



STUDENTS-AS-PARTNERS

IN TRANSLATING PEDAGOGICAL RESEARCH INTO PEER-SUPPORT PRACTICE IN UNDERGRADUATE MATHEMATICS

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TALK OUTLINE

Students-as-Partners

Sonia's project

Project outline

Interviews with lecturers

Developing resources and final report

Integration into PASS

(Quick) introduction to PASS and the student coordinator role

Scholarly-informed PASS materials

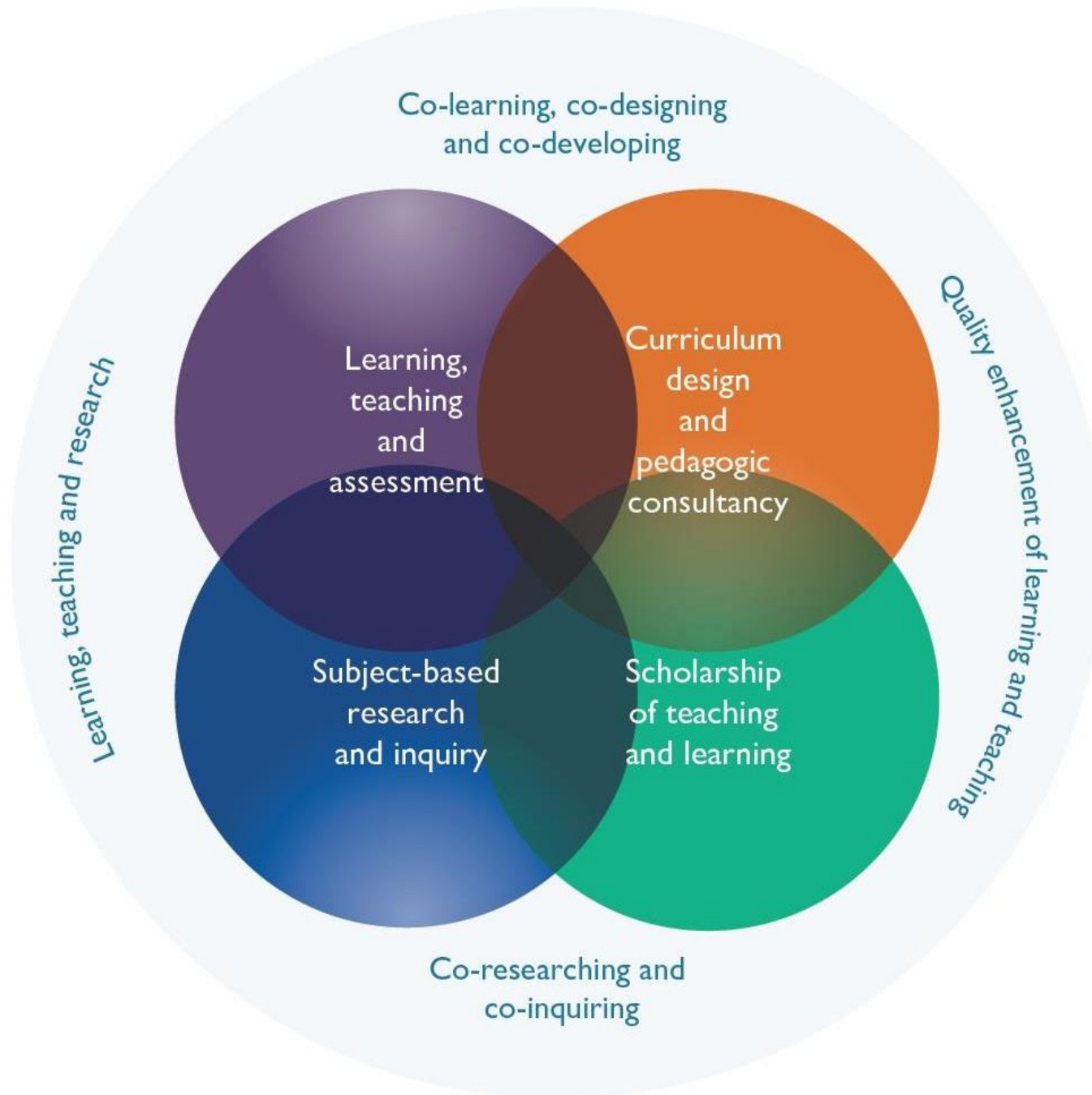
What's next?



STUDENTS AS PARTNERS (SAP)

Students as Partners is...





(Healey, Flint and Harrington 2014)



STUDENTS AS PARTNERS (SAP)

Students can **influence** how we teach and they take more **responsibility** for their learning.

