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## Editor's Note

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Here is the Autumn Edition of the **sigma** Newsletter 2022 amidst a myriad of major local and global changes! The Newsletter is a reminder of how the Network members continue to support and develop maths and statistics teaching in a variety of guises not overwhelmed by these changes.

Nationally we've said goodbye to Boris Johnston and have had a new Prime Minister and Cabinet installed: Frying pan and fire come to mind.

We have seen the passing of a monarch who ruled for over 7 decades, Queen Elizabeth II and witnessed the naming of the New King: Charles III, hope his influence to highlight environmental concerns is not diminished with his new responsibilities.



We're seeing the direct impact of global conflict in Ukraine, certainly on the economy, directly hitting our wallets but of more concern is the impact it's having on the decisions made on our behalf as a nation.

On a positive note, locally our steering group and roles within are changing, allowing for new enthusiasm and ideas. One of these changes is, my reduced involvement in the Group, due to my taking early retirement from full-time employment within Maths and Statistics education to pursue more independent and pro bono research. I'm grateful to the **sigma** Network for the support and opportunity to participate, it's been delightful! I encourage you to have a look at Alun's report that follows on the last AGM at the MSOR Conference for details and how you can get/remains involved.

Included in this edition is the result of a major piece of work by a multidisciplinary group at Munster Technological University on Dyscalculia, the resulting resources are freely available. Peter shares his journey as he navigates his way around combining variances.

**Keep a track of the upcoming events some of which are online and some campus based.**

A big thank you to all authors for their contributions to this edition, my last one as editor, passing on the baton to Lois Rolling from Middlesex University, our new editor for the Newsletter. Look out for her emails for contributions; the deadline for contributions for the next edition (Spring 2023) is **8<sup>th</sup> March 2023**. We welcome contributions on any topic that may be of interest to practitioners and academics supporting higher education students in their learning of mathematics and statistics.

Finally, as usual: the views expressed do not necessarily constitute recommendations from the **sigma** Steering Group or any associated parties.

Happy Reading

– Chetna Patel

## Annual General Meeting

**Alun Owen**

Head of Statistics Advisory Service and Chair of **sigma**-Network | Coventry University

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The Annual General Meeting of the **sigma** Network took place, in person for the first time since 2019, on the fringe of the CETL-MSOR conference at Abertay University on the on 1<sup>st</sup> September 2022. The conference itself attracts many members of the mathematics and statistics support communities across the UK and Ireland and further afield, as well as those with a wider interest in learning, teaching and assessment in HE mathematics, statistics and OR. The AGM this year was therefore well attended and allowed the **sigma** Network to present our work and get feedback from a varied audience of likeminded practitioners.



A notice of the meeting and associated documentation was sent out in advance of the AGM, with responses invited by email from those that would not be able to attend in person. These documents will be available on the **sigma** Network website at <http://www.sigma-network.ac.uk/constitution-and-agms/>.

The AGM was attended by approximately 100 people (27 Individual Members with voting rights, and the remainder made up of visitors). Overall members from 19 institutions were represented, along with guests from 8 additional institutions. A further 6 Individual Members with voting rights who could not attend in person submitted their views by email to the Chair. Hence a total of 33 members contributed to the AGM making the meeting quorate.

The Chair's Report highlighted some good news in that a new full programme of workshops, virtual coffee mornings and other events has been planned for the current academic year. We hope you will all find this of great value in terms of supporting your own practice as much as you have all done so in the past. Details of this programme of events will also shortly be advertised on our website but can be found in a separate article in this newsletter. The Chair's report also the acknowledged significant contribution that Chetna Patel has given as Treasurer of the **sigma** Network, as she is standing down after many years' service in this role. I'm delighted to let you know that Tony Mann has agreed to take on this role from Chetna. Chetna is reigning in her commitments after her recent retirement and will therefore also be stepping down in her role as Editor of the newsletter. This newsletter may well be her last as Editor so can I also take this opportunity to thank Chetna, again for what has been many years' service making sure we are all updated with the latest news and information about events, which has been such a valuable part of the success of the **sigma** Network. Thank you Chetna for everything, although I know you will keep in touch with us and indeed you have agreed to support the incoming Editor with the next edition.

