Improving Teamwork and Communications skills for Physics 1 Students through Collaborative Outreach Posters

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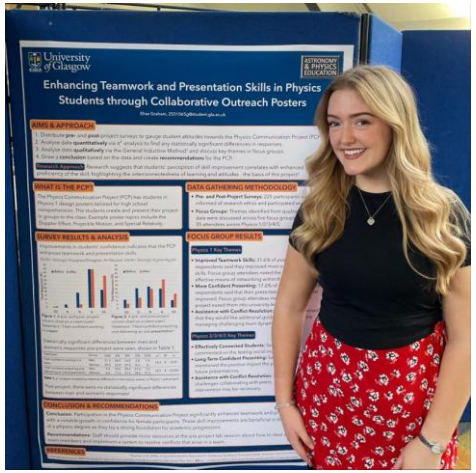
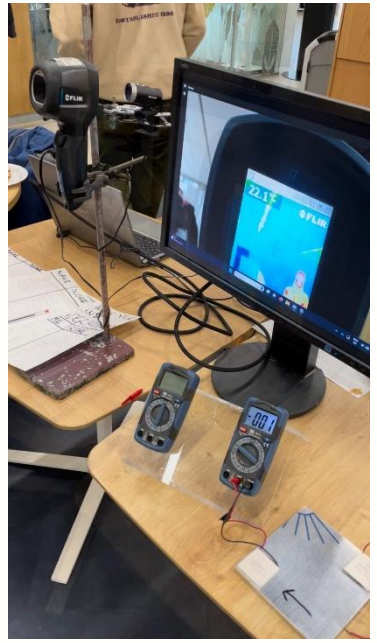
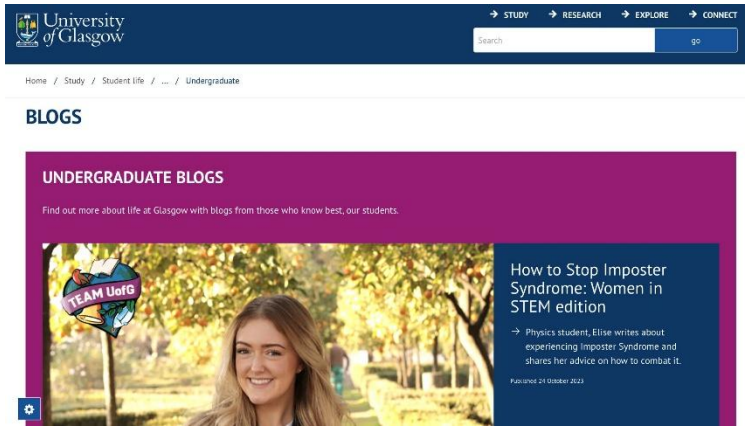
Introduction







In this presentation …

- The importance of communication and teamwork skills in undergraduate science students
- Introducing first year students to these skills
  - The Physics Communication Project (PCP)
- Evaluating the PCP and the effect it had on student confidence
- Conclusions

Importance of skills (1)

- IOP accredited degree framework[1] recognises the importance of “soft” skills.
  - Underscores the necessity of nurturing a broad range of transferable skills throughout the academic program, which are essential for success.
  - Programmes must provide training in a broad range of transferable skills, and their use should be demonstrated throughout the programme.

[1] *IOP degree accreditation framework* [Online]. Available: https://www.iop.org/sites/default/files/2022-09/IOP-Degree-Accreditation-Framework-July-2022.pdf (accessed on July 2025).

Importance of skills (2)

The framework encompasses crucial expectations:

- Stipulates students must undergo training in diverse transferable and professional skills such as communication, teamwork, and presentation.
- Emphasis on the need of acquiring these skills irrespective of the academic program (BSc/MSci/MSc)
- Students taking our introductory physics course can be on a wide range of degree plans … Physics, Theoretical Physics, Astronomy & Physics, Physics with Astrophysics Maths & Physics, Astronomy & Maths, Physics & Computing, Chemical Physics, Mathematics …

Tackling these skills

- PCP tackles communication and teamwork skills right at the start of students' degrees.
- Helps foster friendships between students: beneficial for academic performance and contribute to a supportive environment - can lead to improved academic outcomes[2].
- Studies demonstrate that collaborative efforts yield superior academic progress, highlighting the importance of teamwork dynamics within the PCP[3]
- Plays a crucial role in sustaining students' interest in pursuing physics. Collaborative projects can deepen field knowledge and increase degree interest, which is especially useful for students uncertain about their academic path[4]. (Yekimov, 2021).

[2] Alotaibi, T. A. et al (2023). The benefits of friendships in academic settings: A systematic review and meta-analysis. *Cureus, 15*(12)
[3] Alexopoulou, E., & Driver, R. (1996). Small-group discussion in physics: Peer interaction modes in pairs and fours. *Journal of Research in Science Teaching, 33*(10), 1009–1114.
[4] Yekimov, S. et al (2021). Using the project method to motivate students studying physics. *Journal of Physics: Conference Series, 1889*.