Staff and students **learn from each other** through an ongoing dialogue.



"[SaP leads to] **student engagement**, increased **motivation** and **ownership of learning**, increased **sense of confidence** and **self-awareness**, as well as a **sense of belonging** to university, discipline and community as some of the most important positive outcomes of the practice." *(Mercer-Mapstone 2017)*

FACILITATING EFFECTIVE TEACHING PRACTICES IN ABSTRACT ALGEBRA AND PROOF COMPREHENSION

- Inspiration:** Exposure to maths education research and evidence-informed teaching
Inspired by how Craig Barton (2017) translated conversation with educational researchers into classroom practice
- Context:** Students often find the transition to abstraction and proof reasoning challenging
Focus on introductory abstract algebra topics at UoM



STUDENTS - AS - PARTNERS

Co-creation throughout the project

Project initiated through shared interest in mathematics education

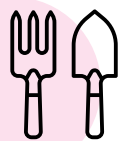
Research question and methodology developed collaboratively

Student experience informed the project focus and output

Continuous dialogue shaped interviews, findings, report writing and toolkit2



THE PROJECT



Planning

SaP partnership
Defining project aims



Literature Review

Maths education
Proof Comprehension



Lecturer Interviews

Teaching practices
Staff perspectives



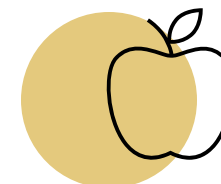
Toolkit development

Scholarly-informed
practice



Synthesis

Student voice
Research evidence



Implementation

PASS coordinator
role

THREE KEY THEMES

Examples & Variation

"When I think of a Lie Algebra, I have a stack of friendly examples that I know are representative. But students don't have that..."

Explanation & Discussion

"They don't understand why I am doing the next step and I have to explain again...."

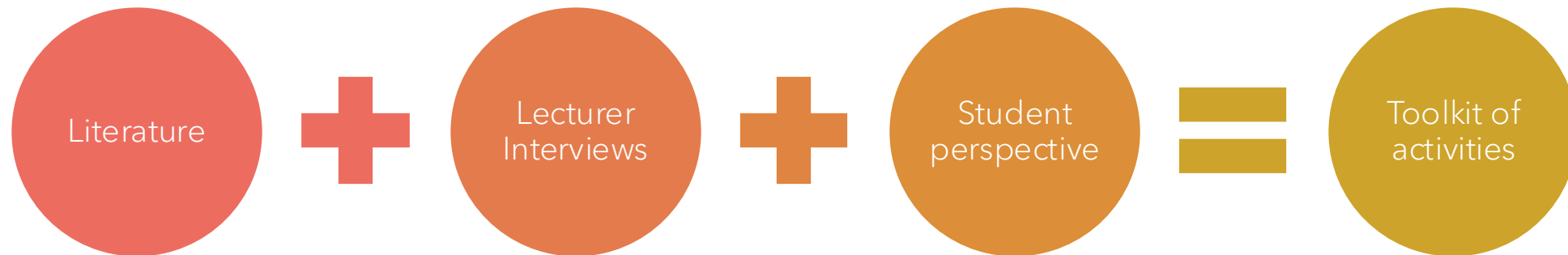
Feedback & Self-Regulation

"I always tell my students to highlight where in the proof they got stuck...."



FROM THEORY TO PRACTICE

- Scholarly-informed activities
- Low-cost interventions
- Smaller groups in tutorials