The Treasurer's report in the notes for the AGM highlighted the significant impact that the work of all of you do in keeping the **sigma** Network alive, allowing it to support others and yourself, through the goodwill and generosity of your employing institutions. As we now operate with a zero budget this has been essential to allow us all to continue what we do so well, which is supporting our students.

The Secretary's Report summarized the continued steady growth in Individual Membership of the **sigma** Network, which now stands at 211 members, along with over 400 registered on the JISC **sigma** Network mailing list. To subscribe to the **sigma** Network JISCMail list, go to <http://www.jiscmail.ac.uk/sigma-network>

If you have a professional interest in HE mathematics and statistics support, do please sign up as an Individual Member. It's free and you can join by going to <https://www.sigma-network.ac.uk/apply-for-individual-membership/> . We do sometimes email the membership with information that is not posted on the JISC Mail list, for GDPR reasons. By joining you will not only evidence your commitment to excellence in mathematics and statistics support, but you will also be able help influence the future direction of the network.

A key element of the AGM is to ratify the Steering Group membership for the coming year, and the list of names (see below) was approved. Finally, the AGM provided an opportunity for some to offer appreciative feedback, much of which focused on thanks to the Steering Group for all their hard work and for the planned events for the coming year, especially “the qualitative support session for students, the anxiety workshop and the communal online training on new MSS tutors.” All that remains is for me to add my personal thanks to the Steering Group for their continued commitment to the cause, but also to all of you for making our network such an active, vibrant and valued asset in allowing us to support our students as well as we do.

### **Steering Group Membership 2022/23**

Alun Owen Coventry University (Chair)

Chetna Patel Retired (Editor of newsletter)

Ellen Marshall Sheffield Hallam University

Emma Cliffe University of Bath (Vice-chair Technical)

Lois Rollings Middlesex University

Mark Hodds Coventry University (Vice-chair Operations)

Mary Lorimer Loughborough University (Secretary)

Peter Hart University of Sheffield-

Theresa Wege Loughborough University

Rob Wilson Cardiff University

Sue Pawley Open University

Tony Mann University of Greenwich (Treasurer)

Plus co-opted members:

Ed Southwood University of Bath (Membership secretary)

Samuel Walton Birmingham City University (Early Career Representative)

Duncan Lawson (Representative of the IMA)

Anne Savage (Representative of the SMSN)

Kirsten Pfeiffer (Representative of the IMLSN)

### Raising Awareness Around Dyscalculia in MTU

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In 2020 a small multi-disciplinary group was formed by staff from the Disability Support Service (DSS), Academic Learning Centre (ALC) and Mathematics department in Munster Technological University (MTU) in Ireland. The group also included a student partner who had experience of learning with dyscalculia. The aim of the project was to raise awareness around dyscalculia, and it was funded by the MTU Teaching and Learning Unit.

Over the course of a two-year project, we approached the issue of dyscalculia awareness from several perspectives. We surveyed DSS students who had an official dyscalculia diagnosis to ask them how it had impacted on them and what approaches they had found helpful. We also surveyed teaching and support staff across the campus to establish the level of awareness of dyscalculia within the university. Based on the findings arising from the surveys, we held workshops over 2021 and 2022 for staff and students which included Hillary Maddocks, a tutor linked with Loughborough University, the British Dyslexia Association, Sue Johnston Wilder on maths anxiety, and our student partner also spoke about their experiences.

Two sets of guidelines were developed in 2021, one for lecturers and one for students. Our aim was to make simple and accessible recommendations that could be easily implemented either in the classroom or a student's own studies and also kept the principles of Universal Design for Learning in mind. It is hoped that they will help teaching, learning and support of Mathematics, and numbers-based subjects, for a much broader range of students.

These guidelines are available to all working in Mathematics and Statistics support, from the project website. And other information we have gathered during the course of this project is also there: <https://mathematics.cit.ie/dyscalculia> . If you would like a hard copy of the guidelines, we would be happy to send them to you.

