**Mini-capstone projects to develop active laboratory collaboration in first-year biomedicine students.**

**Background**

Studies have shown an increase in loneliness within the student population, causing an increase in mental health conditions on commencing higher education (Diehl et al., 2018, McIntyre et al., 2018). Increased psychological distress is associated with poor student outcomes and ultimately withdrawal from degree programmes. Therefore, interventions at the beginning of university life may be able to combat loneliness and potentially mitigate increased mental distress. This can have a profound impact on student wellbeing and give students a feeling of belonging within the university community. This is important not only for student welfare, but also for the development of key transferable skills desired by employers such as teamwork and communication. Active approaches to learning may offer an opportunity to allow students to develop these skills whilst also facilitating effective knowledge transfer and recall (Morgan & Jones, 2025). This is particularly important in healthcare subjects such as biomedical science, where teamwork and communication are paramount to ensuring patient safety and quality assurance (Hussain et al., 2023).

In practical-based subjects, such as biomedicine, many students form natural groups within laboratory classes based on people they already know, resulting in increased comfort, which they maintain for the length of the module and even their full degree program. However, this does not mirror real world employment, where individuals will work with a variety of people rather than their friends. As a result, laboratory education may establish unrealistic expectations for students when they graduate and not prepare them for a successful transition from higher education to employment (Crebert et al, 2004). Therefore, embedding more opportunities for students to work in randomly mixed groups enables students to work with peers they may not know, expanding their professional and social networks, whilst also preparing them for employment. This ultimately aims to combat student loneliness whilst supporting the development of key practical and transferable competencies sought by employers.

We also observe that students are unable to conceptualize how different practical skills are used in conjunction with one another, as they are often taught as separate entities. This is beneficial to allow students to appreciate and understand the underlying principles of assays or methodologies, however, they are often used in conjunction with one another or as a part of a series, such is the case in diagnostic laboratories. This is where students silo their knowledge, with the realization of how methodologies relate potentially occurring later in higher education or upon completion of professional experience. However, this may not occur at all, further detrimentally impacting student attainment and their ability to successfully transition to becoming independent professionals upon graduation.

This project sought to design a mini-capstone project within the first-year laboratory skills module, to enable students to expand their social networks and understand how practical elements are used in conjunction in professional environments.

**Session Design**

The practical class, delivered in trimester 2, was designed to give students the opportunity to use the skills they have learnt within the first 6 months of their first-year laboratory practical skills module. This included utilization of equipment they had not used since the first trimester (enabling recall) and linking that with the knowledge they had recently acquired.

The design revolved around team building and communication. As previously described, students get little opportunity to work as a team together, especially within the laboratory environment, where it is an essential part of science. Each class the students usually work as pairs or in a group of three and usually with their friends. The class was designed to use three skills from the first trimester to try to establish memory recall and use three skills from the current trimester that they had recently learnt.

A “simulated” patient was created that required students to work together to diagnose, the students were given artificial blood and urine samples and where required to carry out tests to lead to a complete diagnosis of the patient. The session was designed to be shorter than could be completed individually, thus obliging students to work collaboratively to complete the diagnosis before time expired. The process allows the students to carry out the skills, which are important for their end summative assessment, providing students the opportunity to understand the importance of the skills when they are using them for diagnostic purposes, giving the students a more authentic learning experience.

**Session Delivery**

Upon entering the laboratory, students were allocated a random number between 1 and 10 and asked to sit at the corresponding laboratory bench with that number. This automatically separated students from their usual seating and the people they would sit with. The class started with slides recapping previous practical skills that would be utilised within this session. A slide of ice breaker questions (see examples below) was then presented to the screens. The students were given approximately 7 minutes to discuss the ice breaker questions in their new teams. The 7 minutes allowed the students enough time, whilst making the timing seems obscure, giving the students the impetus to start the discussions.

The questions were:

*Let’s start by introducing ourselves* - This gave students that did not know each other the opportunity to meet and greet new people.

*What is your area of interest within biomedical science?* - This allows students to discuss their interests, giving a deeper conversation and potentially discussing strengths and weaknesses.

*What is your favourite animal or dinosaur?* - This was added as a fun conversation starter.

Once students finished their ice breakers, the remaining PowerPoint slides explained the context of the session and provided details of a patient-based scenario where students would have to work together to diagnose the patient within an allocated time limit (40 minutes). The students were told a prize would be given to the team that communicated clearly, worked together and gave the correct diagnosis.

Students were provided with the following materials:

* Artificial Patient urine (10 ml) - containing trace amounts of glucose and haemoglobin
* Artificial Control urine (10 ml) - contains no glucose or haemoglobin
* Artificial blood (50 ml) - adjusted to pH 7
* Glucose dipstick tests
* Laminated sheet with colour indicator for glucose test
* Artificial blood in a blood tube with a blood form – with an error on the date of birth
* pH Meter
* Spectrophotometer
* Cuvettes
* Micropipette with tips

Students were given between 40 minutes to an hour to complete the tasks. Academic staff and demonstrator students were asked to encourage students to think about the tasks, discuss any problems with team members and communicate with each other throughout. Students were not told how to distribute all of the tasks, allowing then to delegate and distribute tasks, showcasing their abilities to communicate effectively and demonstrate their leadership potential.

[Please see the protocol booklet, provided alongside this document, for an example exercise that students could complete](https://doi.org/10.25416/NTR.28658594).

**Session outcomes and student feedback**

The session gave students the opportunity to talk through tasks with their peers and utilise the skills they have learnt throughout the module directly linked to clinical scenarios, and mirroring employment. These activities created opportunities where students were able to talk through problems with one another and gave each other advice, facilitating peer-to-peer learning.

Students said they enjoyed the activity, and it was nice to talk with other students they had not spoken with before. One student said they are introverted, and it was nice to be able to talk with others in a safe environment. Many students said it was initially awkward, but the ice breaker questions helped and asking about dinosaurs was a good topic. Another piece of feedback was the mix of degree apprentice students with non-apprentices. The degree apprentice students (who are already employed within the healthcare sector whilst studying their degree) tend to get on with the tasks after communicating with students, however they would complete the tasks quickly and be left with little to do, which would need to consider next time. It would possibly be more beneficial for the apprentice students to work as team leaders, however this something which should be discussed with this cohort beforehand to prevent the forcing of them into leadership positions, thus making them uncomfortable. One non-apprentice student said they felt “*stupider*” working in a team with an apprentice, which again would need to be considered.

The overall feedback that students gave was highly positive. Students enjoyed the team working within the session and began to talk more openly with students they had not previously spoken with, facilitating social interaction and potentially supporting students who may feel isolated in laboratory education. We show this activity can benefit students, giving them much needed exposure to team building exercises, as well as developing communication skills and providing them the opportunity to see how curriculum embedded concepts link together within healthcare.

**References**

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