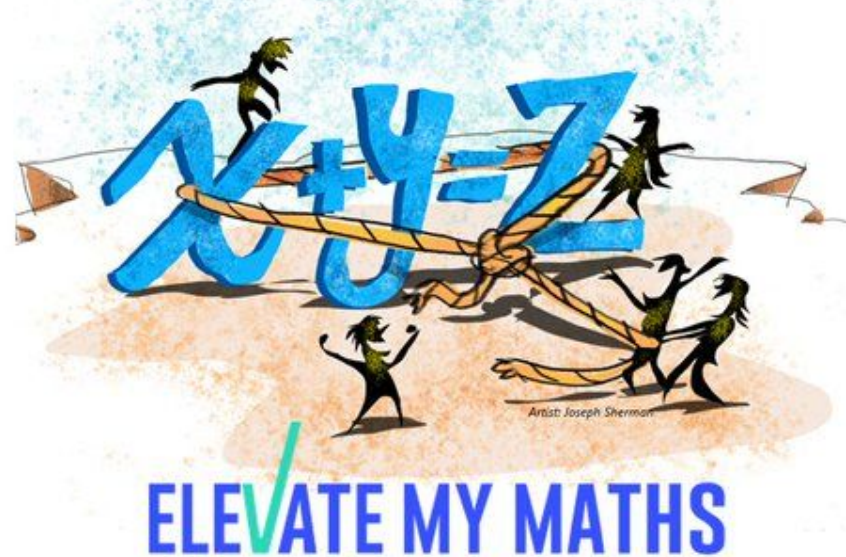


# Closing the Numeracy Gap with Elevate My Maths: A Case Study from University of Derby

E-A×M+S 2021

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# Agenda

- The Challenge
- What the Data says?
- Elevate My Maths (EMM)
- EMM at University of Derby
  - 2018-19 Pilot Project
  - 2019-20 Development and integration into VLE
  - 2020-21 Deployment across the University and its partners
- Lessons Learned and Next Steps
- Demo and Q & A

# The Challenge

Present levels  
of numeracy



Level of numeracy  
required for **full  
participation** in a  
**technological society**

# Causes?



## SOCIETAL ATTITUDES

- The myth of the math gene
- Some people can do math while others cannot.
- Snowball Effect; HE remedies SE, SE remedies PE
- Over-reliance on calculators.

- ✓ Everyone can be numerate!
- ✓ Everyone needs to be numerate.

# Numeracy Trends: USA

GLOBAL RANKING IN MATHEMATICS FOR USA\*\*

15 YEAR-OLDS

70%

OF AMERICAN  
ADULTS ARE BELOW  
THE DESIRED LEVEL  
OF NUMERACY\*

2009

PORTUGAL  
28th



ITALY  
SPAIN  
LATVIA  
RUSSIA  
GREECE  
ISRAEL  
TURKEY  
CHILE  
MEXICO  
BRASIL  
INDONESIA

2012

PORTUGAL  
ITALY  
SPAIN  
RUSSIA  
SLOVAKIA  
36th



SWEDEN  
HUNGARY  
ISRAEL  
GREECE  
TURKEY  
CHILE  
MEXICO  
BRASIL

2015

OECD AVG  
ICELAND  
LUXEMBOURG  
SPAIN  
LATVIA  
HUNGARY  
SLOVAKIA  
ISRAEL  
40th



GREECE  
CHILE  
TURKEY  
MEXICO  
COLUMBIA

2018

ITALY  
SLOVAKIA  
LUXEMBOURG  
HUNGARY  
LITHUANIA  
SPAIN  
38th



ISRAEL  
TURKEY  
GREECE  
CHILE  
MEXICO  
COSTA RICA  
COLUMBIA

N.B.

In 2018 Five  
Asian Pacific  
Countries that  
typically rank  
in the top 10  
did not report.



