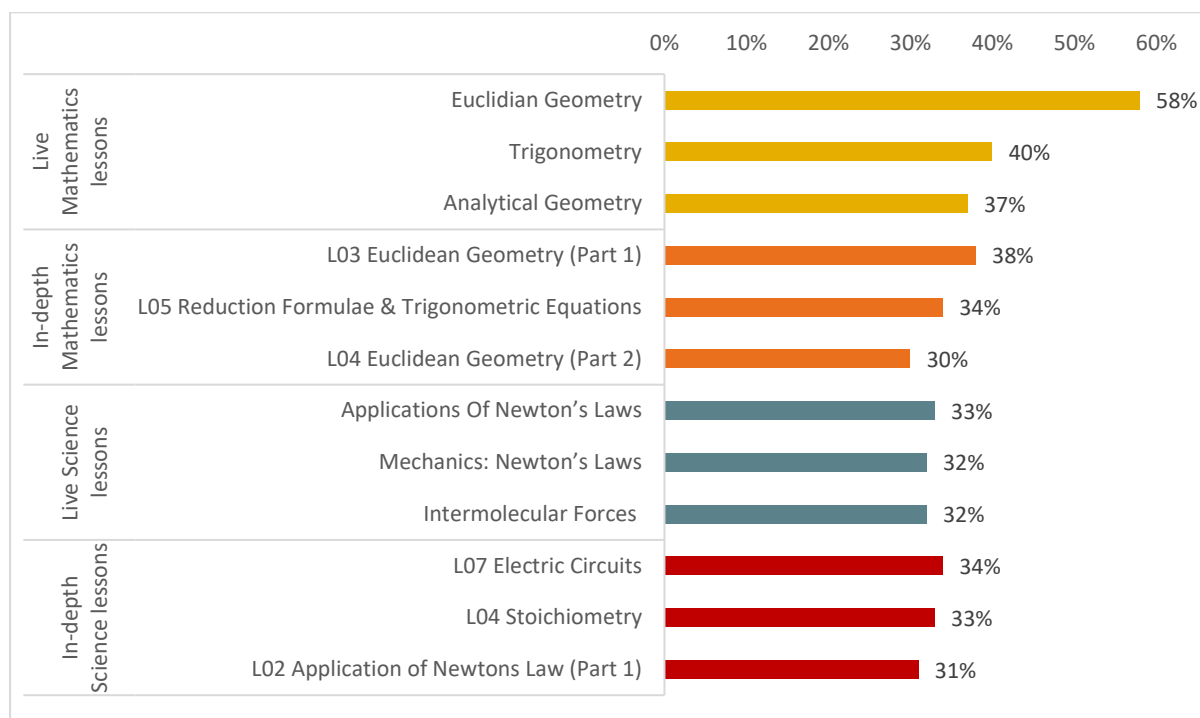
The TDP focuses predominantly on the school curriculum in terms of the Annual Teaching Plan (ATP), which follows the Curriculum and Assessment Policy Statements (CAPS). According to the tutors interviewed during the June/July holiday school, the TDP follows the Grade 11 and 12 syllabuses, which aims to prepare the learners for exams.

The programme has, however, committed to train learners using higher order questions so that they can easily transition to tertiary education, and therefore aims to cover what is taught at school but also to go beyond this to some extent. Gaps, such as challenging questions, which are not usually covered at school in the CAPS curriculum, were therefore also covered in these sessions. Furthermore, some topics had not been taught at particular schools, and tutors therefore had to explain the relevant concepts in order to allow them to complete the higher-order questions related to these topics.

It was emphasised that learners enter the programme with different levels of preparedness and follow different curriculum topics at their respective schools. As such, tutors have to adjust the programme in accordance with the learners in their classes.

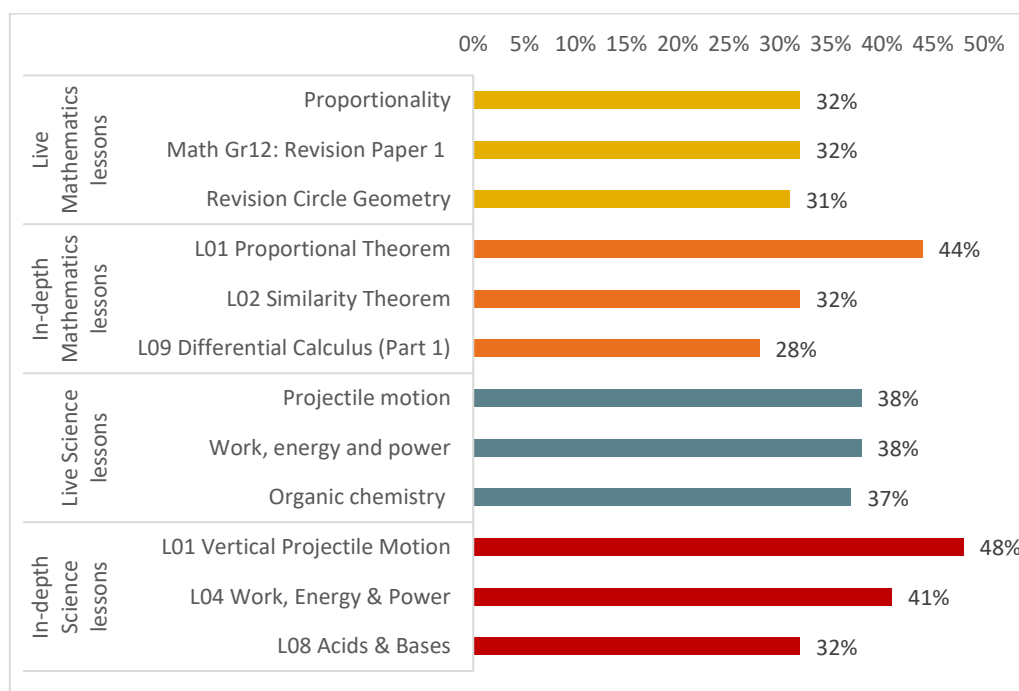
Learners in both grades were asked which three maths and which three science lessons (live and in-depth) they found most useful during the TDP. Figure 24 provides the Grade 11 responses and Figure 25 presents the Grade 12 responses.

**Figure 24: Most useful Grade 11 mathematics and science topics**



The most useful mathematics topic for the live lessons was *Euclidian Geometry*; similarly for the in-depth lessons the most useful topic was found to be *Euclidian Geometry (Part 1)*. For the science live lessons, *Applications of Newton's Law* was the rated as the most useful, closely followed by *Mechanics: Newton's Law* and *Intermolecular Forces*. For the in-depth science lessons, *L07 Electric Circuits* was highlighted as the most useful, just ahead of *L04 Stoichiometry*.

**Figure 25: Most useful Grade 12 mathematics and science topics**



Of the live mathematics lessons, *Proportionality* and *Math Grade 12: Revision Paper 1* were found to be the most useful; while for the in-depth lessons, learners reported *L01 Proportional Theorem* as the most useful. For the science live and in-depth lessons, those on *Projectile motion* were highlighted as the most useful by learners, as well as *Work, energy and power* for the live lessons.

Possible explanations for the topic selection for both grades could be linked to the complexity of the topics, whether they had been taught to the learners at school, or the teaching methodology employed during these lessons. It is important to determine which topics are the most difficult or learners require the most revision in to ensure the best use of teaching time for the TDP.

### 3.3.2. Career guidance

Providing career guidance at secondary school is critical in order to expose learners to the various career paths available (Makola et al., 2021). The aim is to enhance an individual's ability to make well-informed career decisions, taking into account their objectives, priorities, strengths, and aspirations (Nota et al., 2014). Career guidance can be presented in various ways, including hosting career workshops and expos, and facilitating information sharing by role models. South African schools provide career guidance through Life Orientation, however, studies have found that in schools in the more disadvantaged areas, Life Orientation educators often do not have the necessary expertise or breadth of experience to adequately facilitate such discussions (Diale et al., 2014; Makola et al., 2021).

TDP learners were asked in the holiday school focus groups what kind of career guidance they had been exposed to during the programme. The TDP offered learners broader life skills, studying at university and career path programmes. Learners were provided with tablets comprising applications and websites with extra-curricular information. The TDP learners were also provided with data that could be used to research and learn more about career pathways. Stellenbosch University was responsible for career and study information and a representative spoke to the learners about 1) productivity, 2) the future of STEM careers, 3) entry requirements to universities, how to apply to university and how to choose university courses, 4) bursaries and application deadlines, 5) positive self-talk, and 6) the importance of planning and time management.

Figure 26 sets out the career activities provided during the June/July holiday school. The sessions also covered human development, time and stress management in relation to career guidance. These included videos on how to apply for university, career guidance information, choosing a career, fields of study and bursaries. Learners preferred the Career EXPO to the applications and websites available via the TDP tablets. The Stellenbosch University representative also provided extra websites and email addresses for bursaries and university faculties with different career choices.

