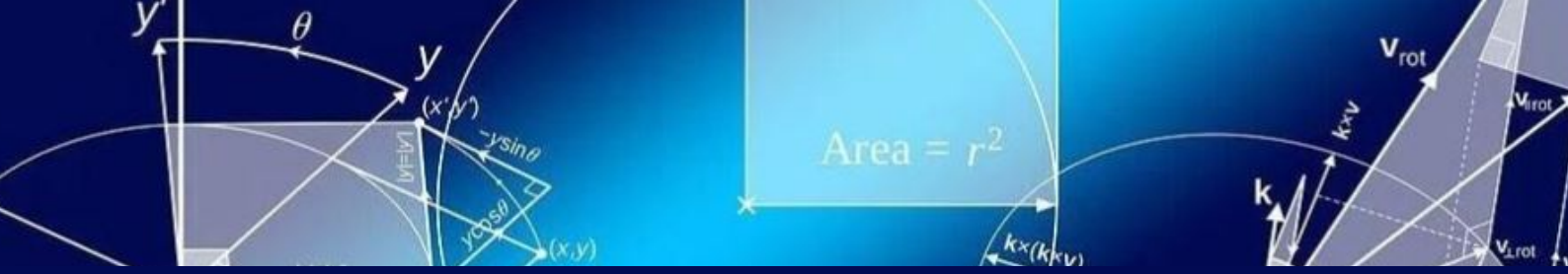

DMISRS Project Survey 2020

Understanding the support mechanisms available to first-year mathematics students at 13 universities participating in the 2020 DMISRS Project.

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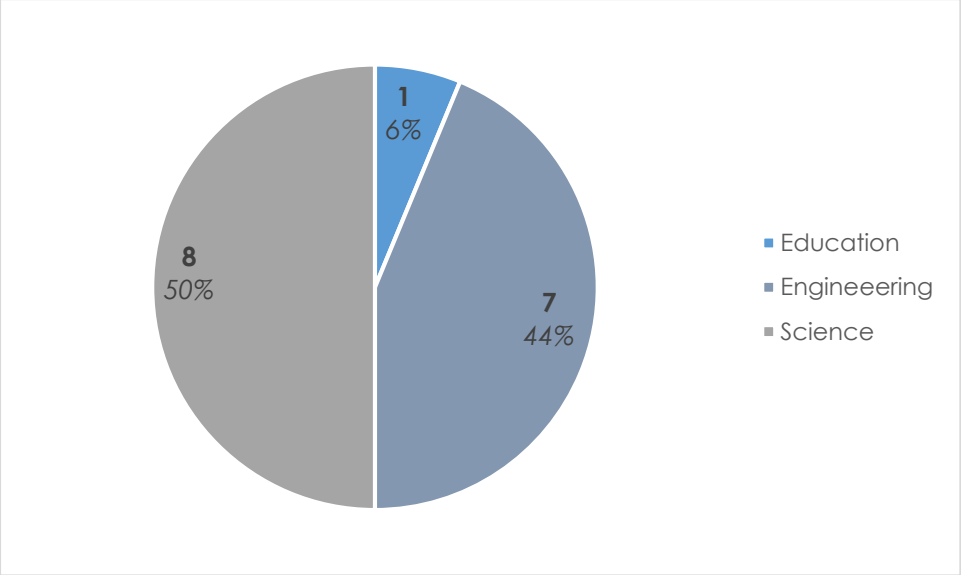
University Information

Sixteen respondents from 13 universities completed the DMISRS Project Survey in October 2020. These universities include:

1. Cape Peninsula University of Technology
2. Central University of Technology
3. Durban University of Teachnology
4. Mangosuthu University of Technology
5. Nelson Mandela University
6. Rhodes University
7. University of Johannesburg
8. University of Limpopo
9. University of Zululand
10. Sol Plaatje University
11. Stellenbosch University
12. Vaal University of Technology
13. Walter Sisulu University

Most respondents work in the Engineering or Science faculties; Figure 1 displays the number of respondents per faculty.