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DERBY

Results from the Organization for Economic Co-operation and Development (OECD)

(\*) [Programme for the International Assessment of Adult Competencies \(PIAAC\)](#)

(\*\*) [Programme for International Student Assessment \(PISA\)](#)



# Numeracy Trends: Canada

55%

OF CANADIAN  
ADULTS ARE BELOW  
THE DESIRED LEVEL  
OF NUMERACY\*

## GLOBAL RANKING IN MATHEMATICS FOR CANADA\*\*

15 YEAR-OLDS

2009

SHANGHAI  
SINGAPORE  
HONG KONG  
SOUTH KOREA  
TAIWAN  
FINLAND  
LIECHTENSTEIN  
SWITZERLAND  
JAPAN



NETHERLANDS  
MACAU  
NEW ZEALAND  
BELGIUM  
AUSTRALIA

2012

SHANGHAI  
SINGAPORE  
HONG KONG  
TAIWAN  
SOUTH KOREA  
MACAU  
JAPAN  
LIECHTENSTEIN  
SWITZERLAND  
NETHERLANDS



POLAND  
BELGIUM

2015

SINGAPORE  
HONG KONG  
MACAU  
TAIWAN  
JAPAN  
B-S-J-G (China)  
SOUTH KOREA  
SWITZERLAND  
ESTONIA



NETHERLANDS  
DENMARK  
FINLAND  
SLOVENIA  
BELGIUM

2018

JAPAN  
KOREA  
ESTONIA  
NETHERLANDS  
SWITZERLAND  
POLAND



BELGIUM  
DENMARK  
SLOVENIA  
U.K.  
AUSTRIA  
FINLAND  
IRELAND  
GERMANY

N.B.  
In 2018 Five  
Asian Pacific  
Countries that  
typically rank  
in the top 10  
did not report.



UNIVERSITY OF  
DERBY

Results from the Organization for Economic Co-operation and Development (OECD)

(\*) [Programme for the International Assessment of Adult Competencies \(PIAAC\)](#)

(\*\*) [Programme for International Student Assessment \(PISA\)](#)



# Numeracy Trends: UK

## GLOBAL RANKING IN MATHEMATICS FOR UK\*\* 15 YEAR-OLDS

49%

OF BRITISH ADULTS  
ARE BELOW THE  
DESIRED LEVEL OF  
NUMERACY\*

2009

OCED AVG  
POLAND  
SWEDEN  
CZECH REP  
**22nd**  
  
HUNGARY  
LUXEMBOURG  
IRELAND  
SLOVAKIA  
PORTUGAL  
UNITED STATES  
ITALY  
SPAIN  
LATVIA

2012

OCED AVG  
**19th**  
  
ICELAND  
LATVIA  
LUXEMBOURG  
NORWAY  
PORTUGAL  
ITALY  
SPAIN  
RUSSIA  
SLOVAKIA  
SWEDEN  
HUNGARY  
ISRAEL

2015

NORWAY  
AUSTRIA  
NEW ZEALAND  
AUSTRALIA  
RUSSIA  
SWEDEN  
FRANCE  
CZECH REP  
PORTUGAL  
**27th**  
  
ITALY  
OCED AVG  
ICELAND  
LUXEMBOURG  
SPAIN

2018

FINLAND  
SWEDEN  
**13th**  
  
NORWAY  
GERMANY  
IRELAND  
AUSTRIA  
CZECH REP  
LATVIA  
FRANCE  
ICELAND  
NEW ZEALAND  
PORTUGAL  
AUSTRALIA

N.B.  
In 2018 Five  
Asian Pacific  
Countries that  
typically rank  
in the top 10  
did not report.

# Numeracy Gap: Impact



## EMPLOYMENT SKILL GAP

Growing gap between the **19.3% wage increase** in numeracy ability of employees and the numeracy expectations of employers. 3x more STEM related job openings in the past decade.