**Figure 26: Career activities during in-person holiday school**

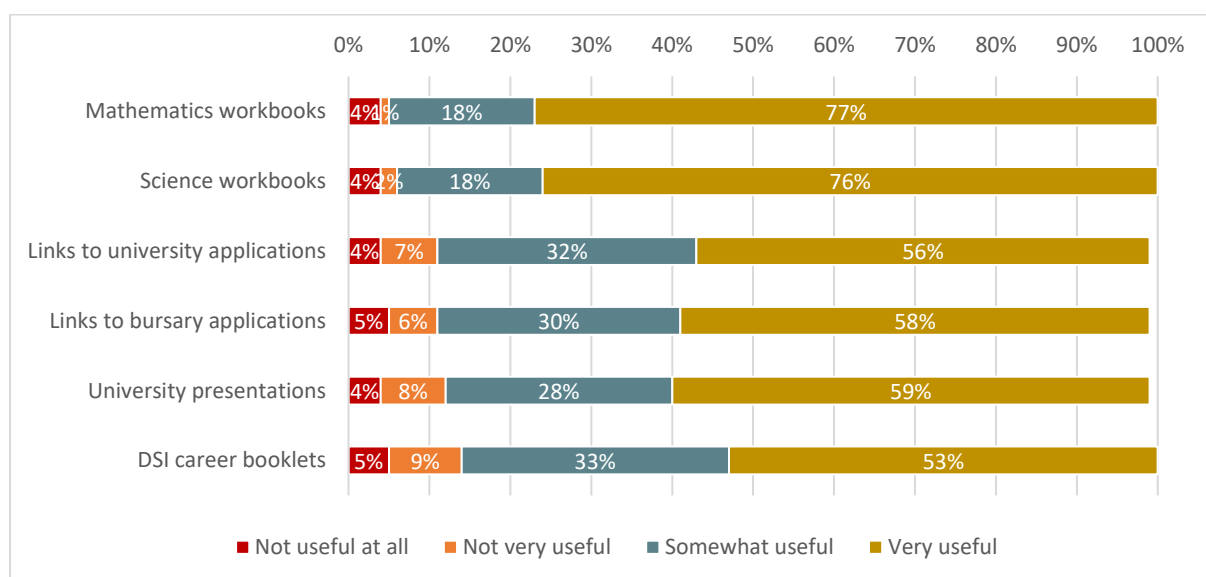


Learners highlighted that the career guidance they received helped them to think about and plan for the future, preparing them for tertiary education and subsequent career pathways. It also helped learners to understand more about what they might want to do and what is required from them, such as the points required to qualify for specific courses or degrees. Some learners had also begun job shadowing to expose themselves to a working environment.

### 3.3.3. TDP resources

Various resources are provided for learners through the TDP. We asked learners to indicate how useful they felt these were in terms of either their learning, university preparation, or career guidance (Figure 27).

**Figure 27: Usefulness of TDP resources**



Almost all of the learners were of the view that the mathematics workbooks, followed by the science workbooks were somewhat or very useful. In fact, the information provided by learners indicated that almost 90% of them found the links to university applications and bursaries, university presentations and DSI career booklets somewhat or very useful as well. The data points to the fact that these learners not only found traditional resources such as workbooks valuable, but resources that provide pathways to further education and future careers opportunities were extremely useful as well.

### 3.4. Impact on learners' knowledge, understanding and skills

In the initial survey, Grade 12 learners were questioned about the degree to which their marks had improved in the previous year (Grade 11) as a direct result of participating in the TDP. Additionally, they were asked to assess the extent to which the TDP contributed to enhancing their understanding of each subject. According to the responses, the vast majority, 83% of learners, felt that their mathematics marks had improved, with 79% reporting an improvement in their science marks due to the TDP. On a rating scale ranging from 1 (small extent) to 5 (large extent), two thirds of learners expressed that their understanding of mathematics (65%) and science (64%) had improved at a level

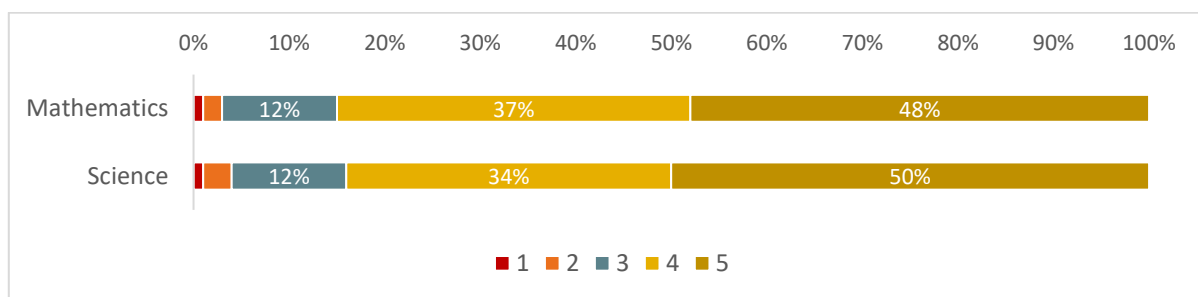
of 4 or 5 during their first year in the programme. These results suggest that the TDP has a positive impact on learners' performance and understanding.

To further assess the TDP's impact, all learners were surveyed in a follow-up at the end of the year to determine the extent to which their knowledge and understanding improved during 2022, the mathematics and science topics they found most useful, and the skills they gained.

### 3.4.1. Knowledge and understanding of topics

Learners were asked the extent to which their knowledge and understanding of mathematics and science increased as a result of being part of the TDP, rated on a scale from 1 (poor) to 5 (excellent) (Figure 28).

**Figure 28: Improvement in knowledge and understanding**

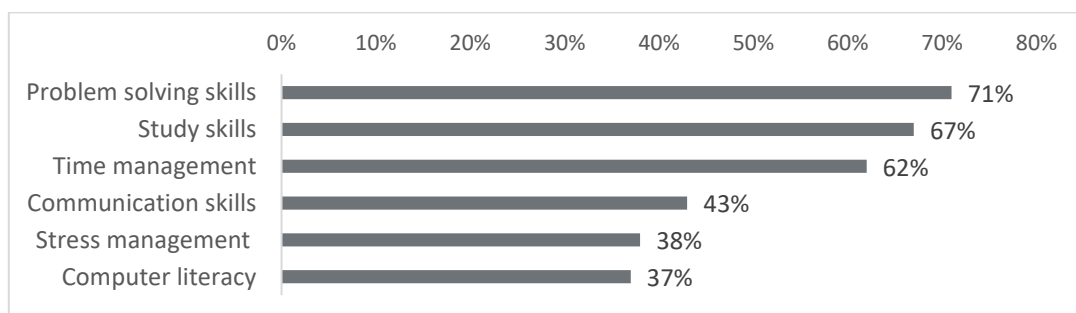


For both mathematics and science, half of the learners reported an excellent improvement in their knowledge and understanding attributed to the TDP, while a further third rated the improvement as a “4”. However, these results indicate that there is still room for improvement since the other half of the learners did not perceive the impact of the programme as “excellent”. It could be that the teaching methods require enhancement, or it could be that other, external factors hindered the effectiveness of the programme. Further investigation including feedback from learners could provide more detailed evidence on the effectiveness of the programme.

### 3.4.2. Skills gained from the TDP

The TDP aims to provide learners with a range of skills, both related to mathematics and science, and those that can be used in other areas of their lives and in the future. Figure 29 displays the percentage of learners that said they had acquired each of the skills identified – they were asked to indicate all skills they felt they had gained.