PCP Structure (1)

- Runs across Weeks 2, 3 and 4 of first semester
  - Week 2 - training week
  - Week 3 – feedback week
  - Week 4 - presentation week

- We use the lab class as this splits the 250+ students into 5 groups of ~50.
  - They are then randomly assigned to a group of 4/5 members
  - Given a choice of three topics to choose from …

PCP Structure (2)

	A-05
A	Youngs Double Slit Experiment
B	Elastic and inelastic collisions
C	The Ideal Gas Law

	C-12
A	Superposition/Interference – constructive and destructive
B	Simple Harmonic Motion
C	Pressure in fluids

Before we introduced this system …

Theme	Count
Doppler Effect	24
Newton's Laws of Motion	9
Young's Double Slits	5
Thermal Expansion	3
Heat Transfer Mechanisms	2
Superposition and Interference	1
Conservation of Energy	1
Momentum and Collisions	1
Time Dilation	1
Simple Harmonic Motion	1
Lasers	1
Refraction	1
Projectile Motion	1
Total	51

Training week

. **Outreach:**

- What is “outreach”?
- Why is outreach important?
- What kinds of outreach are there?
- What makes good outreach?

. **Posters**

- What makes a good poster?
- How do you actually make a poster in PowerPoint?

Working in a team

- Why do people work in teams?
- What makes a good team?
- What role would you best take in a team?

Reflecting on your work

- Critical self-reflection is an essential skill, and we’ll look at some useful ways to do this.

Feedback & Presentation

- Week 3 lab class time given over to development time for students, with staff on hand to provide feedback on works in progress.

- Week 4 – presentations.
  - Each day split into three sessions, so class present to around 20 people
  - Posters presented electronically
  - 5 minutes for presentation + 5 minutes for Q&A

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Assessment

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	Weighting	Criteria for full marks
(A) Quality of poster	40 %	▪ Clearly defined layout and structure; appropriate choice of font; not too much material; professionally created; suitable to audience; followed submission rules
(B) Technical content	20 %	▪ Good quantity of accurate, technical content appropriate for the level of the target audience; sources of information given
(C) Presentation, Response to questions and teamwork	40 %	▪ Presentation of poster was handled confidently; questions answered clearly and confidently; evidence that the students had worked well as a team; questions handled equally, presentation shared amongst members, all contributed to poster preparation.

Personal reflection

- Students only receive their marks if they complete a personal self-reflection statement
  - Reflection itself is not marked – we simply want they to explore this

- What personal strengths and skills do you think you best displayed during this project?
- What do you think your personal weaknesses were?
- What worked particularly well in your team? Why?
- What did not work well in your team? Why?
- Why do you believe the references you chose are reliable?