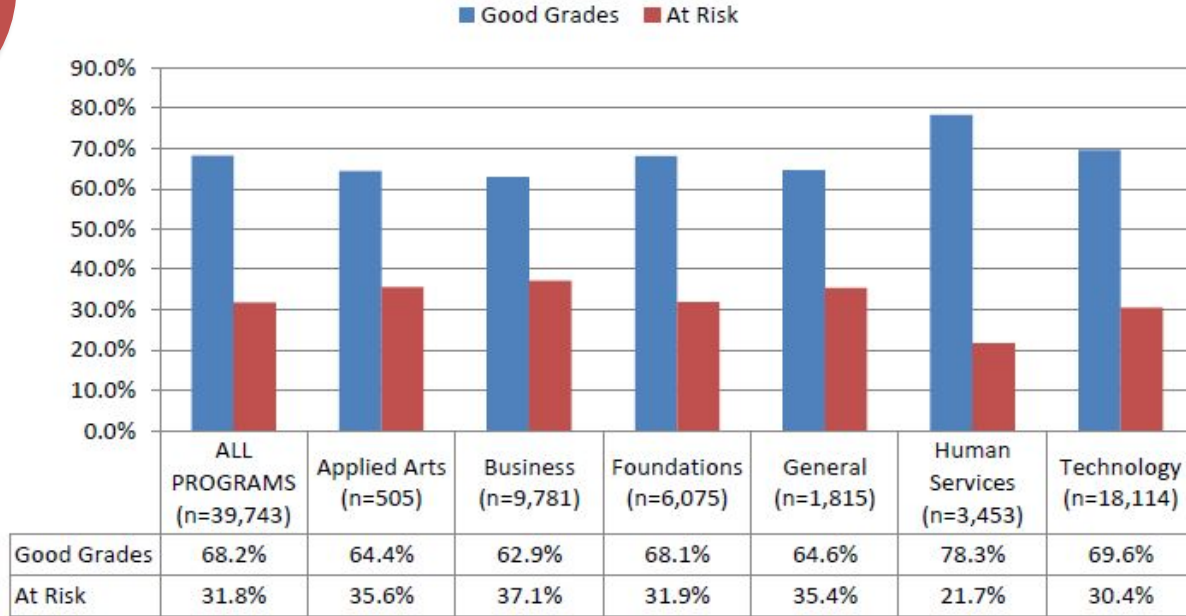
People in STEM fields tend to **earn 26% more**



# College Data in Canada

~1/3  
AT RISK

Research shows students are “at risk” of **not completing their** program due to their grades in first semester mathematics courses



## ASSESSMENT FOR LEARNING FOR STUDENT SUCCESS AND RETENTION

- Psychometrically validated assessment items paired with interactive pedagogies.
- Developed in collaboration with **all 24 Community Colleges** in Ontario through the College Student Achievement Project, funded by the Ministry of Education and the Ministry of Training, Colleges and Universities.



# Vretta and Elevate my Maths (EMM)

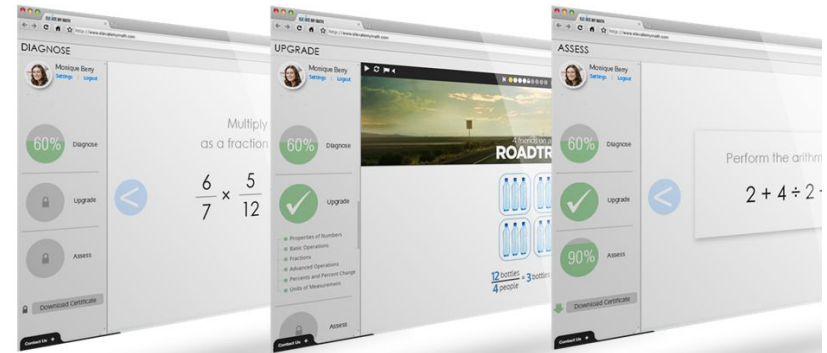
**Vretta:** Award winning Canadian educational technology company