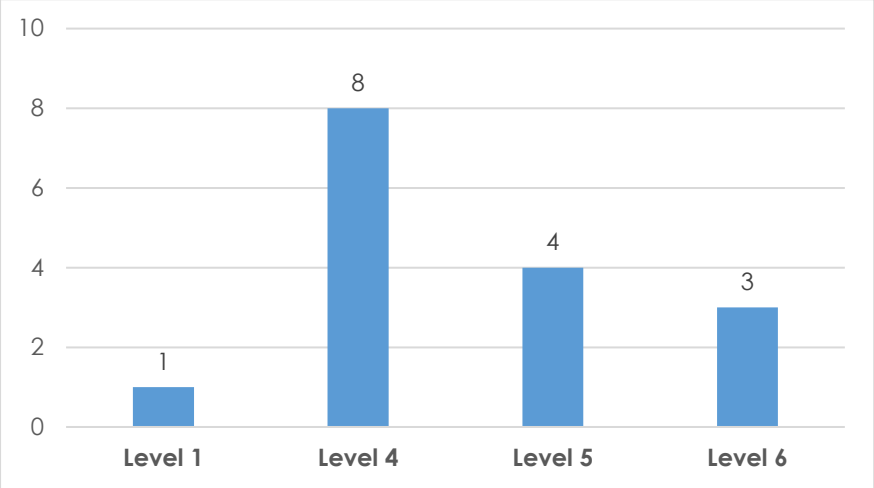
Figure 1. Number of Respondents per Faculty.



Current Use of the NBTs

Most respondents report that NSC Level 4 is required in order for students to be eligible to register for their mathematics course (see Figure 2).

Figure 2. Number of respondents per NSC Level requirement.



Less than half of the respondents (44%) report that their universities require that prospective students write the NBTs, and 38% require students to write the MAT test. The majority of universities (88%) do not use the NBT results for student placement, or to identify support needs (75%).

Among those respondents who do use the NBTs to identify support needs, they reporting doing so in the following ways:

- By identifying and addressing gaps before starting mainstream classes;
- By placing students in extended or differentiated support programmes; and
- Through a student support centre specifically designated to Mathematics students.

Course Topics

The most frequently assigned textbooks are those by James Stewart. For a full list of textbooks per faculty, please see Appendix A.

When asked whether any course topics could be omitted from the curriculum, only 3 respondents answered in the affirmative. One said that they think Cramer's Rule could be moved to the second semester's module. Another respondent noted that some Pre-Calculus topics could be offered on a supplementary basis as they take up a lot of time with "*limited evidence of impact*". Lastly, another respondent said that they

feel as though there is too much focus on content and not enough on the depth of students' understanding and critical thinking.

Respondents identified a wide array of topics that students generally struggle with. Basic algebra was commonly noted by 5 (31%) respondents. Other gaps include, among others: differentiation; integration; formal reasoning; complex numbers; calculus; trigonometry; and functions.

Identification of these problems generally stemmed from multiple sources, including: the students themselves; test, exam, and assignment performance; and from lecturers' and tutors' observations.

Mechanisms of Student Support

Respondents were asked to describe the mechanisms of student support that are available to their first-year students.

Special Sessions

Only 3 (19%) of the respondents reported implementing special sessions with their students. Topics covered by these sessions varied per university; one mainly covers algebra, another uses these sessions for orientation and administration issues, and the final respondent reports that all course topics are covered.

These sessions are compulsory at two of the universities, and are facilitated by specially appointed staff. Attendance was rated lower at the university in which attendance is voluntary. Two respondents rated the effectiveness of these sessions: in the case of compulsory sessions that cover all topics, the respondent rated these sessions as *somewhat effective*. In the case of the voluntary sessions that mainly covers algebra and is targeted at weak students, the respondent rated these sessions as *very effective*.