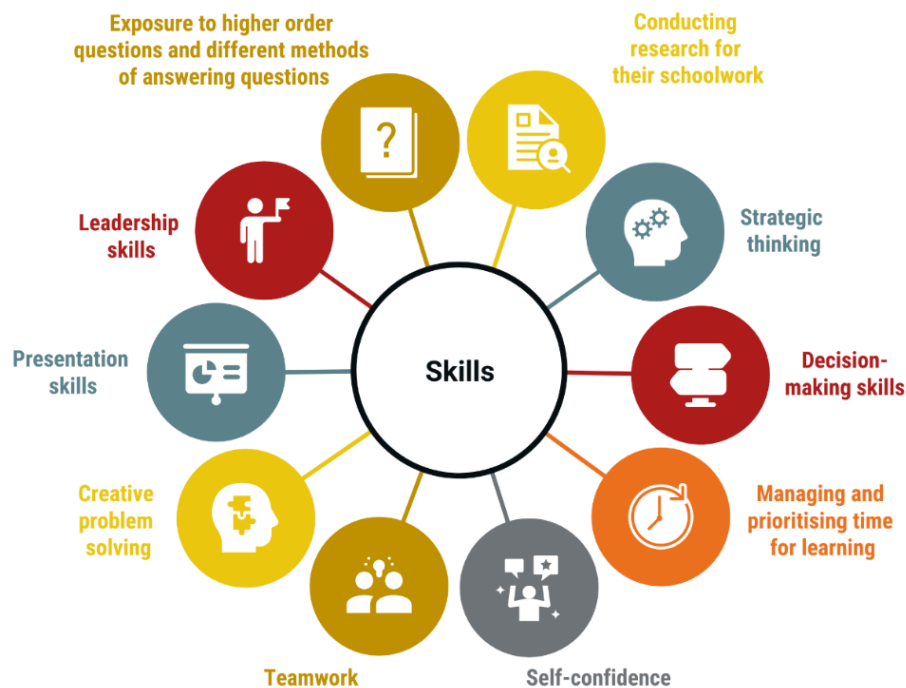
**Figure 29: Skills gained**



More than 70% of the learners indicated that they gained problem solving skills, followed by study and time management skills. Computer literacy skills was the least gained skill as indicated by around one third of the learners. The data presented in Figure 29 highlights the importance of the TDP in equipping learners with relevant life and academic skills. In both academic and practical contexts, problem-solving is regarded as a key skill promoting critical thinking and the ability to handle challenging situations. Learning time management, study skills and communication skills also better prepare learners for success, not only in their immediate academic endeavours, but also in higher education and professional settings. The fact that around a third of the learners reported gaining computer skills indicates a potential area for development and/or improvement in the programme. Computer literacy is seen as a crucial skill, particularly in the workplace, since the world has become more digital, especially as a result of the pandemic, which highlights the need for programmes like the TDP to embrace and promote this skill more.

During the focus groups conducted during the June/July holiday school, Grade 11 and 12 learners were also asked about what skills they had gained from the TDP. Learners reported developing both technical and social skills in addition to those already noted (Figure 30).

**Figure 30: Further skills gained**



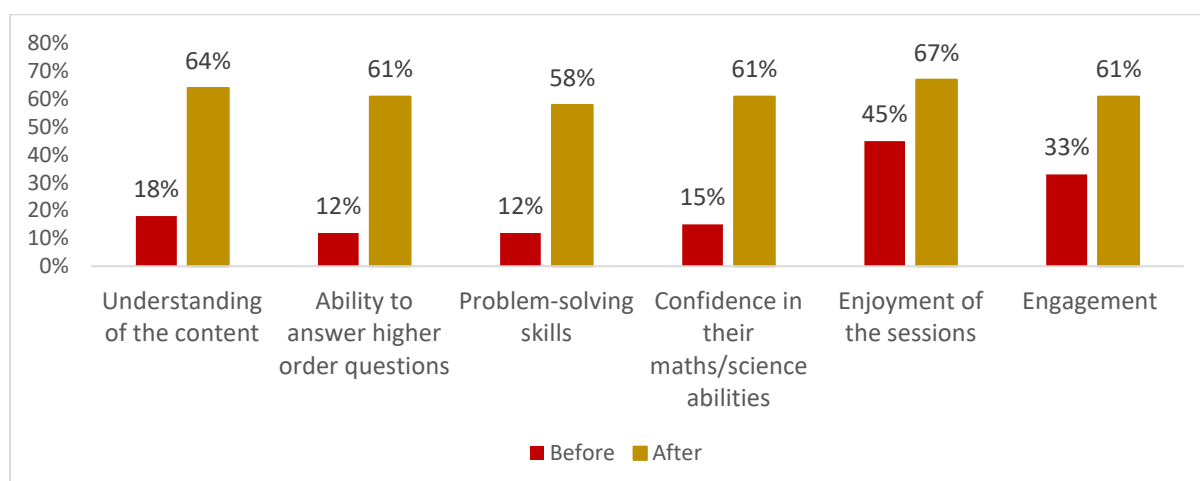
Importantly, several of the groups noted that what they gained from the programme, they were also able to share with other learners, thus becoming ‘tutors’ at their own schools and empowering their classmates by teaching them high-level problem-solving skills.

### 3.4.3. Tutors’ views on learner related aspects before and after the TDP

Tutors were asked to rate a set of learner-related aspects at the start, and at the end, of the TDP (the tutors completed the survey in September/October), from 1 (lowest) to 5 (highest).



**Figure 31: Tutors' rating of learner-related aspects at the start versus the end of the TDP (4 or 5)**



Each of the areas were rated as 4 or 5 by a larger percentage of the tutors at the end of the TDP, than at the beginning of the programme. The aspects with the greatest increase over the course of the programme were learners' ability to answer higher order questions, their understanding of the content, their problem-solving skills and their confidence in their abilities. Learner's enjoyment and engagement also increased to some extent.

### 3.5. Engagement in the sessions

During the June/July in-person holiday school in five provinces, three sets of data were collected relating to learner engagement in the TDP sessions: 1) observations of the sessions, 2) tutor interviews and 3) learner focus groups.

#### 3.5.1. In-person engagement

Different teaching and engagement techniques were observed across the lessons. In some instances, learners worked on their own while asking for assistance from the tutors when necessary. However, the tutors moved around the class, checking and helping learners struggling with specific questions.

In other instances, learners were engaged in group work activities, including working on past exam papers. They discussed the questions with each other and enlisted the tutors' assistance, where required, to clarify any misunderstandings. At the same time, they were asking questions within and across their groups and helping each other find solutions.

The tutors also asked learners to present their findings during the lessons, either based on their individual work or group work. One observer noted, "*the learner used a different method from what the tutor was expecting to solve a quadratic equation. The tutor invited the learner to demonstrate this method in front of the whole class*". Learners and the tutor were also able to ask the learners presenting questions, ensuring they understood what they were presenting. These engagements encouraged learners to be more confident in their work and be prepared to share their knowledge with others.

Learners found the tutors to be understanding and patient, and they enjoyed the in-person interaction. Learners reported feeling more confident and less afraid to ask questions, ask for help or make mistakes as all the learners were there for the same reason and were like-minded. They also found the interaction helpful due to the small class sizes which enabled them to get more contact time with the tutors, as well as receive individual attention. The in-person sessions also facilitated better communication between learners, allowing them to learn from each other, help one another, and do homework together. They were also able to form stronger bonds with other learners through the shared experience.

### 3.5.2. Online engagement

Online sessions were considered information-giving lessons, and tutors facilitated work that the learners were expected to learn. This was done by clarifying any missing information or dealing with misunderstood concepts.

Learners reported that the tutors were patient and encouraged them to ask questions, assisting them outside of the sessions as well. They also made efforts to reschedule lessons and be flexible in assisting learners. There was more opportunity for interaction during the tutorials, as opposed to the Saturday lessons. Some learners reported feeling more comfortable asking questions online and found the “comment” section and the “raise hand” feature very useful. However, there were some issues reported, such as network issues, a lag in learners being admitted to the sessions, schedule clashes with normal schooling and too many questions in the chat making it difficult to get the tutors attention and the required assistance timeously. These aspects hindered the engagement during online sessions.

### 3.5.3. Encouraging engagement

Despite the challenges encountered, in both in-person and online sessions, the tutors stated that they would explain concepts repeatedly and in different ways using various methods until the desired learner comprehension was reached. Tutors also highlighted that they managed learners according to their needs and made appointments with learners who required additional help. Learners felt that the tutors made them a priority and made them feel comfortable, encouraging their creativity, by allowing them to explore new ideas and different approaches. Bringing together learners from various schools also enabled the exchange of ideas and exposure to different forms of learning.

Tutors noted that learners participated more during the in-person sessions than during the online sessions. Participation was encouraged through question and answer sessions, group work, and tutorial sessions. However, they also indicated that the online lessons allowed for continued engagement with learners, keeping them involved and supplementing their learning. Additionally, one tutor noted, *“online is flexible... we talk, we arrange when we can meet and discuss”*.

A combined approach therefore allows for the best of both. Some of the ways in which the tutors encouraged learner engagement included:

- **In-person engagement**
  - Learner presentations are encouraged
  - Working in groups/pairs, facilitated by tutors

- Learners are asked to provide answers and explain concepts
  - Lessons are learner-centred - learners lead the class and engage with each other
  - Question and answer sessions; and
  - Ask learners for feedback on lessons and challenges.
- **Online engagement**
    - Learner presentations are encouraged
    - WhatsApp groups allow learners to engage with each other and to ask the tutors questions
    - Tutors send learners questions prior to the online sessions and learners must prepare to engage around the questions; and
    - Kahoots quizzes are used to get feedback from learners.