*Motto: "Our vision is a world where everyone enjoys maths"*



- Basic maths for College students
- Fills gaps in prior knowledge
- Assessment for learning

- 1** DIAGNOSTIC ASSESSMENT  
IDENTIFY SKILLS THAT REQUIRE MASTERY
- 2** UPGRADING MODULES  
ACHIEVE MASTERY
- 3** SUMMATIVE ASSESSMENT  
ASSESS LEVEL OF MASTERY





# 2018 WINNER

## BEST TRANSFORMATIONAL PROJECT

### For Raising the Level of Numeracy & Supporting Student Success



Products: EMM (Canada, UK), Mathematic (Luxembourg), IntroMath, etc.



# Numeracy Trends: United Kingdom

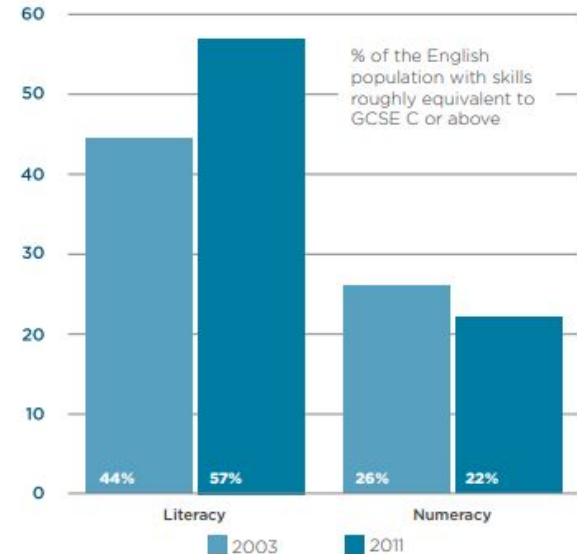
Government statistics from 2021 suggest that

- 17 million adults – 49% of the working-age population of England – have the numeracy level that we expect of primary school children
- Economic Impact: £20 billion a year
- The gap between literacy/numeracy is increasing

**Conclusion:** Current approach not delivering a numerate workforce...

## Numeracy at University?

- We have a duty to support ALL students
- Should we just accept claims like *“I’ve always been bad at Maths”*?

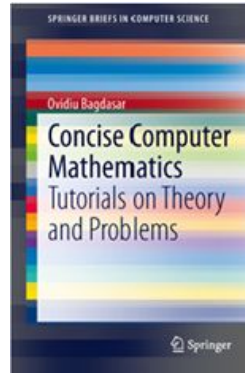


# University of Derby: My Class

- Computational Maths, Year 1 (set theory, logic, linear algebra, graphs, number theory)
- **Student numbers:** ~ 130-180
- **NSS – Feedback:** 40-50% (2012)

## Solution (pre-COVID)

- Textbook + Recordings + Maths Jokes
- E-assessment (BB, 800+ questions)



## Student feedback

**2013-14:** *"I really liked how we were able to re-take **the online tests** as this **became the perfect revision tool**; it facilitated my learning and comprehension of all the material presented".*

**2014-15:** *"I have **always sucked at maths**, even in school I barely scrapped a C. Strangely, I am enjoying computational mathematics, to the point I enjoy doing some in spare time".*

# UoD & Vretta collaboration timeline

## 2017-18 First steps

- Meet Dr Graham Orpwood (Vretta) - BCME 2018
- EMM Pilot @UoD: design, implementation, DPIA

## 2018-19 Pilot projects

- Vretta's CEO visit to UoD and CELT
- Workshops, conferences, seminars
- UoD and Vretta partnership signed (April 2019)

## 2019-21 Full implementation

- 12 new courses + Blackboard integration
- Deployment in modules/programmes
- Digital badges and translations