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Some examples

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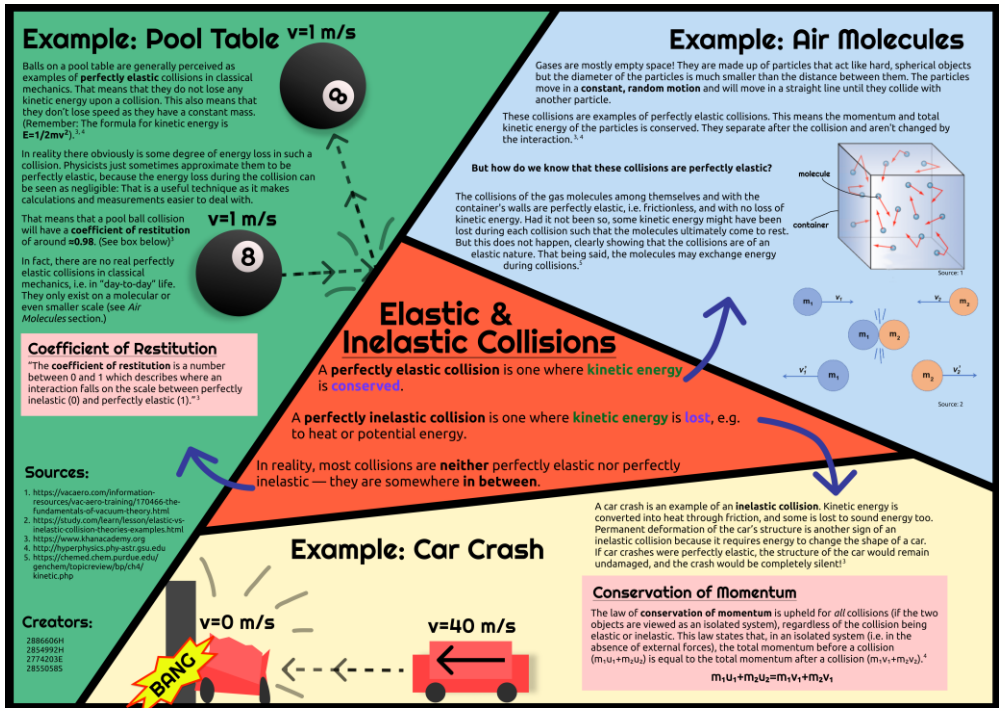
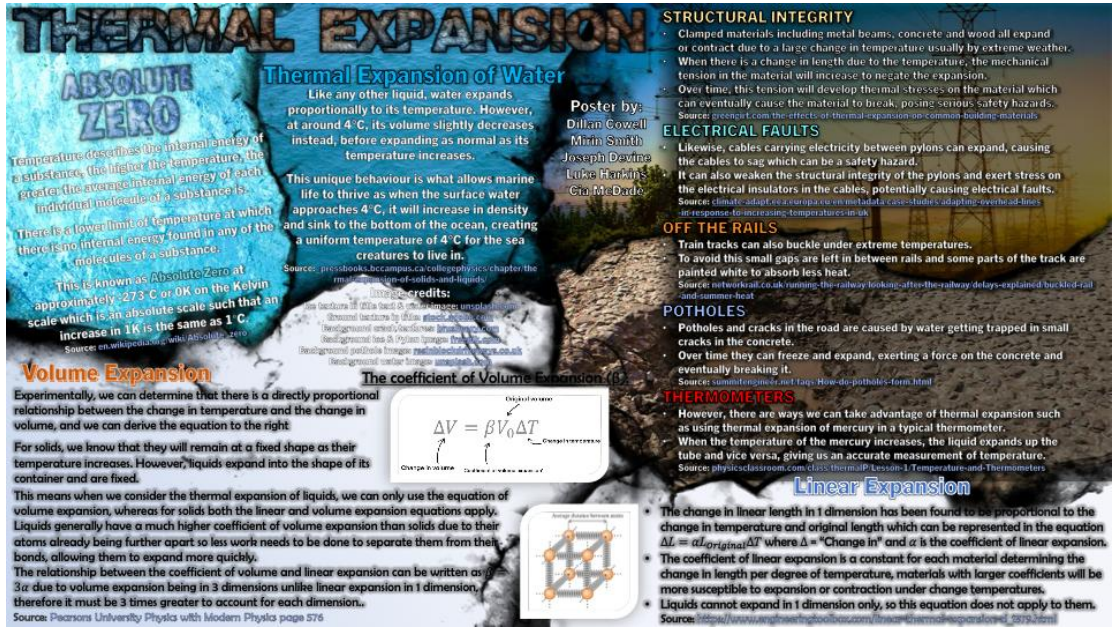
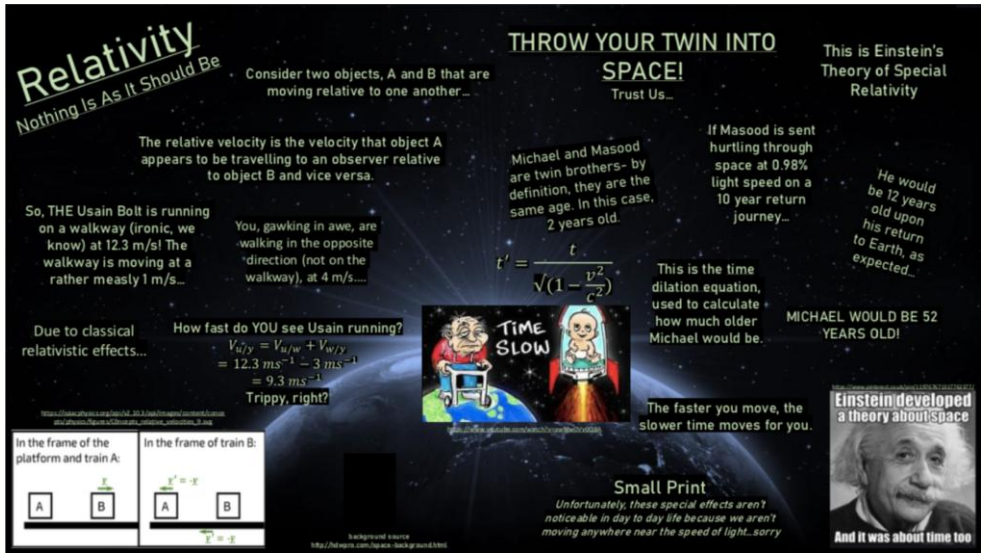