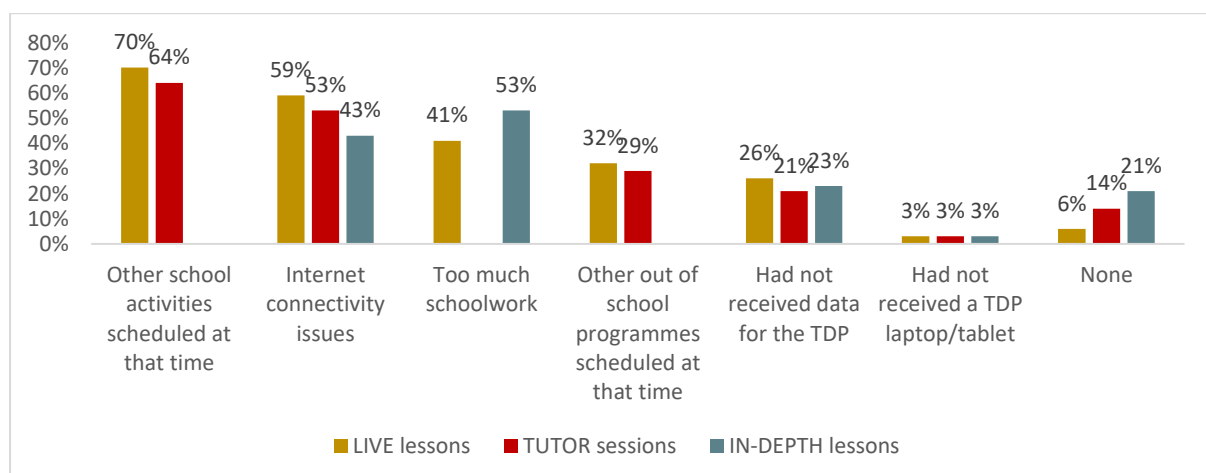
### 3.6. Challenges encountered

#### 3.6.1. Barriers to attending the TDP lessons

Learners were asked the reasons why they were unable to attend the TDP sessions. The most common issue was other school activities being scheduled at the same time as the TDP. More than half of the learners reported that they had internet connectivity issues during live and tutor sessions, and a further 50% reported that the amount of schoolwork they had was a hindrance to them attending the TDP. Around a third also indicated that other out-of-school programmes scheduled at the same time as the TDP prevented them from attending sessions.

Figure 32 further shows that around a fifth of the learners reported a lack of data, and a very small percentage noted the lack of a laptop or tablet as a barrier to attending sessions. Considering these barriers, several strategies could be employed to increase attendance and participation in the TDP, including scheduling TDP sessions in more than one time slot to enable learners with conflicting school commitments to attend. Otherwise, the organisers could provide pre-recorded versions of the live sessions. A dedicated technical support team could also be established to assist learners with technical challenges and to ensure the on-time provision of data to learners. These proactive measures could strengthen the TDP's effectiveness.

**Figure 32: Barriers to attending lessons**



### 3.6.2. Challenges identified by tutors

The tutors were also asked what challenges they had encountered in the 2022 TDP. This was an open-ended question that allowed tutors to provide their own responses. Figure 33 presents the main challenges identified, in relation to the online sessions and the in-person holiday school, including connectivity and technological related challenges, low attendance and scheduling conflicts, limited face-to-face interaction, low levels of engagement from some learners, a mismatch between the ATP and what is taught at schools, and teaching learners from different backgrounds with different ability levels. It was noted that grievances and challenges are escalated to the provincial coordinator.

**Figure 33: Challenges encountered by the tutors**



The tutors were also asked how they - or their colleagues - had attempted to address some of these challenges and strengthen the tuition programme. Tutors highlighted the existence of a yearly meeting of all tutors nationally to plan (prioritising topics) and share good practices for different topics. In addition, tutors, regardless of the grade they facilitate, often came together to discuss particular learner groups, their learning progress and challenges they were experiencing. During these meetings, solutions for dealing with these challenges were shared.

Furthermore, some specific solutions to these challenges were noted:

- Learners were asked which days they were available for the online tutorials, as the sessions sometimes clashed with other school programmes
  - In some cases, the sessions were then held on a different day to accommodate more learners;
- The tutors had a list of the names of their learners, and could therefore see who had joined the sessions, ask them to answer questions and interact with them in a more friendly manner;
- Diagnostic tests were used to identify misconceptions, errors, and gaps in learners' knowledge;
- Some tutors put learners in groups to work on a question and then they had to present the answer, allowing them to work with learners of different ability levels;
- Some tutors also incorporated games into the lessons, seeing which group of learners finished answering the questions first or presenting multiple choice questions and seeing which group of learners gave the most correct answers.

### 3.7. Summary

In 2022, learners engaged more with the live lessons (attendance) than the in-depth ones (accessing lessons). Most learners reported attending at least 8 to 10 provincial tutor sessions. Overall, the presentation and content of the lessons, tutor's knowledge of the subject, and impact on their learning were rated positively by the learners. For the live and in-depth lessons, learners were also positive about the resources used by the tutors. Engagement with the tutors and other learners received the lowest rating for the provincial tutor sessions, which is not unsurprising for virtual sessions.

The in-person July holiday sessions received more positive ratings than the online October holiday school, highlighting the importance of face-to-face interactions in the programme.

Some learners did report accessing the supplementary lessons provided, with the most popular and highest rated subject being Life Science. English HL, English FL and Geography were accessed by a third or less of learners. Understanding learners' reasons for accessing particular subjects and how useful they found the materials may lead to encouraging more learners to use these resources.

The TDP focuses predominantly on the school curriculum, while also committing to bridging gaps in understanding and training learners using higher order questions. As learners enter the programme with different levels of preparedness and follow different curricula at school, the tutors had to adjust the programme in accordance with the learners in their classes. Learners identified the three most useful lessons for mathematics and science in each grade. It is important to determine which topics are the most difficult or learners require the most revision in to ensure the best use of teaching time for the TDP.

Learners indicated that their performance, knowledge and understanding of mathematics and science improved as a result of their participation in the TDP. The tutors also highlighted that learners' ability to answer higher order questions, understanding of the content, problem-solving skills, confidence in their abilities, enjoyment and engagement increased to varying extents over the course of the

programme. In addition, learners gained a range of technical and soft skills, which would facilitate their academic performance and success in other areas of life.

Different teaching and engagement techniques were used across the in-person and online lessons, including one-way teaching, individual work, group work and learner presentations. Engagement successes and challenges were identified for both formats, with the in-person sessions facilitating better engagement opportunities. Learners reported that the tutors were patient and encouraged them to ask questions, assisting them outside of the sessions; and the tutors attempted to promote engagement and flexibility as much as possible.

Learners were positive about the resources provided to them through the programme. Some of these resources pointed them to STEM career pathways, and learners were exposed to several other career guidance opportunities. Learners felt that the career guidance they received helped them to think about the future, preparing them for tertiary education and career pathways, and guided them on what they might want to do and what is required from them in relation to specific courses or degrees.

Learners did, however, encounter some barriers in attending the TDP sessions, including other school activities or out-of-school programmes being scheduled at the same time, too much schoolwork, internet connectivity issues, and a lack of data. Considering these barriers, strategies should be explored to increase attendance and participation in the TDP,

The tutors also faced several challenges, including connectivity and technological related challenges, low attendance and scheduling conflicts, limited face-to-face interaction, low levels of engagement from some learners, a mismatch between the ATP and what is taught at schools, and teaching learners from different backgrounds with different ability levels. The tutors employed several strategies to attempt to overcome these challenges.

Part Four of the report explores the value-add of the TDP and provides insights on the best way forward for the programme.