**The University of Derby becomes Vretta's first Academic Hub in the UK to Support Student Success in Mathematics**

<https://bit.ly/3vPcQUJ>

# Derby implementation: Pilot projects (2018-19)

## Advanced Numeracy Skills (60 questions)



Presented at Advance HE STEM 2019

## College of Engineering & Technology

- Mathematics Year 1 (30)
- Computing Year 1 (130)
- Foundation Year 0 (110)
- Computing Med College (30)

•**Student Feedback:** *“Found it very useful as I hadn't studied Math for over 25yrs. I had a lot of remedy videos to get through, and spent many hours going through additional learning resources.”*



# Numeracy Skills Pilot projects: Results

Institution	Course	Enrolled	Accessed Diagnostic		Accessed Upgrading		Accessed Summative	
			Number	Avg. Score	Number	Avg. Score	Number	Avg. Score
University of Derby	4MA501-Calculus	14	12	81%	12	73.50%	2	95%
University of Derby	4CC503-Computational Mathematics	136	132	68%	132	79.74%	87	88%
University of Derby	3EJ502-Preliminary Mathematics	115	109	72%	111	83.29%	70	89%
University of Derby	Career Service	7	6	61%	6	45.41%	1	94%
Mediterranean College-Athens	4CC503-Computational Mathematics	20	18	51%	19	27.86%	1	90%
Mediterranean College-Thess	4CC503-Computational Mathematics	5	2	73%	2	40.48%	0	
	<b>Totals:</b>	<b>297</b>	<b>279</b>	<b>67%</b>	<b>282</b>	<b>58%</b>	<b>161</b>	<b>91%</b>

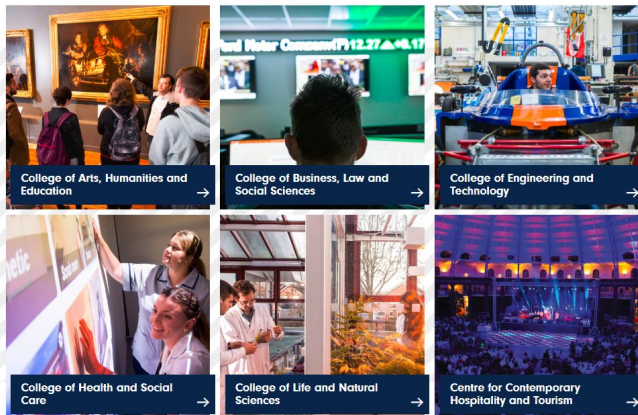
- Students went through numeracy skills training
- Basic maths skills checked – no need to repeat in class!
- **Engagement:** 102 min (Pre-Test), 230 min (Remediation), 46 min (Post Test)
- **Improvement:** 14% Maths, 17% Year 0, 20% Comp Maths, 39% Comp Maths (Med College)
- **Pass rate (4CC503):** *Up to 90%, from 84-85% in previous years.*

# Derby Implementation: Second phase (2019-20)

## EMM full catalogue (Summer 2019)

- ❖ Number sense (Units 1-6)
- ❖ Proportional reasoning (Units 7-8)
- ❖ Algebra (Units 9-10)
- ❖ Measurement and Geometry (Units 11-14)
- ❖ Data Management and Statistics (Units 15-20)
- ❖ Business and Financial Maths (Units 21-28)
- ❖ Health Sciences Mathematics (Units 29-30)

### Our Colleges



## New EMM courses developed @UoD (Sept 2019)

- ❖ D1 - Fundamentals
- ❖ D2 - Basic Algebra and Geometry
- ❖ D3 - Numbers, Proportions and Applications
- ❖ D4 - Statistics, Data Analysis and Probabilities
- ❖ D5 - Basic Financial Mathematics
- ❖ D6 - Applied Financial Mathematics
- ❖ D7 - Algebra and Measurement for Finance
- ❖ D8 - Business and Financial Mathematics
- ❖ D9 - Basic Algebra and Statistics for Finance
- ❖ D10 Proportions, Statistics and Dosage Calculations