Data gathering methodology

Physical survey’s, one before and one after the PCP

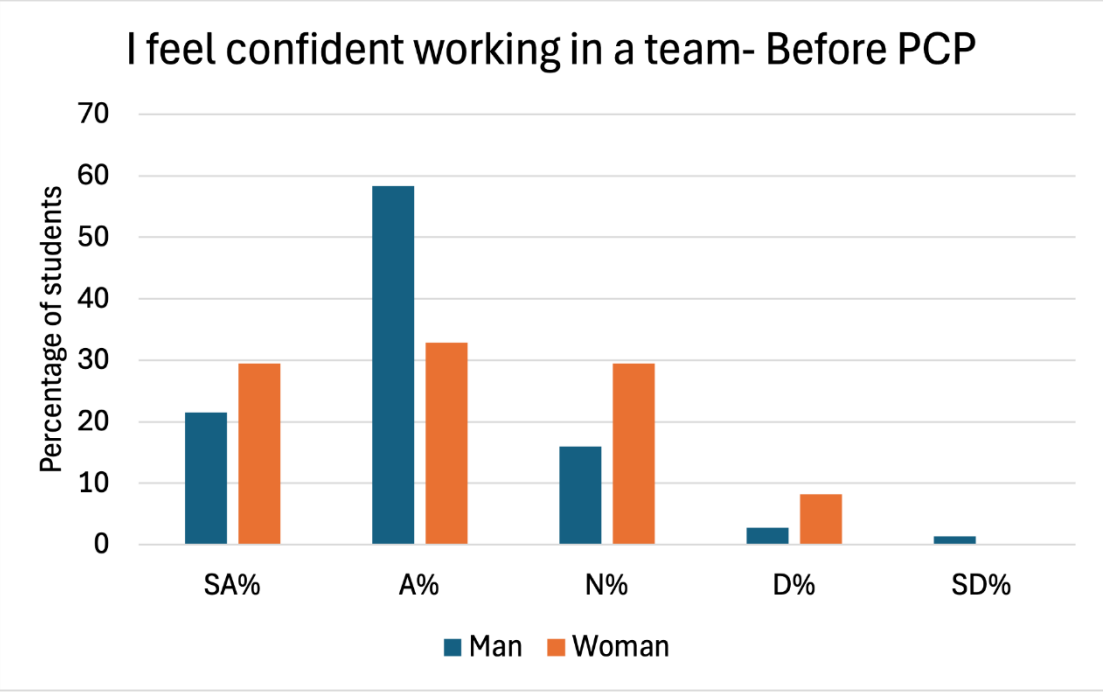
Focus groups with first-year students

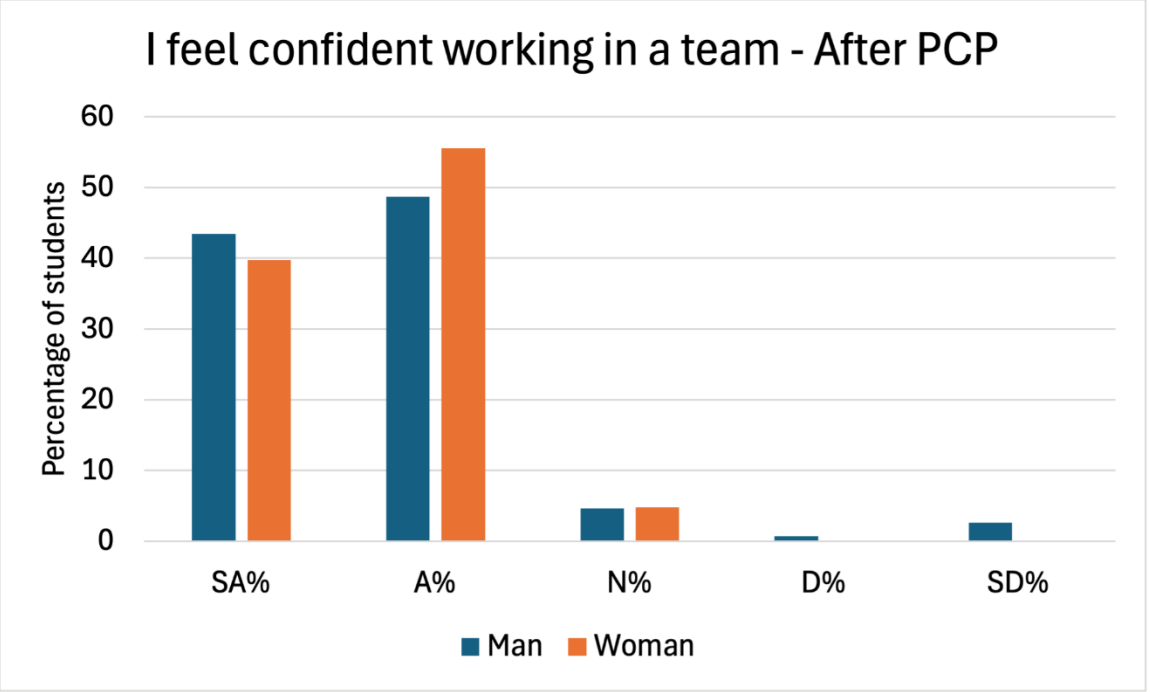
Focus groups with senior students.

Structure of physical survey

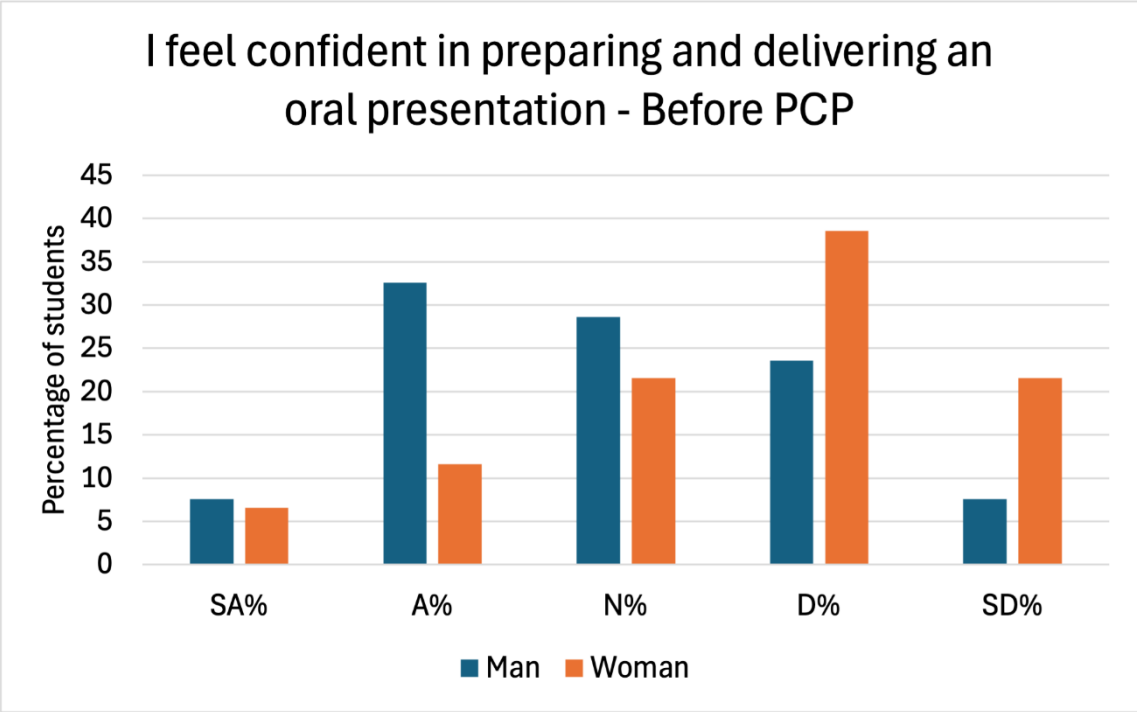
- *Section 1.* Investigating students' confidence using a particular skill.
- *Section 2.* 'Are there any aspects of the Physics Communication Project you are looking forward to?'
- *Section 3.* 'What skills would you like to improve through participating in the PCP?'
- *Section 4.* 'What new skills would you like to learn from participating in the PCP?'