Tutorials

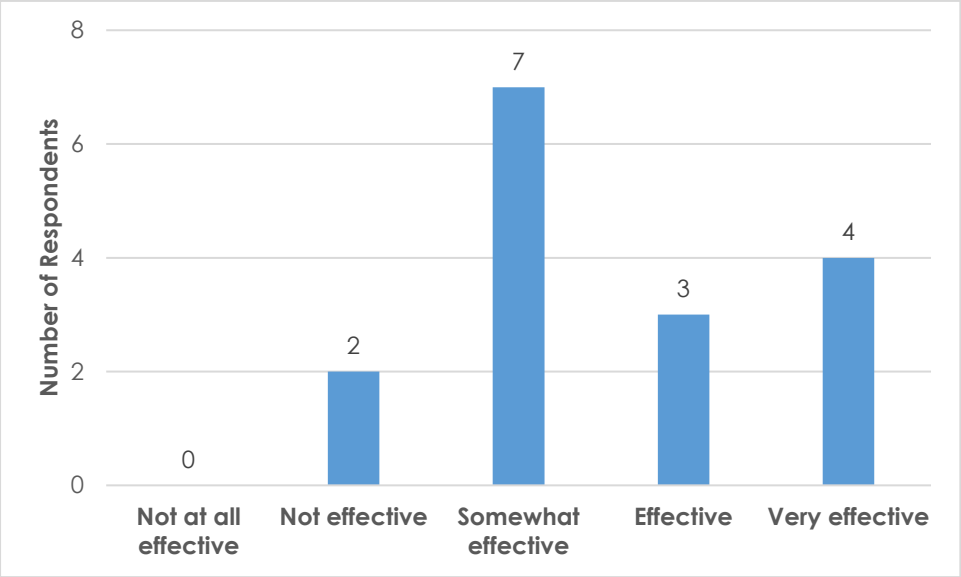
All universities report offering tutorials to students once lectures have commenced. Tutorials are compulsory at most of them (69%). All but two universities cover current lecture material in their tutorials, whereas two include content covered in high school as well. A quarter of respondents report that tutorial content is chosen solely according to lecturer observations, while others also take student requests, student performance, and tutor observations into account. Attendance at tutorials varies

considerably, with 25% of respondents reporting low attendance (20% - 40%), 31% of respondents reporting average attendance (40% - 60%), and 38% of respondents reporting an attendance rate of 60% and above.

Tutors are most commonly undergraduate students, postgraduate students or lecturers, and are trained by most universities (69%). Half of the respondents reported that tutors are *often* available to answer student questions, while only two respondents reported that students are *never* or *rarely* available. If tutors are not available, students turn to lecturers with their questions.

As for the effectiveness of this type of student intervention, most respondents rated tutorials as *somewhat effective* in supporting students (see Figure 3).

Figure 3. Respondents' rating of tutorials' effectiveness.



Seven out of the 16 of respondents (44%) offer additional tutorials to students (e.g. on the weekend) and these take the form of individual consultations, test revision, question-answer sessions, online chatrooms, or are specifically structured around student requests.

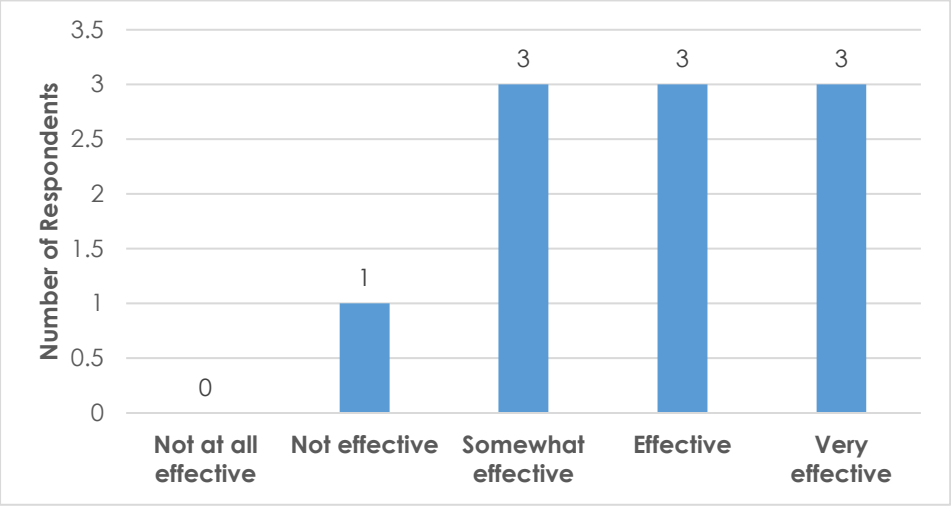
Additional Materials

Many respondents (63%) report that students are provided with additional material to help bridge knowledge gaps. These materials include videos, additional notes, and supplementary lecture notes.

Lecturer observations, student requests, and student performance help to determine what materials are provided. These materials are made available to students through

online platforms. Six universities (38%) monitor whether students access these materials, and report varied levels of utilisation (20% - 100%). Generally, this intervention is viewed as an *effective* form of student support (Figure 4).

Figure 4. Respondents' rating of additional materials' effectiveness.



Peer Support

Less than half of the survey respondents (44%) report that peer support is available to students, with most of these universities actively encouraging students to form peer-support groups. This is typically done with the help of mentors.