## PART FOUR: THE IMPORTANCE OF THE TDP AND THE WAY FORWARD

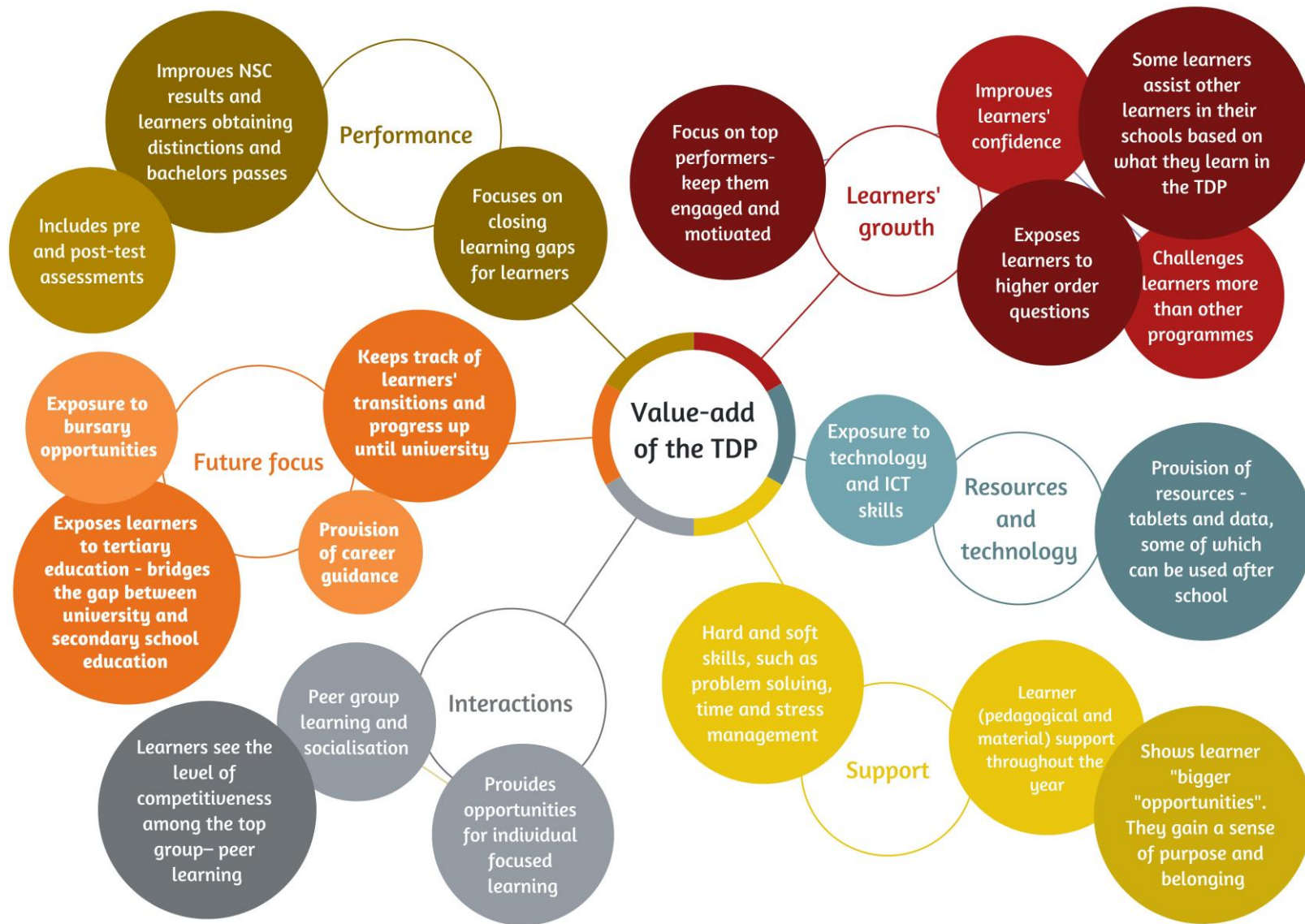
### 4.1. Introduction

In order to assess the importance of the TDP, we asked the provincial tutors and coordinators their opinion on the value-add of the programme, in and of itself, as well as in comparison to other similar out-of-school tuition programmes; while learners were also asked about their thoughts on the programme. We also asked the tutors and coordinators about their preferred TDP format, and all role players provided suggestions on the best way forward for the programme.

### 4.2. Value-add of the TDP

Figure 34 presents the tutors' and coordinators' responses about the value-add of the programme, categorised in relation to performance, future focus, interactions, support, resources and technology, and learners' growth. The programme has important benefits for the learners and provides them with support and opportunities that they would be unlikely to get at school or at home.

Figure 34: Tutor and coordinator views on the value-add of the TDP





The tutors highlighted that they also benefitted from being involved in the TDP through the opportunity to challenge themselves and refine their skills, working with advanced learners, and being challenged by, and learning from, them. One tutor noted, *“when you interact with these learners, as a teacher you realise that these learners have got different ways of approaching the problems...[so] you learn a lot from these learners”*. Engaging with teachers from across the country, sharing questions and creating Level 4<sup>5</sup> questions also allowed for the development of a pool of extra mathematics and science material. All of these are benefits which the tutors could transfer to other learner groups.

### 4.3. Learner views of the TDP

During the focus groups, learners were asked their views about the TDP in an effort to understand the importance and benefits of the programme. Figure 35 presents the learner responses in relation to increases in their knowledge, performance improvement, access to resources, pride in being selected, increased confidence, forming friendships and being part of a community, self-reflection and growth, and being empowered to help other learners. All of these aspects are important for academic and personal success in both the short and long term for the learners, and lead to them being able to help others and make a meaningful contribution to their communities.

---

<sup>5</sup> The National Qualifications Framework is organised by a series of levels of learning achievement from one to ten. Level 4 is the National Senior Certificate in Grade 12.

Figure 35: Learners' views on the benefits of the TDP



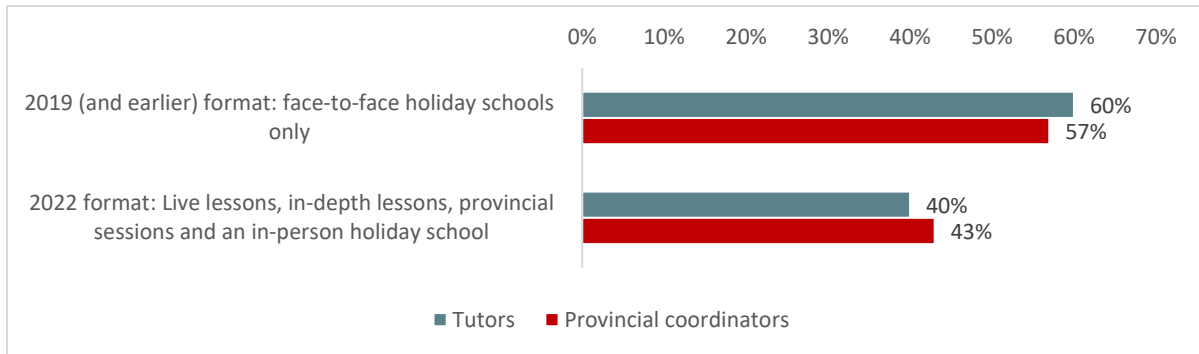
#### 4.4. TDP format

Due to the shifts that were required in the TDP format since 2020, in the online tutor and provincial coordinator surveys we asked those that had been involved in the programme since 2019 or earlier, and had therefore been part of the different formats, which one they preferred of the four used (Figure 36):

1. 2019 (and earlier): face-to-face holiday schools
2. 2020: TDP smart classroom video lessons

3. 2021: TDP live and pre-recorded video lessons, and provincial sessions
4. 2022 format: Live lessons, in-depth lessons, provincial sessions and an in-person holiday school