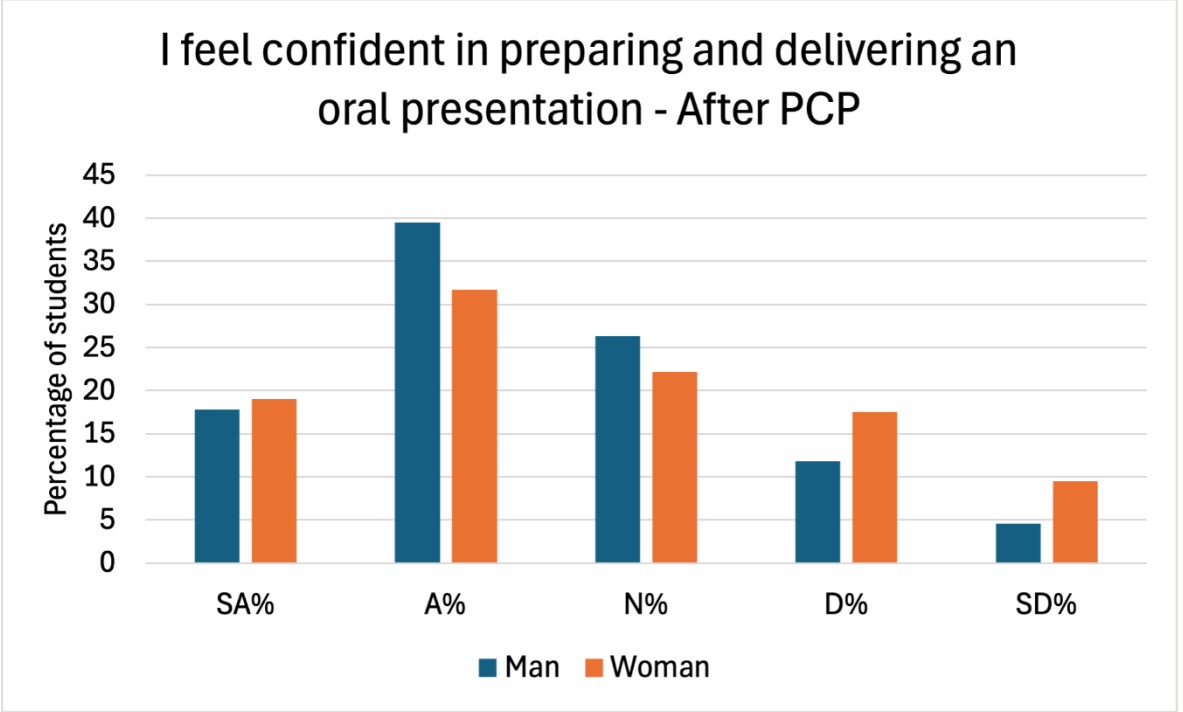
Men versus women pre-post PCP



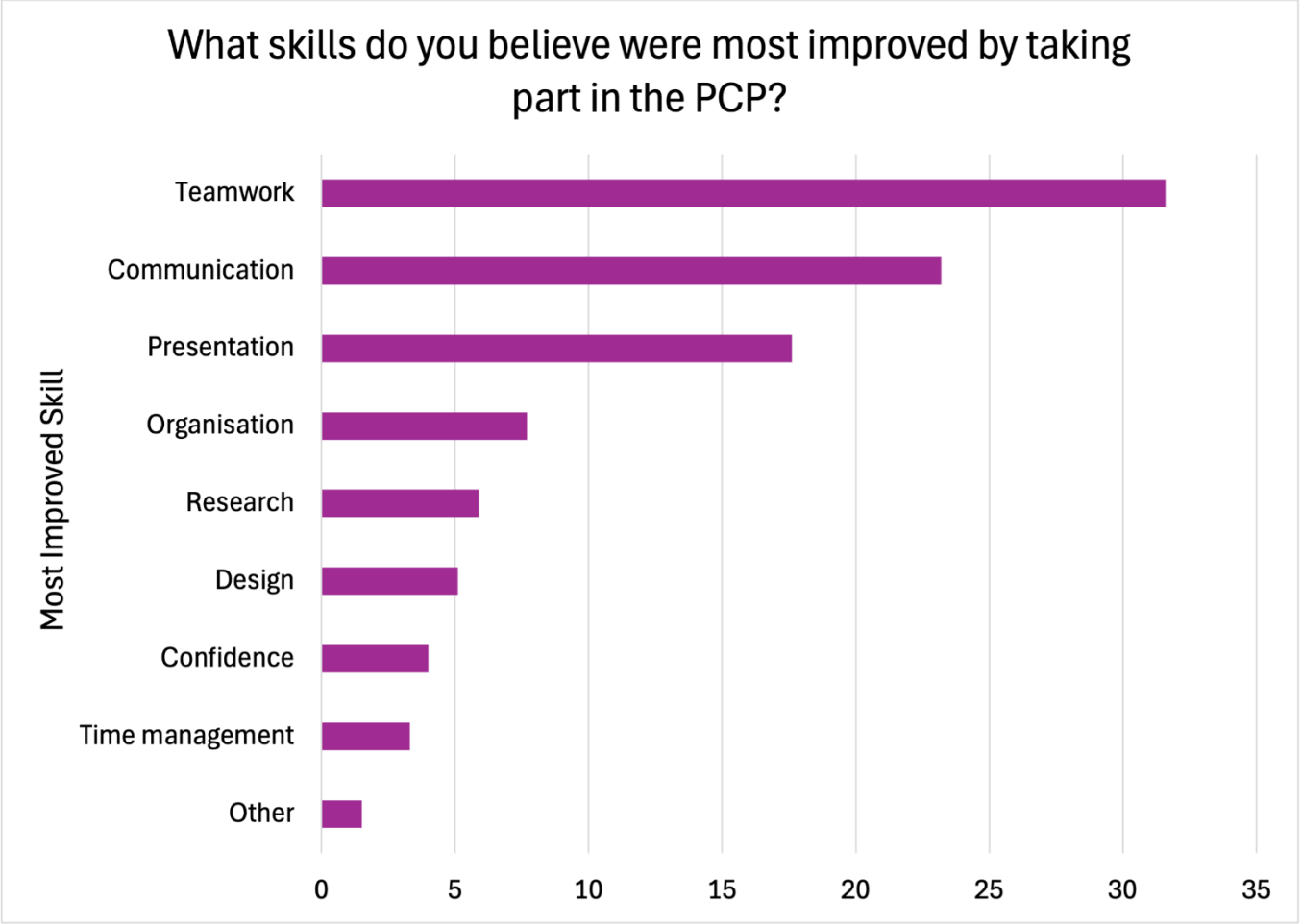


Men versus women pre-post PCP (2)