Groups are mostly led by strong students. Respondents reported that generally all students join these groups; only one reported that it's typically weak students who join.

The groups tend to take the form of question-and-answer sessions. Only one respondent rated this form of support as *not at all effective*; the rest deem them *somewhat effective* and *effective*.

Hot Seats

Only a quarter of respondents reported that they implement hot seats, which are available to students every day at two universities and once a week at another two. They are generally utilised by all students, however, utilisation rates were mostly rated by respondents as low (between 0% and 40%).

Hot seats are mostly manned by lecturers or support staff. When asked whether the person who runs the hot seat communicates with lecturers, respondents reported very mixed degrees of communication, from *rarely* to *always*.

Peer support was rated as *somewhat effective* by two respondents, *effective* by one respondent, and *very effective* by one respondent.

Lecturer Support

All universities offer lecturer support to students, which is generally available to students on a daily basis in some form (68%). This support takes the form of emails, individual meetings, WhatsApp groups, online chat rooms, and phone calls. All students typically make use of this offering. Respondents perceive this type of support to be manageable for lecturers, and think that this is an effective mechanism of support for students.

Figure 5. Degree to which lecturers can manage this type of support.

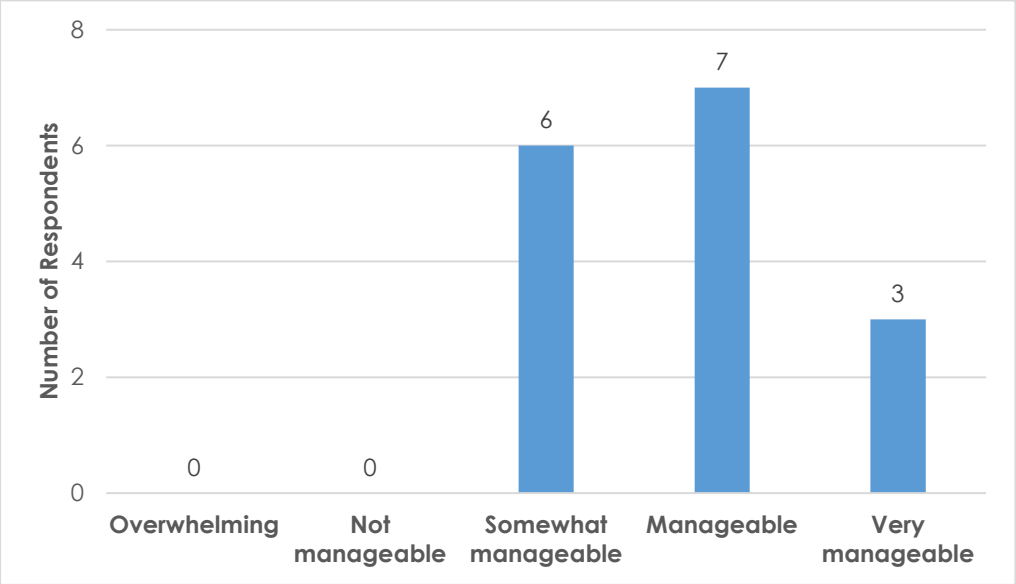
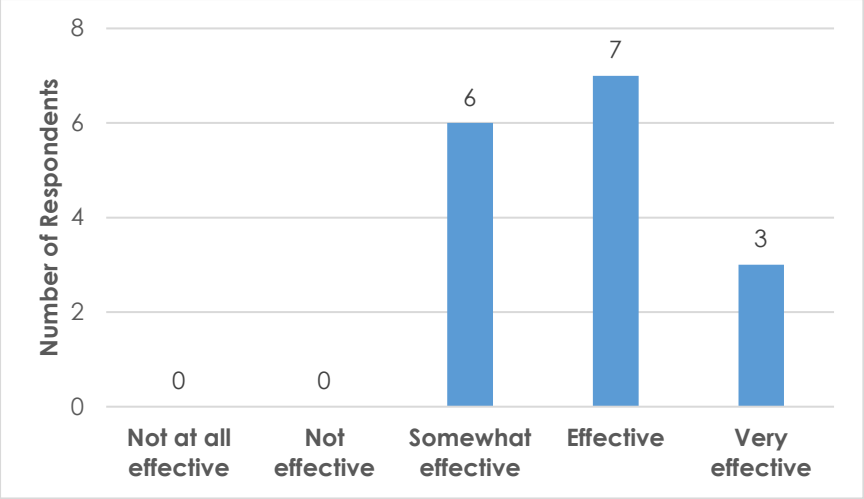


Figure 6. Respondents' rating of lecturer support effectiveness.