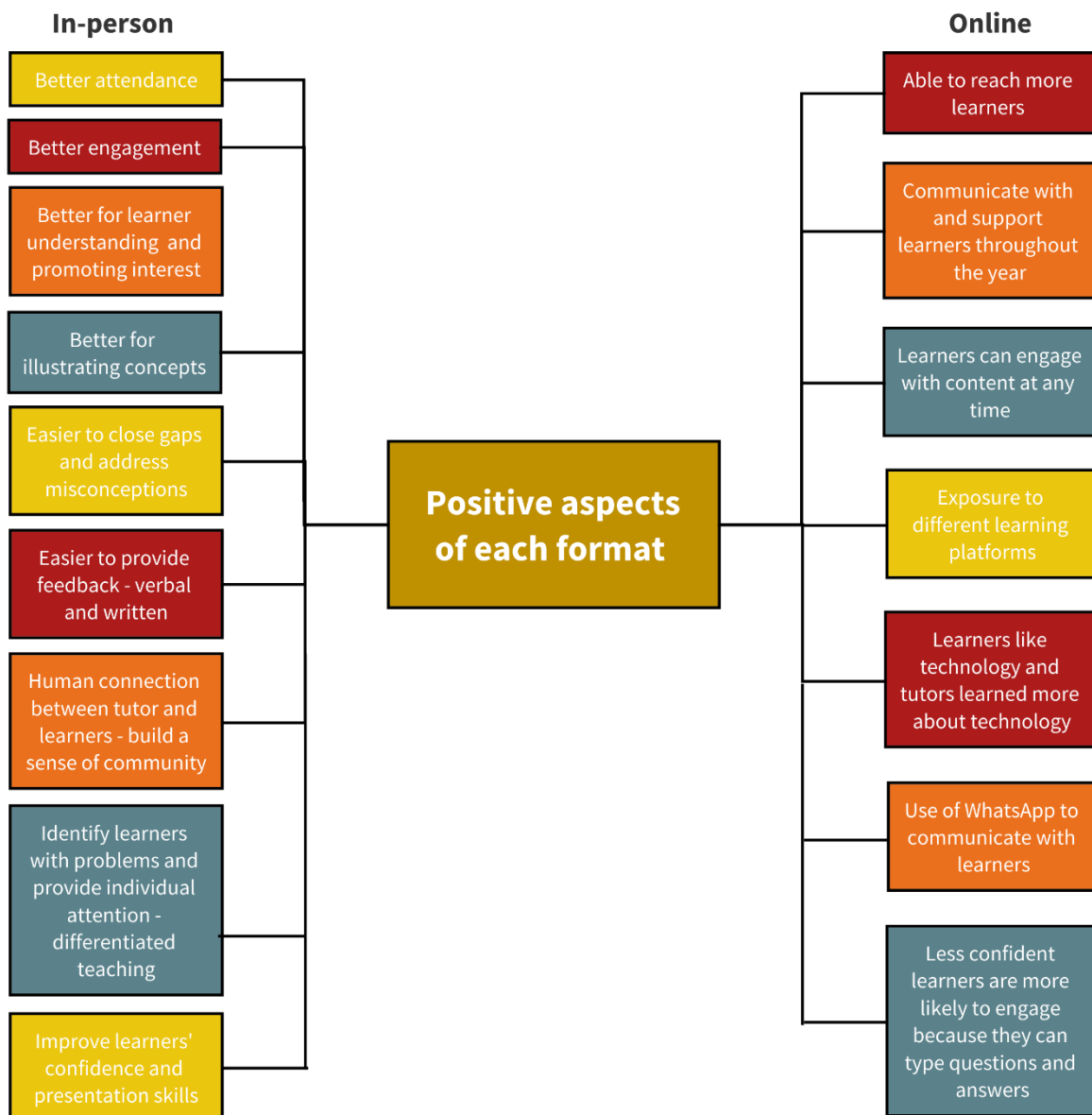
**Figure 36: Preferred TDP format**



Of the four formats, two were preferred by both the tutors and the coordinators: the in-person format in 2019 and earlier, and the 2022 format, which included some in-person sessions during the June/July holiday school. These findings reveal that the incorporation of at least some form of in-person engagement is considered critical for the programme.

We also asked for an explanation of the respondents' preferred format. Figure 37 provides aspects of each the in-person versus the online sessions highlighted as beneficial by the tutors and coordinators. The more conducive learning environment provided by in-person interactions was emphasised, and the flexibility and reach of the online interactions were also noted.

**Figure 37: Positive aspects of in-person vs online lessons**



Some respondents noted that online teaching was problematic due to challenges associated with connectivity and loadshedding, as well as intermittent issues with the tablets. In addition, conflicts in scheduling presented challenges, where learners had other work to complete or only arrived home late due to travelling long distances from school. A hybrid model allows a more holistic approach to teaching and learning, where the benefits of each format can be maximised.

#### 4.5. Suggested improvements to the TDP

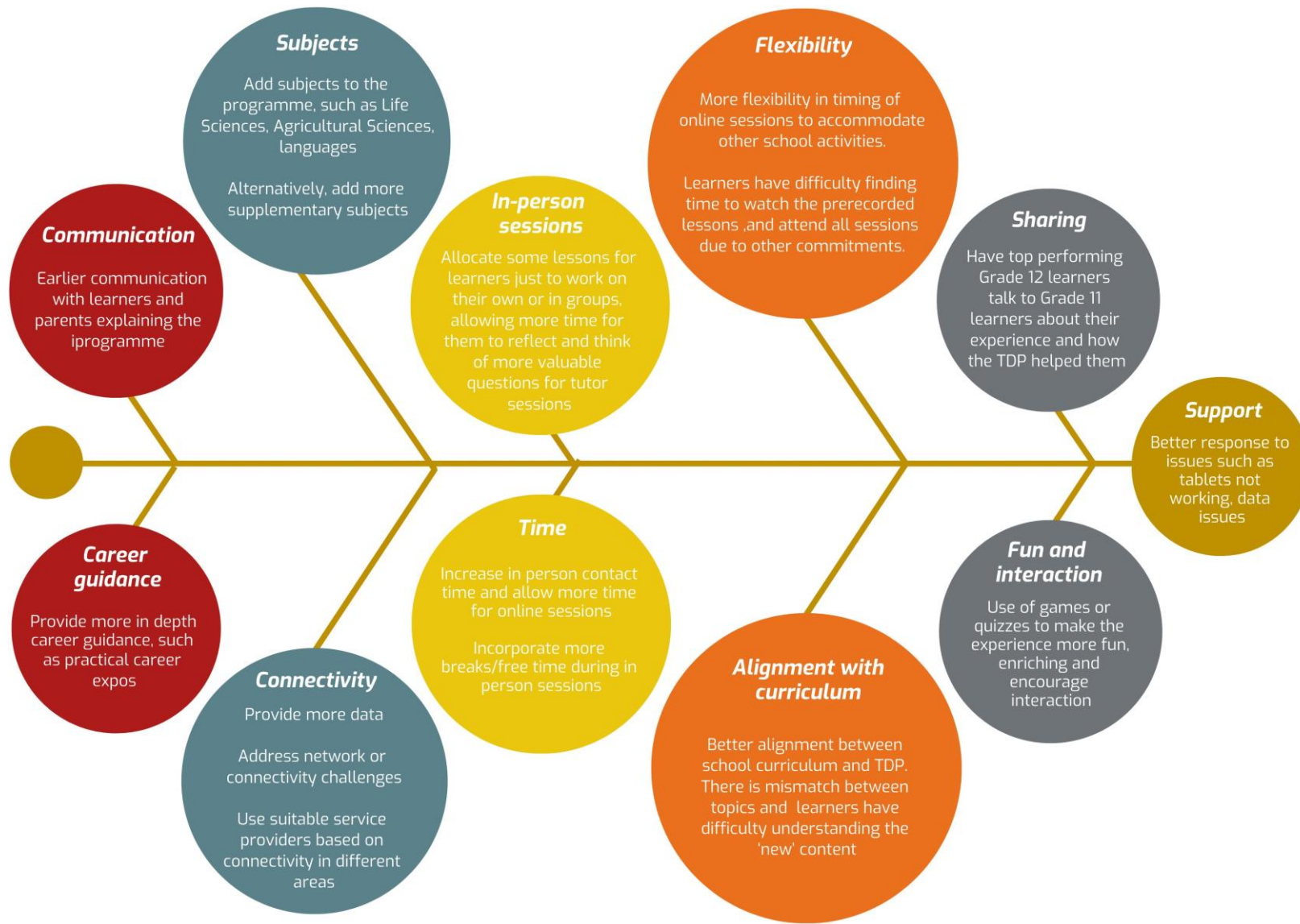
##### 4.5.1. Learners' suggested improvements

During the holiday school focus group discussions, learners provided inputs in relation to how the programme could be improved to be more beneficial to the participants (Figure 38). There was some overlap with the suggestions provided by the tutors and coordinators.

Among the feedback and recommendations for improving the programme is starting early communication with learners and their parents and/or guardians to clarify the goals and expectations of the TDP. A need to diversify or broaden the scope of learning areas by introducing life sciences, agricultural sciences, and languages, or potentially add extra supplementary subjects, was identified. It was also advised that individual or group work sessions should be scheduled for learner reflection and to draft questions for tutors to promote a better understanding and to stimulate critical thinking.

Flexibility in online session timings was also highlighted due to the challenges learners face trying to balance TDP lessons and other responsibilities. A motivation strategy was also proposed involving high-performing Grade 12 learners sharing their positive experiences and the impact the TDP had on them with the Grade 11 learners. Additionally, learners requested a prompt resolution of technical problems, such as malfunctioning tablets and concerns related to data: Suggestions were made to provide more data and choose service providers based on the connectivity strengths of areas to reduce such technical issues. A stronger emphasis was recommended regarding the alignment of the TDP with the curriculum to avoid confusion and to improve comprehension. Learners also requested extended in-person and online sessions, as well as regular breaks during the in-person sessions. The increased use of interactive elements, such as games or quizzes, was also suggested to increase learner engagement and to improve the learning process. Lastly, a more extensive approach to career guidance, perhaps through practical career expos, was thought to be crucial for the learners' future planning.