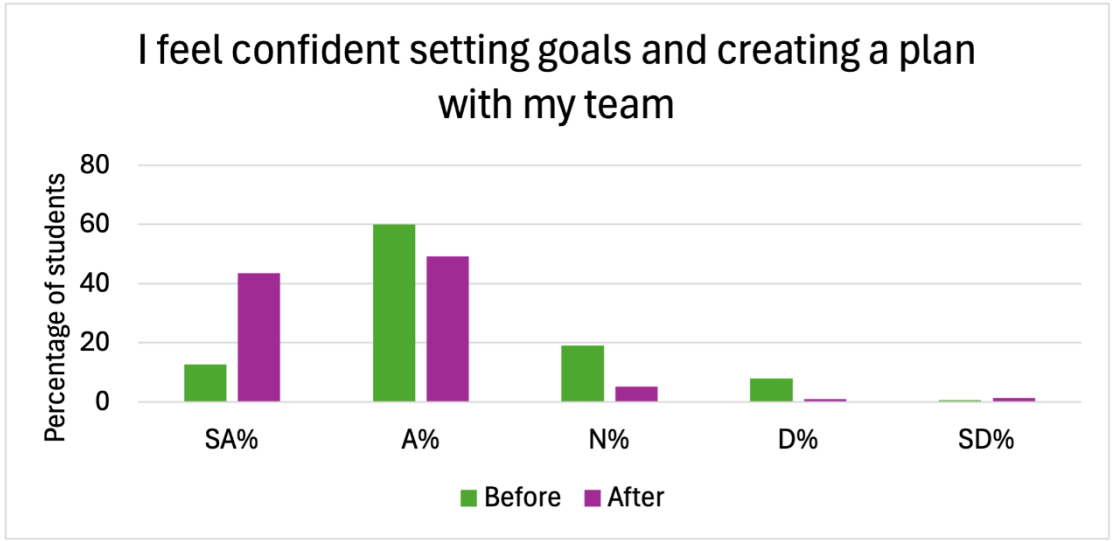


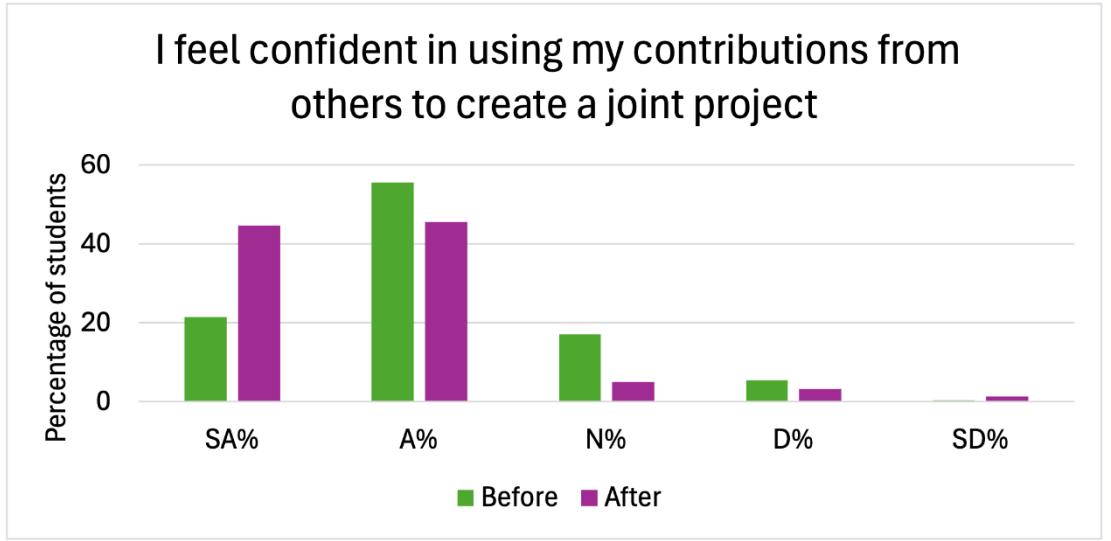


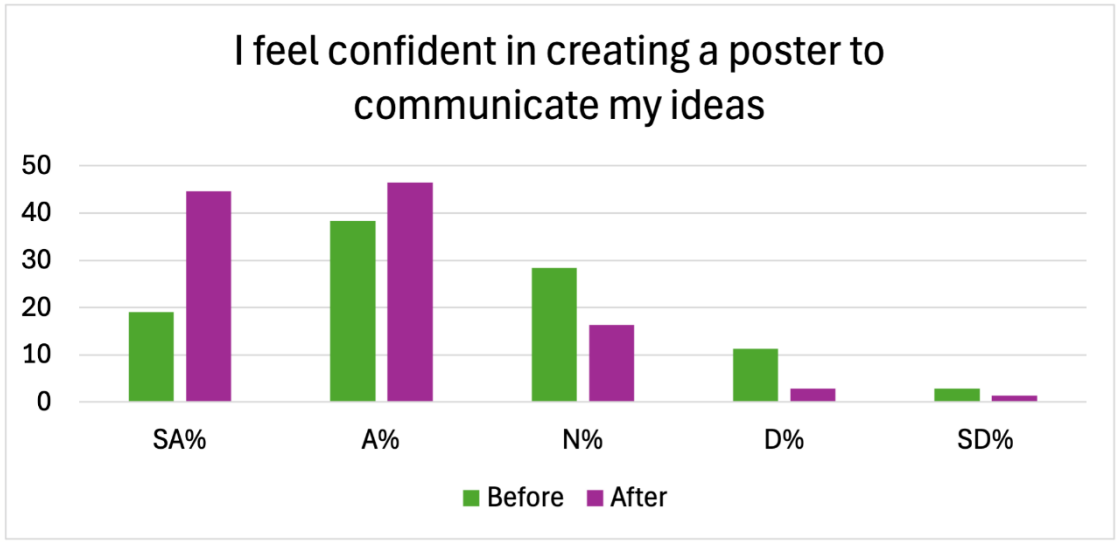
Most improved skills

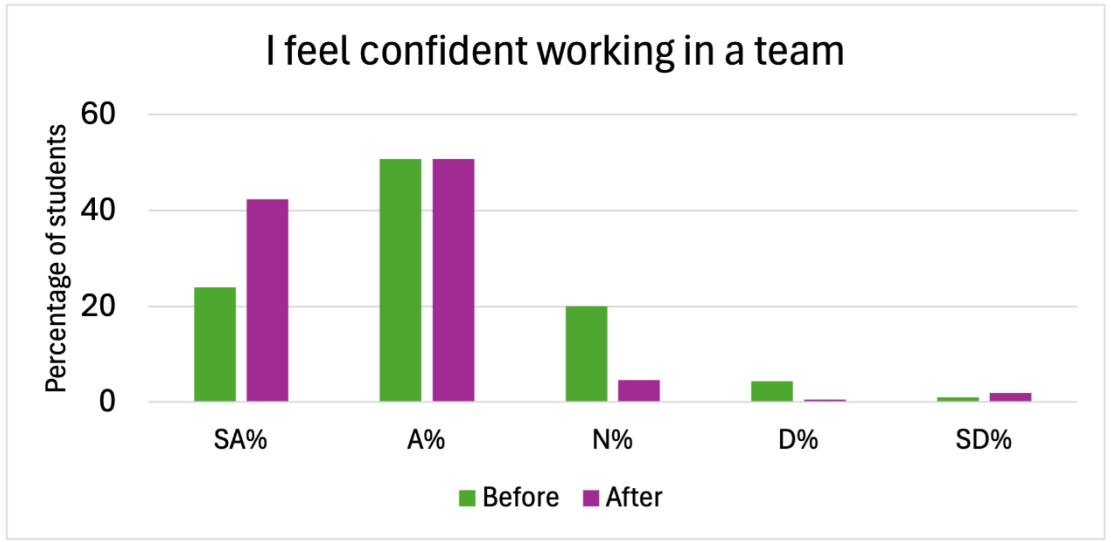


Before versus after the PCP

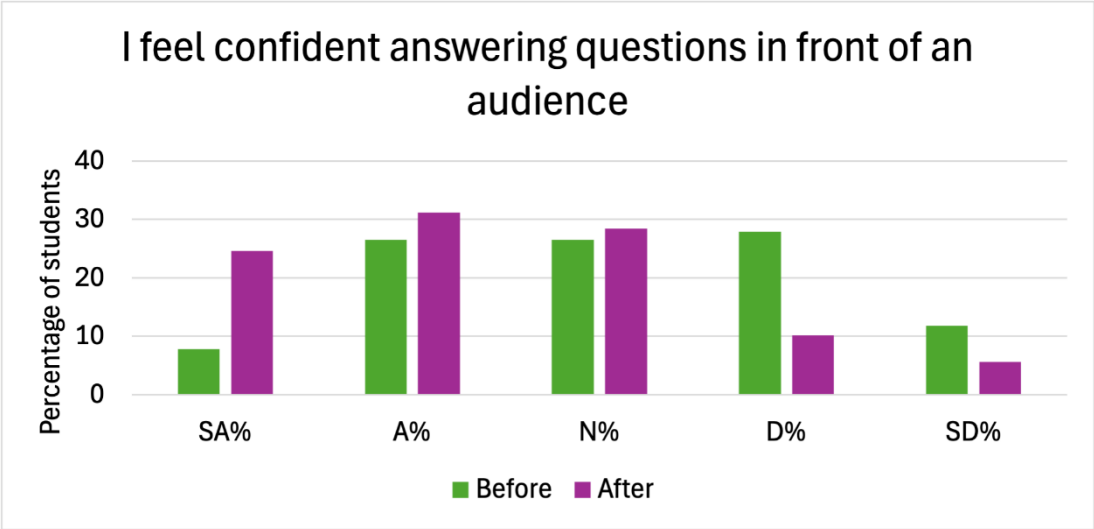


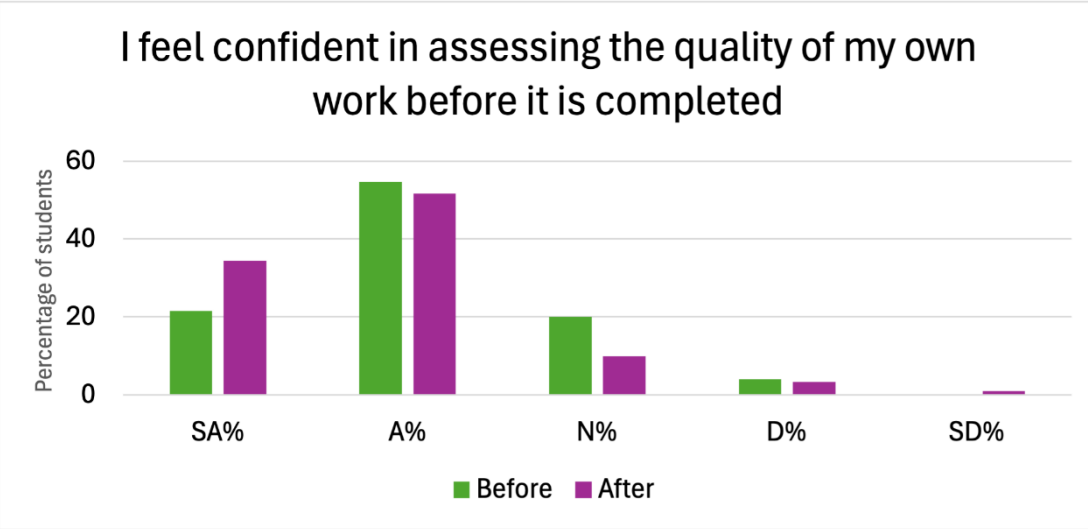


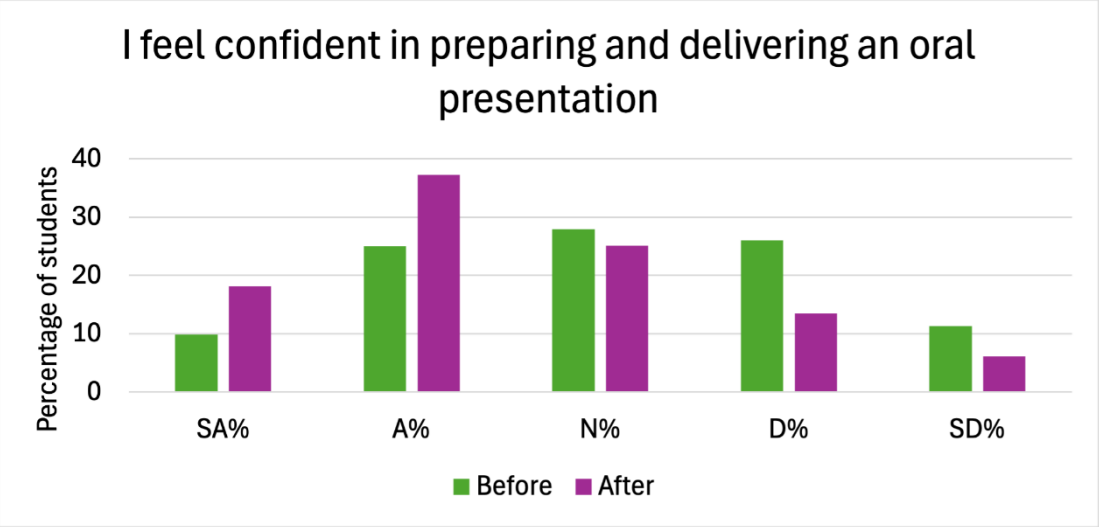




Before versus after the PCP (2)







Focus group key themes

First-years said…

- Enhanced teamwork skills
- More confidence presenting
- Required support on conflict resolution

Second-, third-, fourth-, and fifth-years said…

- Lasting friendships created
- Sustained enhancement of presentation skills
- Required support on conflict resolution

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Conclusions

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- *Improved confidence in presentation skills*

  Addressed gender discrepancies in confidence levels with a marked reduction in disparities following the PCP.

- *Enhanced confidence in teamwork skills*

  Students' attitude toward teamwork significantly improved.

- *Lasting friendships*

  Students gained a sense of community, correlated with improved academic performance. Helped others with degree path navigation.


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Thank you for listening …
Questions?
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