Additional Support

Just one respondent mentioned additional support available to students at their university: class representatives raise concerns or questions on behalf of students with the lecturer, Head of Department, or Vice-Dean.

Alternative Support

Respondents were asked about alternative support mechanisms available to students who are not coping. Most respondents (63%) said that some form of support is available. This takes the form of an extended programme at four universities, and a bridging programme at three universities. Other support mechanisms include: affording students the opportunity to rewrite exams; repeating the course in the following semester; student tracking; and augmented programmes for weak students.

Changes to Student Support

Respondents were asked whether they would like to see their student support services change in any way; 75% said yes. Personnel and teacher-student ratios were commonly noted as problematic; smaller student groups and the ability to recruit additional qualified tutors would help to improve university offerings. However, as one respondent noted: "*the appointment of tutors is contingent and dependent on UCDG funding. There is no fixed departmental budget against which these appointments may be made*".

Additionally, one respondent said that tutorials should be compulsory, and another mentioned a need for more unstructured tutorial sessions facilitated by postgraduate students. Greater integration of online resources was also commonly noted by respondents, including the use of e-textbooks, online support services, and mobile apps linked to e-learning platforms. This would necessitate improved IT support, as noted by one respondent.

Lastly, one respondent noted a pedagogical concern; they would like to see a "*focus on learning rather than marks*".

Eleven respondents (69%) feel as though they need support in order to change their student support services. Linked to the needs outlined above, most said that they would benefit from improving tutorials and managing large groups of students. In particular, respondents noted the need to: maintain reasonable lecturer-student

ratios; obtain resources to employ and train additional tutors; and learn how to support large groups of struggling students. One respondent made a specific request: "*an indication of how tutorial services are rendered elsewhere in SA and a sense of their efficacy. The situation at our institution has reached the stage where lecturers are now providing tutorial support in multiple classes as well*".

Other needs that can be potentially addressed by the DMISRS project include:

- The value of learning;
- Problem-solving and reasoning skills;
- The facilitation of tutorial sessions;
- Funding to support online platforms and IT services; and
- Funding to support tutor recruitment and/or training.

Uses of MAT Test Data

Respondents were asked what kind of useful information the MAT Test could provide universities. Three respondents offered a critical view of the MAT test, stating that they do not agree with the assessment, questions on conceptual understanding should be emphasized over ones testing procedural understanding, and that it does not test students' ability to construct a logical argument.

Other respondents highlighted potential uses of this data, including: the individualised reports; identifying at-risk students; sharing the data with module lecturers; and curriculum development.

Appendix A: Textbooks

Respondent's Faculty	**Textbook**
Engineering	Stewart Calculus, International Metric Version
	K Singh, Engineering mathematics through applications
	Calculus by James Stewart (8th Edition)
	Various sources
	Engineering Mathematics for WSU, Dr JCoetzee
	Abramson, J. (2014). Precalculus. Texas: OpenStax Herman, E. & Strang, G. (2016). Calculus (Volume 1). Texas: OpenStax
	Engineering Mathematics , K. A. Stroud, Sixth Edition
Education	Calculus (Concepts and Contexts), James Stewart
Science	Calculus Volume 1 by Gilbert Strang & Edwin Herman (openstax)
	Discrete Mathematical Structures (6th Edition) by B. Kolby, R. Busby, S. Ross. Pearson Education Limited, 2014
	Calculus by James Stewart (8th Edition)
	MAT 1S1: Biocalculus: Calculus for the Life Sciences (Stewart and Troy, 2015) MAM 1: Calculus: Early Transcendentals (Stewart, 7th or 8th edition)
	Abramson, J. (2014). Precalculus. Texas: OpenStax, Rice University, available from https://open.umn.edu/opentextbooks/textbooks/precalculus-2014 Herman, E. & Strang, G. (2016). Calculus (Volume 1). Texas: OpenStax, Rice University, available from https://open.umn.edu/opentextbooks/textbooks/calculus-volume-1
	Engineering Mathematics by K A Stroud, 5th Edition, Engineering Mathematics 1 and 2. Advanced Engineering Mathematics by K A Stroud 4th Edition, Engineering Mathematics 3
	Own notes