**Figure 38: Learners' suggested improvements**



#### 4.5.2. Tutors' and coordinators' suggested improvements

Tutors and coordinators were also asked to provide suggestions for improving the TDP. They reiterated some of the suggestions made by learners, such as more face-to-face contact time and more time for online sessions; improved responses to technical issues; the addition of English First Additional Language (FAL) and Home Language (HL)<sup>6</sup>; aligning the TDP more with the ATP; improving internet access by using different network providers; and allowing more flexibility in online sessions. Additionally, several other improvements were suggested:

##### 1. Tutor resources

- Improved resources such as tablets and visualisers for more effective tutoring, and better delivery of content and interaction, as well as an app that allows tutors to write and broadcast
- Tutor training on effective online methods of teaching that include the maximum utilisation of the gadgets provided

##### 2. Stakeholder engagement

- Arrange specific sessions for tutors to discuss misconceptions in their subjects
- More frequent meetings with all key stakeholders to reflect at the end of each term, to review progress, highlight challenges and identify opportunities

##### 3. Increase the scope of the TDP

- Increase the number of learners in the programme, and add learners in Grade 10

##### 4. Stricter admissions policy

- Tutors felt that some of the learners were struggling with the higher order questions, and that only learners performing at Level 6 or 7<sup>7</sup> should be chosen for the TDP
- Group the learners according to ability levels

##### 5. Focus on the basics

- Suggested focus on not only higher order questions, but also some basic concepts (closing gaps) for those learners who may have missed out, particularly due to the impact of the Covid-19 pandemic

##### 6. Learner attendance

- Should be monitored, and follow-ups made on a weekly basis
- Engage with the learners' teachers regarding issues of attendance
- TDP App could be improved to allow tutors to monitor the learners' usage of this app

##### 7. Engaging learners

- Ensure that all learners are added to WhatsApp groups with their tutors
- Encourage learners to WhatsApp tutors questions and send learners questions via WhatsApp

##### 8. Learner resources

- In addition to the workbooks and study guides, textbooks should be made available as resources
- Record each session, so learners can access them at a later stage

---

<sup>6</sup> It was noted that most learners are doing HL, but those whose home language is not English were not faring well. English is crucial as it is the medium of instruction and testing for mathematics and science.

<sup>7</sup> Level 6 is a National Diploma or an Advanced Certificate and Level 7 is a Bachelors Degree or Advanced Diploma. These learners are therefore able to answer more advanced questions.

## **9. Learner assessment**

- Post and pre-tests should be written during class time, and tutors should be included in the setting of these tests

## **10. Content coverage**

- Contact TDP schools and conduct a survey of content covered before the holiday school, in order to better plan the sessions

## **11. Online classes**

- Schedule tutorials with combined groups; Cover the content with all learners in one grade and use the tutorials to work through questions
- Have an online platform that allows for group work
- Have a second tutor or assistant to respond to questions and comments in the chat

## **4.6. Summary**

The provincial tutors and coordinators identified a range of value-adds of the TDP in relation to improving learner performance; having a future focus beyond school to tertiary education and career pathways; encouraging interactions and individual focused learning; providing learners with support, resources and technology; and promoting learners' personal growth. The tutors also reported benefiting from being involved in the programme.

Learners reported increases in their knowledge, performance improvement, access to resources, pride in being selected, increased confidence, forming friendships and being part of a community, self-reflection and growth, and being empowered to help other learners. All of these aspects are important for both academic and personal success. The programme has important benefits for the learners and provides them with support and opportunities that they would be unlikely to get at school or at home.

A TDP format with at least some face-to-face interactions (2019 and earlier, and 2022 format) was preferred by both the provincial tutors and coordinators. These findings reveal that the incorporation of at least some form of in-person engagement is considered critical for the programme. However, benefits of the online sessions were also acknowledged. The more conducive learning environment provided by in-person interactions was emphasised, while the flexibility and reach of the online interactions was noted. A hybrid model allows a more holistic approach to teaching and learning, where the benefits of each format can be maximised.

All role players provided suggestions as to how the TDP can be improved. These related to earlier communication with learners and their parents/guardians; broadening the scope of learning areas; flexibility in the scheduling of online sessions; prompt resolution of technical problems; ensuring better connectivity; better alignment with the curriculum and a focus on the basics as well as more advanced topics; more face-to-face interactions and engagement; more extensive career guidance; improved resources for tutors and additional resources for learners; training for effective online teaching; more stakeholder engagement; a more strict admissions policy; and improved and monitored learner attendance.

In Part Five / V, we present key findings and subsequent recommendations based on the evaluation of the 2022 TDP.



## PART FIVE: FINDINGS AND RECOMMENDATIONS

The Talent Development Programme (TDP) aims to assist learners to improve their mathematics and science knowledge and skills and prepare them for higher education. It also provides career guidance and support, as well as a number of different learning resources. This report has provided an evaluation of the 2021 Talent Development Programme. In this final section, we present key findings from the study, and thereafter set out several recommendations for enhancing the programme.

### 5.1. Key findings

#### 5.1.1. TDP role players

##### *TDP learners*

- ❖ Learners were selected from 354 schools. The provinces with the highest number of participating schools were Limpopo, Mpumalanga and North West. The number of learners participating in each province ranged from 69 in the Eastern Cape to 86 in Western Cape.
- ❖ Access to home resources varied, with just under 40% of learners having an internet connection or computer/tablet, besides those provided by SUNCEP. A significant portion of the learners came from lower to medium socioeconomic status.
- ❖ A third of respondents' mothers and about a quarter of fathers had completed matric, reflecting the level of educational capital in the home.
- ❖ Only 17% of learners spoke English as their home language, with just over a third speaking English at home "always" or "almost always". This has implications for the support they receive at home in terms of their learning.

##### *Provincial tutors*

- ❖ Two thirds of respondents were male, with the majority being Black African, and around two thirds being above the age of 45.
- ❖ The tutors had completed either a Bachelor of Education (BEd) or Bachelor of Science (BSc), with nine having an Honours degree and a further four having completed a Master's degree.
- ❖ The provincial tutors were well positioned to take part in the TDP as the majority were mathematics or science teachers.
- ❖ Just over half of the tutors had been involved in the TDP for at least three years.

##### *Provincial coordinators*

- ❖ Of the seven provincial coordinators that responded to the online survey, four were male and six were Black African.
- ❖ All of the provincial coordinators indicated that they had been involved in the TDP for more than four years.

#### 5.1.2. Mathematics and science: performance, attitudes, aspirations and experiences

##### *Learners' performance*

- ❖ Most of the learners obtained a B or higher in mathematics, science and English in their previous grade. Higher results in mathematics than science and English were reported.

### *Learners' attitudes*

- ❖ The learners expressed high levels of enjoyment of mathematics and science. Similarly, learners placed a high value on the subjects and were confident in their abilities to perform well in them.
- ❖ Most learners expected to do “very well” in all three subjects, particularly mathematics: around 80% for each grade.

### *Learners' aspirations*

- ❖ Most Grade 11 learners planned to pursue a tertiary qualification up to Master's/Doctoral level.
- ❖ The top five fields of interest for Grade 12 learners were STEM related, with Health being the most popular field.

### *School experiences*

- ❖ Overall, most learners felt they received good support and feedback in mathematics, science and English and were happy with the instruction they received.
- ❖ Slightly more learners agreed that they received good support and feedback in mathematics than in science and English.

### *Out-of-school programme attendance*

- ❖ A quarter of Grade 11 and more than a third of Grade 12 learners had participated in an after-school science programme, and around a third had attended a mathematics programme.

### *Prior digital and online learning experience*

- ❖ Thirty-five percent of learners had never worked on a computer or tablet prior to the TDP.
- ❖ More than three-quarters of learners indicated that they did not have prior online learning experience.

## 5.1.3. Attendance/use and experience of sessions

### *Mathematics and science lessons and tutor sessions*

- ❖ Around half of the respondents had only accessed between three and six of the in-depth lessons. The majority of learners provided positive feedback on the lessons in terms of presentation, content, tutors' knowledge, resources used by tutors and the impact on their learning.
- ❖ Around a third of learners reported attendance of at least 11 provincial tutor sessions. Learners rated the lessons positively in relation to presentation, content, tutors' knowledge, engagement and impact on their learning. For each aspect, science was rated higher than mathematics.

### *Supplementary lessons*

- ❖ The most accessed lessons were for Life Science, followed by English First Additional Language (FAL), Home Language (HL) and Geography.
- ❖ The highest rated subject was Life Science. Although Geography was the least accessed subject, it was the second highest rated.

### *Holiday schools*

- ❖ Almost three-quarters of the learners rated the in-person July holiday school as excellent (5) compared to the online October session, where less than half of the learners rated the sessions as excellent.

#### 5.1.4. Content coverage, career guidance and resources

##### *Content coverage*

- ❖ The TDP follows the ATP for learners and goes beyond this to some extent through the incorporation of higher level questions.
- ❖ Learners enter the programme with different levels of preparedness and follow different curriculum topics at their respective schools. Tutors must therefore adjust the programme in accordance with the learners in their classes.

##### *Career guidance and resources*

- ❖ Various forms of career guidance were provided to learners.
- ❖ Learners highlighted that the career guidance they received helped them to think about the future, preparing them for tertiary education and career pathways.
- ❖ In addition to the career guidance resources, learners reflected positively on the resources provided by the TDP.

#### 5.1.5. Impact: knowledge, understanding and skills

- ❖ For both mathematics and science, learners reported improvement in their knowledge and understanding attributed to the TDP.
- ❖ Tutors provided positive feedback on the improvement in learners' understanding, skills, confidence, enjoyment and engagement over the course of the programme.
- ❖ Learners reported gaining a range of technical and social skills through their participation.