# Tips for students with **dyscalculia**

## Study tips

- Use colour – like highlighter pens to highlight different parts of the question, or coloured paper or wash on your computer screen.
- Repetition is key.
- Use index cards (or similar apps) for important words, formulas, or methods.
- Practicing again and again is a good strategy.
- Try drawing a diagram to see if it is helpful. For functions questions try to plot the function (e.g., on calculator or app). This might help you understand the question better.
- Print out a worked example, cut it up and try to order it correctly.
- Go back over your notes and add extra explanations.
- As you meet new terms create a glossary (list of terms and definitions) so you can easily remind yourself of the definition of a term if it comes up again later in the semester.
- If a question is a long piece of work, try mind mapping it.



# Guidelines for lecturers to support students with dyscalculia

## Time Management

- Use the 12-hour clock for all timetables – try to avoid the 24-hour clock. Students may need extra support in working with timetables and working within set time frames, e.g., timed assessments.
- Provide a clear assessment schedule at the beginning of the module.
- Be very clear about deadlines and regularly remind students of a deadline coming up.
- Encourage students to access supports such as Academic Success Coaching/ DSS Learning Support around time management strategies.



## Teaching Methods

- Lots of repetition and practice.
- State the 'obvious'. Try not to assume too much prior knowledge.
- Introduce new concepts with concrete resources or examples where possible. Try to stick to concrete examples until understanding is clear. Only then move on to more abstract examples.
- Make links between new material and previous material as clear as possible. Remind students regularly of how current content and what has been done in previous lectures/terms are linked. Particularly important for key words or concepts.
- Break down a multi-step problem into small, manageable steps.
- Be patient and allow students time to process new information.
- Distributed and spaced practice can help retention of material. For example, adding some exercises from previous topics to exercise sheets.
- For functions questions encourage students to plot the function (e.g., on calculator or app).
- Allow students to work together at times. Peer support can encourage different ways of understanding the problem.
- Create 'recipes' for important methods.



# Guidelines for lecturers to support students with dyscalculia

## Presentation Methods

- Read slides aloud and give verbal explanations of diagrams, data, or methods.
- If a question is a long piece of work, try mind mapping it.
- Use colour, e.g., each variable has a different colour/colours in Excel cells. Give each term of a quadratic a different colour.

## Teaching Materials

- Provide notes in advance where possible. This allows students more time to listen and understand in class.
- Provide sample answers or templates (well written out solutions).
- Provide recordings of examples (including the verbal descriptions) for students to watch back at their own pace.
- Provide lots of written out examples with written explanations.
- Use coloured papers or backgrounds.
- Provide a glossary of key words/terms/theorems and their definitions.

## DSS Students

- Allow the use of calculators and formula books.
- Allow the use of assistive technology.
- Allow the use of extra time in exams/tests.

## Other

- Be aware of where there may be hidden maths in subjects which can also pose difficulties, e.g., music harmony.

MTU Disability Support Service – Cork campus: [www.mycit.ie/dss](http://www.mycit.ie/dss)

MTU Academic Learning Centre: <http://alc.cit.ie>

This is a TLU Development Fund project sponsored by the Teaching and Learning Unit, Office of the Registrar and VP for Academic Affairs in partnership with the Department of Mathematics, Academic Learning Centre, and Disability Support Service.





## Variations for products and quotients: a forester wanders down a statistical byway

Peter Mitchell

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Most users of statistics learn that where means of two independent samples are added or subtracted then the variance of the sum or of the difference is obtained by adding together the variances of the two means. Usually we encounter this in computing the variance of the difference between two means, and then the confidence limits, after a t-test or analysis of variance. But suppose we have two independent samples where we need to multiply the means and find the variance for the product? Many years ago this was my problem. I had sample measurements of tree height and of trunk cross-section near the base from which to obtain the volume. (The geometrically astute will see immediately that the volume of this cylinder will be a large over-estimate for a tapering tree trunk, and foresters use established tables of "form factor" for each species—usually around 0.3—to allow for this.) Fortunately the Forest Mensuration Handbook provided a formula and a worked example.

$$SE_{MA \times MB} = \sqrt{M_A^2 SE_B^2 + M_B^2 SE_A^2}$$

where  $SE_{MA \times MB}$  is the standard error of the product;

$M_A$  and  $M_B$  are the means of samples A and B; and

$SE_A$  and  $SE_B$  are the standard errors of the means of samples A and B.