## Integration with Blackboard (Dec 2019)

Key areas (Jan 2020)	EMM courses	Modules	Programmes
Engineering	30	8	1
Apprentices	35		7
Derby Business School	26	9	
Psychology	2		1
Maths Hub	10		
Total	103	17	9

# Derby implementation: Second Phase (2019-20)

## Student view



### D1 - Numeracy Skills: Fundamentals

Enabled: Statistics Tracking

This course covers:

Topic 1: Properties of numbers and Arithmetic Operations

Topic 2: Decimal Operations

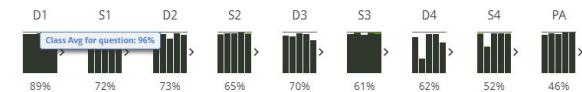
Topic 3: Fractional Operations

Topic 4: Proportional reasoning

Each topic has a diagnostic test, remedy lessons and summative assessment.

Your course grade is the average of the Summative Assessment grades.

Presented at Advance HE STEM 2020



View Lesson Performance View Assessment Performance

- > 1. Properties of Numbers and Arithmetic Operations
- > 2. Decimal Operations
- > 3. Fractional Operations
- > 4. Proportional Reasoning
- > Proficiency Assessment

## UoD inspired innovations:

- New courses build (by UoD academics)
- EMM 2.0 design: Topics have diagnostic, remedy lessons, summative assessment
- Assessment for learning: Repeatable summative tests (flexible, engaging)
- Library Maths Skills Guide: <https://libguides.derby.ac.uk/maths>
- Interactive dashboards design, placements

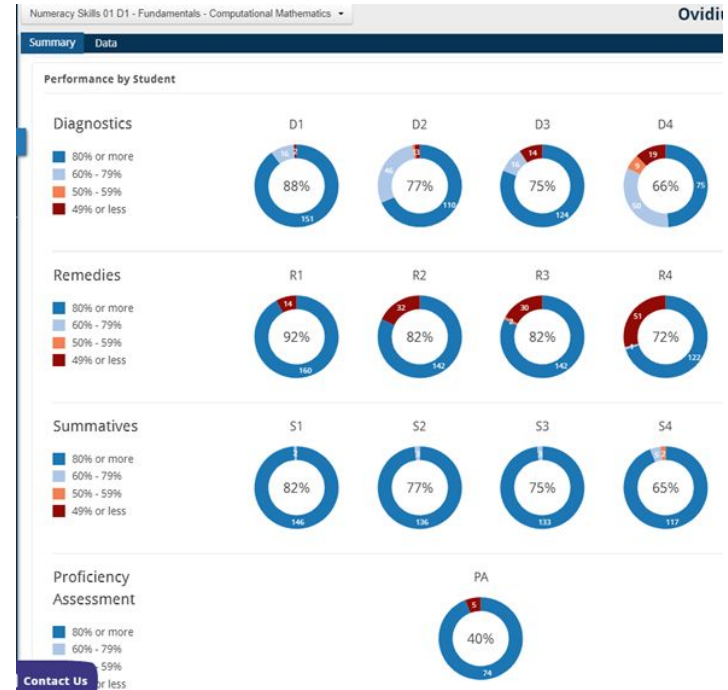
# EMM Course Dashboard (Tutor view)

## D1 (Comp Maths 2020-21)

- 174/173 engaged
- 74/173 got D1 badges
- Used in weekly feedback

## Key readings for feedback

- R1 – engagement (174)
- S4 – achievement (128)
- PA – Completion (badge) (74)



# EMM Digital Badges

- Digital Badges (+400 since Dec 2020)
- Issue - Open Badge Factory <https://openbadgefactory.com/en/>
- Achievements can be shared via social media and with employers



## Top Issued

	IPL - Experts by Experience World Cafe CPD	680
	Virtual Induction Digital Badge	501
	Numeracy Skills: D1 - Fundamentals	275
	Festival of Learning Presenter 2020	155
	Induction for online practice	152
	Numeracy Skills: D2 - Algebra, Measurement and Geometry	110

# Award of Digital Badges

Check my own D1 badge! <https://openbadgepassport.com/app/badge/info/300443#>



## NUMERACY SKILLS: D1 - FUNDAMENTALS

Issued by: University of Derby

Issued on: 1.1.2021

Earned by: Ovidiu Bagdasar

This digital badge is awarded for completing the numeracy training course "D1 - Fundamentals", developed by the University of Derby and powered by Vretta's Elevate My Maths platform.