#### 5.1.6. Engagement

- ❖ A range of different teaching techniques and engagement strategies were used during the in-person and online sessions.
- ❖ The in-person sessions facilitated better communication between learners and tutors, and among learners.
- ❖ Learners expressed positive views of the tutors in terms of their interactions and support provided.

#### 5.1.7. Challenges

- ❖ Learners encountered several barriers to attending the TDP lessons, with the most common being other school activities scheduled at the same time, internet connectivity issues and too much schoolwork. Around a quarter also said they had not received data for the TDP.
- ❖ The tutors faced various challenges which varied depending on the format.

### 5.1.8. Importance and way forward

#### *Value-add of the TDP*

- ❖ The coordinators and tutors recognised the importance of the TDP in relation to learners' performance, a focus on the future, interactions, support provided, available resources and technology and learners' growth.
- ❖ Learners also highlighted how the TDP led to improved knowledge and performance, access to resources, pride in being selected, increased confidence, forming friendships and being part of a community, self-reflection and growth, and being empowered to help other learners.

#### *Views on the TDP format*

- ❖ All tutors who had been involved in the TDP since 2019 or earlier, and the provincial coordinators, preferred either the 2019 (and earlier) format of the TDP or the 2022 format, where at least some in-person sessions were included, rather than the purely online formats.

#### *Improvements*

- ❖ The learners, tutors and coordinators made several suggestions for ways to improve the TDP, in relation to both the in-person and online classes. Including addressing content, scope, communication, engagement, support, connectivity, career guidance, resources, learner attendance and assessment.

## 5.2. Recommendations

The recommendations presented are based on the findings of the 2022 evaluation study.



### 5.2.1. TDP format

Both the online and in-person sessions offer benefits to the learners. However, **more face-to-face interaction** would enhance teaching and learning within the TDP. Therefore, a longer, mid-year holiday school or two in-person holiday schools during the year is recommended.



### 5.2.2. Communication

**Earlier communication** with learners and their parents about the TDP and what is expected would assist them in taking part and managing expectations.

All learners should be added to **WhatsApp groups** with their tutors, enabling them to engage around the lessons and any issues they may have.



### 5.2.3. Learner selection

The selection of learners must be **consistent** across provinces and **criteria for selection** should be developed in consultation with the provincial coordinators and the provincial tutors. This may lead to stricter admission requirements or grouping learners in the programme according to their ability levels.



#### 5.2.4. Flexibility in scheduling and lesson formats

Learners highlighted several barriers to attending the TDP lessons. As such, it is important for **lessons to be scheduled outside of school time** and to not coincide with other out-of-school activities where possible.

Some **flexibility in scheduling** or providing sessions in more than one time slot to encourage greater participation may be required. Otherwise, the organisers could provide recordings of the live sessions for learners to access at a later time.

During the in-person holiday school, individual or group work sessions should be scheduled for **learner reflection** and to draft questions for tutors to promote a better understanding and to stimulate critical thinking. Online platforms such as Zoom or Microsoft Teams could also be used for some **group work** sessions during the year, which could be facilitated by the tutors.



#### 5.2.5. Monitoring and encouraging participation

Learner **participation** in the online sessions should be monitored and learners who are not participating should be followed up with. The TDP App could be upgraded to enable tutors to monitor learners' usage thereof.

Providing the opportunity for learners to complete tasks or questions which are marked by tutors may also **encourage greater participation** as learners will receive individual feedback.



#### 5.2.6. TDP content

##### **Content coverage**

As learners enter the programme with different levels of knowledge and schools differ in the way they teach the curriculum, it is essential to identify some **basic concepts** to cover in the TDP to close some of the learning **gaps** that exist and to ensure that all learners are at the same level. Additional sessions may be required for learners that are struggling.

In addition, identifying topics that learners **struggle** with or that may **not have been covered** at their schools is critical. This could be done through a learner survey about topic coverage and understanding of mathematics and science topics, or through conducting a survey of content covered by schools TDP learners attend.

##### **Subjects**

There is an opportunity to **diversify or broaden the scope** of learning areas included in the TDP, by introducing subjects such as Life Sciences, Agricultural Sciences, and languages, or adding extra supplementary subjects.

##### **Career guidance**

Career guidance is an important part of the TDP and a more extensive approach, perhaps through **practical career expos** would be beneficial for learners' future planning.



#### 5.2.7. Learner support

The TDP learners come from an array of backgrounds, in terms of home language, availability of home resources and parental education. This must be considered in determining **strategies for support**.

As **digital literacy** is a crucial element of the TDP and learners enter the programme with different levels of competency, some learners may require additional training or support with online learning.

The provision of computers/tablets and data should be continued, as well as workbooks and study guides, with the possible addition of textbooks.

Having a session where Grade 12 learners share their TDP experiences and the impact it has had with the new Grade 11 learners may also provide **motivation and some guidance** to the new cohort.



#### 5.2.8. Tutor support

Tutors must be provided with training on effective **online methods of teaching** and how best to **utilise the resources** they are provided with.

**Improved resources** such as tablets and visualisers or a stylus to write on the tablets for more effective tutoring, better delivery of content and better interaction would be beneficial, as well as the provision of an app that allows tutors to write and broadcast material.

**More engagement** opportunities among the tutors are also recommended for them to engage around the lessons and any concerns they may have, as well as being able to share strategies and tips to enhance their teaching.



#### 5.2.9. Technical support

Ongoing **technical support** is essential for the programme participants and the tutors. Issues such as malfunctioning tablets should be addressed promptly.

**Data** should be provided timeously so that learners are able to effectively engage with all TDP sessions.

The service providers for the TDP data should be carefully selected based on their respective **connectivity strength** in different provinces, to attempt to reduce connectivity issues.



#### 5.2.10. Stakeholder engagement

Meetings with all **key stakeholders** in the TDP should be planned at the end of each term to **reflect and to review** progress, highlight challenges and identify opportunities.

## References

- Branson, N. and Zuze, T. L. (2012). Education, the great equaliser: Improving access to quality education. In Hall, K., Woolard, I. and Lake, C. (Eds.). *South African Child Gauge 2012*. Cape Town: Children's Institute.
- Caro, D.H., McDonald, J.T. and Willms, J.D. (2009). Socio-economic Status and Academic Achievement Trajectories from Childhood to Adolescence. *Canadian Journal of Education*, 32(3): 558-590.
- Diale, B., Pillay, J and Fritz, E. (2014). Dynamics in the personal and professional development of life-orientation teachers in South Africa, Gauteng province. *Journal of Social Science*, 38(1): 83–93.
- Dube, F. and Moyo, C.G. (2022). The Right to Electricity in South Africa. *Potchefstroom Electronic Law Journal (PELJ)*, 25(1): 1-21.
- Hannan, S., Arends, F. and Reddy, V. (2021). *Science Engagement Projects: Talent Development Programme Report on the 2020 Cohort*. Report submitted to the Department of Science and Innovation.
- Harris, A.L. and Robinson, K. (2016). A New Framework for Understanding Parental Involvement: Setting the Stage for Academic Success. *Russell Sage Foundation Journal of the Social Sciences*, 2(5): 186-201.
- Juan, A., Hannan, S. and Namome, C. (2018). I believe I can do science: Self-efficacy and science achievement of Grade 9 learners in South Africa. *South African Journal of Science*, 114(7/8).
- Nota, L., Soresi, S., Ferrari, L. and Ginevra, M.C. (2014). Vocational designing and career counseling in Europe: Challenges and new horizons. *European Psychologist*, 19(4): 248–259.
- Oskam, M. J., Pavlova, M., Hongoro, C. and Groot, W. (2021). Socio-economic inequalities in access to drinking water among inhabitants of informal settlements in South Africa. *International Journal of Environmental Research and Public Health*, 18(19), 10528.
- Reddy, V., Winnaar, L., Arends, F., Juan, A., Harvey, J., Hannan, S. and Isdale, K. (2022). *The South African TIMSS 2019 Grade 9 Results: Building Achievement and Bridging Achievement Gaps*. HSRC Press, Cape Town.
- Roksa, J. and Potter, D. (2011). Parenting and Academic Achievement: Intergenerational Transmission of Educational Advantage. *Sociology of Education*, 84(4): 299-321.
- Watt, L. (2016). Engaging hard to reach families: learning from five 'outstanding' schools. *Education*, 44(1): 32-43.

Zuze, L., Reddy, V., Visser, M., Winnaar, L. and Govender, A. (2017). *TIMSS 2015 GRADE 9 National Report: Understanding mathematics and science achievement amongst Grade 9 learners in South Africa*. Cape Town: HSRC Press.