For 95% confidence limits use the value of t for  $P=0.05$  for the degrees of freedom of the smaller sample ( $n-1$ ).

I could see that  $SE^2$  was a variance, etc., but was mystified why the  $SE^2$  of each sample must be multiplied by the mean *squared* of the *other* sample before adding. Eventually I realized that considering the units of measurement would help. The units of  $SE_{MA \times MB}$  must be the same as the units of the product, i.e. units of A multiplied by the units of B. The units of the variance of  $MA \times MB$  must be the units of the product squared. Then the two terms on the right-hand side of the equation must have the same units to be added together, and they must each be the units of the product squared. This is achieved by multiplying the SE by the other mean, each squared because in the realm of variances. Well, it is not a rigorous proof but a way of thinking about it.

None of my elementary or intermediate statistical textbooks contain the formula above. I found it in three forestry sources, and a web search turned up some current research in the forestry world. Although routinely used in forest mensuration, especially in North America, the origin of the formula was obscure and investigation found a secure mathematical foundation. The formula above is considered a good approximation especially for large samples.

The question may occur to you as it did to me: is there a formula for the variance of a quotient? Yes, I did manage to find one.

$$V_{MA \div MB} = \frac{M_A^2}{M_B^2} \left( \frac{V_{MA}}{M_A^2} + \frac{V_{MB}}{M_B^2} \right)$$

where  $V_{MA \div MB}$  is the variance of the quotient (or ratio if you prefer) of the means; and

$V_{MA}$  and  $V_{MB}$  are the variances of the means of samples A and B.

And what about when the samples are *not* independent? There are longer formulae for these cases which include the covariance between A and B, computed from the paired observations coming from the same sample unit. But in practice it will be easier to work out the product (or quotient) for each sample unit and use these values as the observations on which to carry out statistics.



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## FUTURE EVENTS

### Events Coming Up in 2022/23

**Alun Owen**

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I'm delighted to announce that we have a full programme of workshops, virtual coffee mornings and other events planned for the current academic year. The full list of events is shown below and some have already taken place. To make sure you are kept up to date with these events, finalized dates, timings and how to register etc., please do join as a member of the **sigma** Network which is free to join, or register on our JISC mailing list, or ideally both. Details are provided in the Chair's AGM report in this newsletter.

Details of this programme of events will also shortly be advertised on our website. We hope you will all find this of great value in terms of supporting your own practice as much as you have all done so in the past. We look forward to seeing you there.

| Date                                       | Event Details   | Host Institution           |
|--|---|----------------------------|
| 11 <sup>th</sup> Aug 2022                  | Virtual Coffee Morning (Online)   | Loughborough University    |
| 1 <sup>st</sup> – 2 <sup>nd</sup> Sep 2022 | CETL-MSOR Conference  | Abertay University         |
| 12 <sup>th</sup> Sep 2022                  | Online sigma training session for new maths support tutors                | Greenwich University       |
| 20 <sup>th</sup> Oct 2022                  | Virtual Coffee Morning (Online)   | Birmingham City University |
| Nov 2022                                   | Workshop: The New Normal  | Open University            |
| Dec 2022                                   | Virtual Coffee Morning (Online)   | University of Bath         |
| Jan 2023                                   | Workshop: Supporting students with Qualitative Analysis and Meta-analysis | Coventry University        |
| Feb 2023                                   | Virtual Coffee Morning (Online)   | University of Sheffield    |
| Mar 2023                                   | Workshop: Maths Anxiety   | Coventry University        |
| Apr 2023                                   | Virtual Coffee Morning (Online)   | University of Bedfordshire |
| May 2023                                   | Workshop: Embedding Maths Support in the Curriculum                       | Middlesex University       |
| June 2023                                  | Virtual Coffee Morning (Online)   | TBA                        |
| July 2023                                  | Workshop: Topic TBA   | TBA                        |