 [Check this badge...](#)

### CRITERIA

[Open criteria...](#)

This course provides a personalised programme of assessments and interactive lessons, designed to help the students to prepare for success in further studies and their career. The system checks students' proficiency levels in maths, provides upgrading as necessary, and helps them build confidence.

# Is this for me? Student Feedback



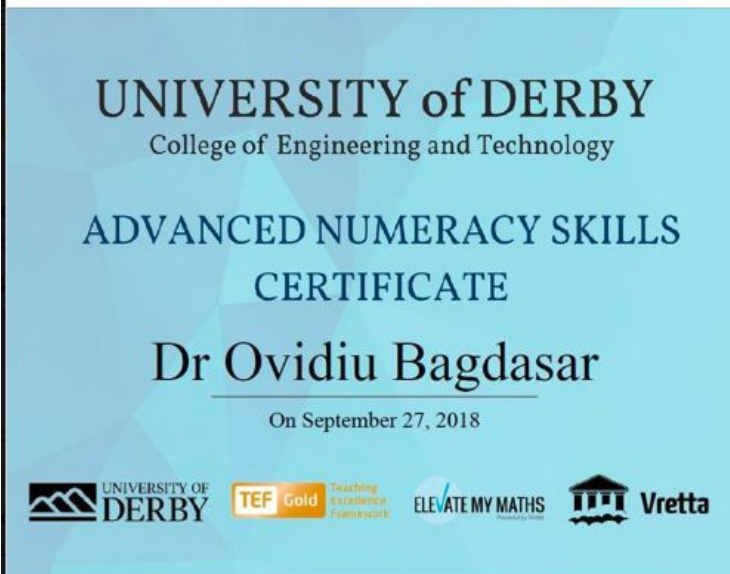
Ovidiu Bagdasar Dimitri

September 29, 2018 · 🌐



Proud to obtain my "Advanced Numeracy Skills Certificate", awarded by Vretta and the University of Derby. The project aims to help students and staff remedy eventual gaps in numeracy and enjoy day-to-day mathematics.

More details about the project can be found here.  
<https://bit.ly/2OpwUv6>



👍❤️😄 172

57 Comments 1 Share



Brettskibols

@Brettskibols

Following



@BagdasarO thank you so much for the wonderful tools in the Computational mathematics module of my degree the Vretta tools were systematic in helping me get back into maths at the age of 30 after 14 years away from the subject 😊

3:37 AM - 10 May 2019

Working and playing with @Brom25 @LCFC\_Community last month made us think of you @dr\_tom\_hunt... #maths #moveandlearn 😊

**"I used to think I was rubbish at Maths - but now I know I'm not!"**

Ethan, Year 5,  
Leicester



# EMM Deployment and Future

@UoD: MathsHub (+development), UoD Applicants

## Some of our UK partners

- FEFZ (Educational charity)
- Derby Opportunity area Schools
- Offered to Universities in the UK and abroad
- 8000 teachers from NASBTT (school based teachers)

## Some Vretta & UoD international partners

*Turkey*



*Sweden*



Haninge  
kommun

*Romania*





# DEMO





AN EDUCATIONAL TECHNOLOGY COMPANY  
THAT IS REVOLUTIONIZING MATH EDUCATION,  
**GLOBALLY.**



OUR VISION IS A WORLD  
WHERE EVERYONE ENJOYS MATH

CUSTOM RESOURCES IN  
**4** LANGUAGES

English | French | German | Portuguese