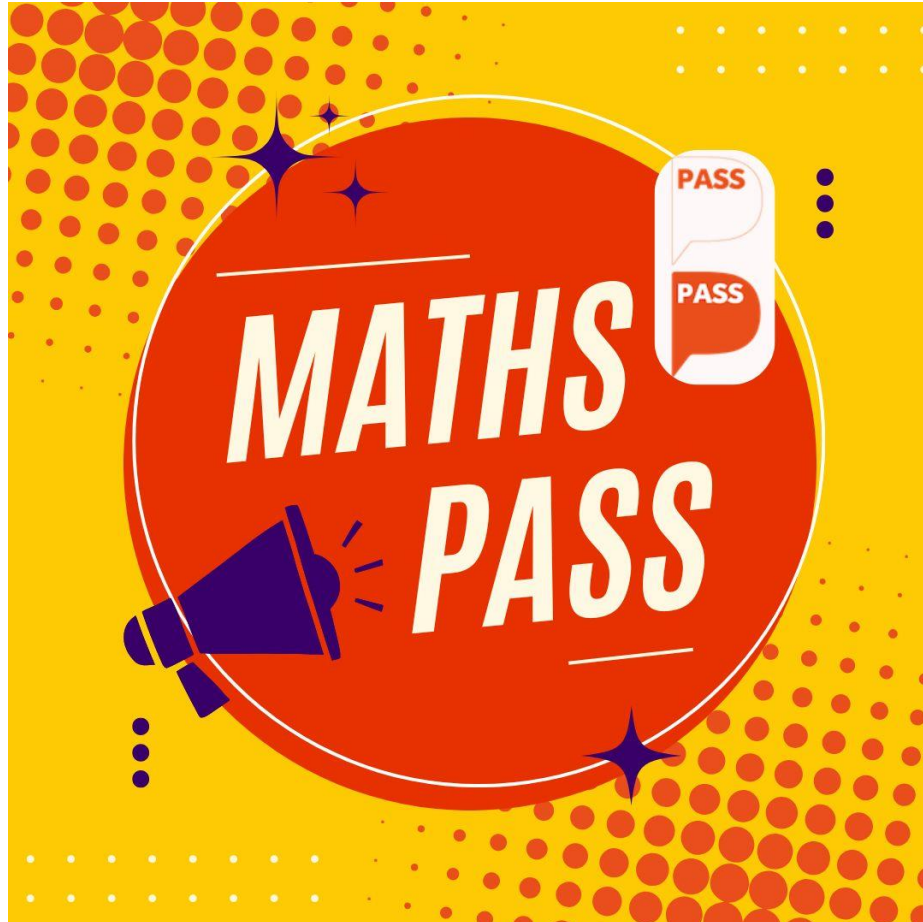


But I wanted to test these myself...



MATHS PASS

Peer-Assisted Study Sessions



Maths PASS Team

PASS Leaders

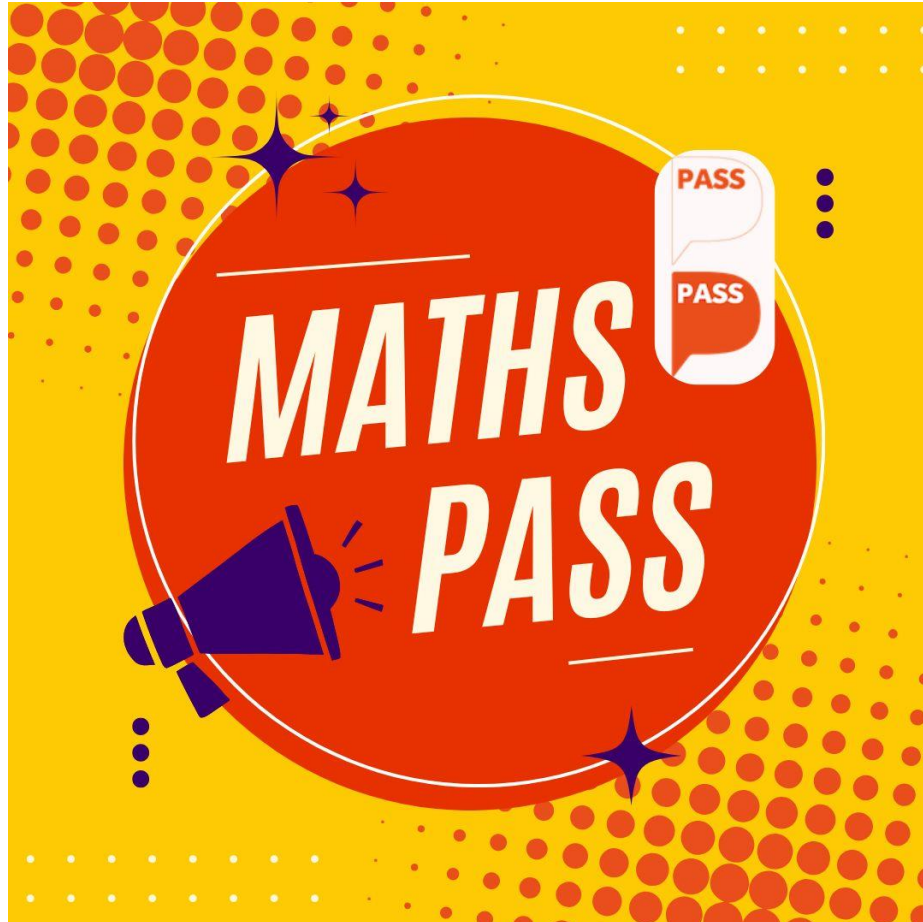
Student
Coordinators

Academic
Coordinator

PS Staff

MATHS PASS

Peer-Assisted Study Sessions



Student-led

- Sense of ownership of the scheme
- Taking responsibility
- Personal investment in the scheme's success

Student coordinators

- Working as partners with me
- Taking a leading role
- Making decisions & guiding scheme's direction

TESTING THE FINDINGS IN PASS

Leader training

- How to facilitate rather than teach
- Using questioning to guide discussion
- Encouraging self-explanation
- Supporting peer- and self-feedback

Weekly activity design

- Reviewed weekly Y1 course content
- Identified challenging concepts
- Adapted existing curriculum
- Reframed content using project-inspired activities



LEARNING THROUGH DISCUSSION

MATHEMATICAL FOUNDATIONS AND ANALYSIS

Prove it!

Try to prove Corollary 5.13.
Work in groups OR if you work
individually share it with the
person next to you.

You can use the guiding questions
to help.

Reminder of Prop 5.1.2:

Proposition 5.12. Let A, B be countable sets. Then $A \cup B$ and $A \times B$ are countable.

Corollary 5.13. If $A_1, A_2, \dots, A_n$ are countable sets, then

$$\bigcup_{i=1}^n A_i$$

is countable.

Task for students: Using Proposition 5.12, prove Corollary 5.13 by *mathematical induction on n* . You may assume that the union of two countable sets is countable.

Guiding questions:

1. What is the base case when $n = 2$? (How does Proposition 5.12 establish it?)
2. What should be the induction hypothesis? (State it clearly in terms of n .)
3. In the induction step, how can you express $\bigcup_{i=1}^{n+1} A_i$ in terms of $\bigcup_{i=1}^n A_i$ and A_{n+1} ?
4. Which previously proved result allows you to conclude that $\bigcup_{i=1}^{n+1} A_i$ is countable?
5. Write a short paragraph completing the inductive argument.

Optional discussion:

- Does the same argument work for *infinitely many* countable sets? (What changes if n is not finite?)
- Can you think of an example where an infinite union of countable sets becomes uncountable?

- Collaborative inquiry
- Guided instruction
- Scaffolding

LEARNING THROUGH COMPARISON

MATHEMATICAL FOUNDATIONS

Proof summary task

Write in around 50 words
what this proof is about!

Try to use as little maths as
possible.

Theorem 5.15. (Cantor 18

Proof We will show that $[0, 1]$ is uncountable. The result is that the set is countable. Write each element as $\{0, 1, \dots, 9\}$, for all $i \in \mathbb{N}$.

We use proof by contradiction. Assume that $[0, 1]$ is denumerable. Then there is a function $f : \mathbb{N} \rightarrow [0, 1]$ and we can list the elements as $a_1, a_2, \dots$.

Choose $b \in [0, 1]$ with $b_i \neq a_{ii}$ if $a_{ii} \neq 1$. Then $b \neq a_n$ for any n . So b is not in the list and we have a contradiction.

MATHEMATICAL FOUNDATIONS

Suggested summary:

Cantor's argument assumes $[0, 1]$ is countable and lists all its elements. Then construct a new number which differs from the n th element at the n th digit, so b is not the same as ANY a_n , leading to a contradiction.

Make sure you understand where the steps in the summary belong in the proof!

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- Self-explanation
- Self-regulation
- Self-feedback



EVALUATION

Recurring themes:

- Increased public speaking confidence
- Deeper understanding through explanation
- Stronger student connections
- Positive impact on PASSees

"The interactive and discussion-based format of PASS sessions should definitely be kept. Peer discussion helps students engage with the content and learn from each other in a supportive environment." - PASS leader

82% said the weekly materials made sessions significantly easier to run.

93% used the materials in every or most sessions.

89% reported increased confidence facilitating PASS.

96% said the materials influenced how they plan sessions now or in the future.



LOOKING FORWARD



- Our SaP experience has been highly productive
 - Project based on pedagogy and discipline-specific research
 - Created scholarly-informed teaching materials
 - Shared knowledge about scholarship with PASS leaders & helped them develop facilitation skills



- Student reflections on SaP
 - Positive reflections
 - Critical/ constructive reflections



- Future use and dissemination
 - Sharing resources and ideas through Maths PAL-PASS Network (21 HEIs)
 - Sharing through Library contacts (Sonia)



REFERENCES

Students-as-Partners

Healey M., Flint A. and Harrington K. (2014) 'Engagement through partnership: students as partners in learning and teaching in higher education', *Advance HE report*.

Mercer-Mapstone, L. (2017) "A Systematic Literature Review of Students as Partners in Higher Education", *International Journal for Students as Partners*, 1(1), pp. 15-37. doi: 10.15173/ijsap.v1i1.3119.



THE MATHS EDUCATION PROJECT

