



Approaches to TBL Assessments in Medicine

Faculty: Medicine

Department: School of Medicine

Module name: Clinical Science Integrative Cases (CSI)

Degree: MBBS

Level: Undergraduate (pre-clinical) Phase 1 (years 1-3)

Approximate number of students: 400 per year

Duration: approximately 2 hours (iRAT, tRAT, tAPP)

Module ECTS: 10 (per year)

Module type: Core

Assessment overview

Programmatic assessments are delivered throughout the academic year alongside teaching, combining case-based learning methodology with team-based-learning (TBL). TBL assessments consist of iRAT (individual Readiness Assurance Test), tRAT (team Readiness Assurance Test), and team Application (tAPP) exercises respectively. TBL assessments follow on from in class case-based learning sessions. The assessments are invigilated and delivered in-person electronically. Students in groups of five or six are given a number of single best answer questions relating to content delivered during the case based learning sessions and answer questions individually, then review the same questions as a team. They are then given a more challenging task to complete as a team. These assessments are known as iRAT (individual Readiness Assurance Test), tRAT (team Readiness Assurance Test), and team Application (tAPP) respectively.

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Design Decisions

Rationale for TBL Assessments

The choice of delivering the module as TBL came from the need to assess team-working skills more effectively. Many high achieving students, while well-versed in medical knowledge, would fall short of working effectively in a team, which is an essential skill for doctors in a clinical environment. TBL had also been historically successfully used to encourage teamwork in BSc Biomedical Science and BSc Pharmacology students.

Rationale for electronic delivery and software used

Electronic delivery of assessments using Learning Activity Management System (LAMS) software provides real-time data as students go through the assessment. Electronic assessments also allow for automated marking of the iRAT and tRAT segment, which is important considering the huge undergraduate cohorts in Medicine of about 400 students per academic year.

LAMS provides the ability to receive live data from student submissions, individually (iRAT) or as a group (tRAT, tAPP). The teacher or examiner has full control over the session and how students progress through the sequence of tasks. One further use of this data is to help meld and shape future sessions; if a question is only answered correctly by 20% of

Insights colour key

Educational Developer

Inclusivity

Learning Designer

Registry

Careers

Interviewee: Chris John (Reader in Pharmacology) and Agata Sadza (Head of Technology Enhanced Education)



students, for example, then the data may suggest the question is misleading or too difficult. Examiners can then investigate this particular question, taking actions as necessary, as well as write future questions avoiding the same shortcomings.

Question design

The iRAT and tRAT assessments consist of Single Best Answer (SBA) questions. In the iRAT, questions are designed to link more closely to the actual clinical and scientific teaching that students receive in the module. During the tRAT, student groups work together to determine consensus answers for the same questions. The tAPP focuses largely on developing team-working skills and other important skills required of future clinician scientists. The question design is therefore much broader and can be condensed into three main categories: data interpretation, infographics, and more complex clinical cases ([example case study here](#)).

Alignment with other assessments and the programme/module

The module is constructed as a collaborative process between other modules. It is intended to connect content-wise with other parts of the curriculum so that students have a consistent knowledge base and understand what and why they are being taught the content in a team-working scenario.

Some of the program level Intended Learning Outcomes have a heavy team-working aspect. The ability to work in a team is heavily weaved into this module's specification and thus lends itself to these ILOs well.

The module and module assessment continues over the three years of Phase 1. This means that students will develop a sense of consistency and familiarity with the assessment type, allowing for long-term progression of integrated knowledge from case-based learning in a team-based environment.

Practicalities

Preparing students for assessment

To prepare students, there are formative TBL assessments in other modules that serve as preparatory work for CSI. Within CSI, a number of formative cases are constructed and then delivered

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via a Teams call to allow students to practice in their groups and to facilitate the process of the real assessment in-person. These formative cases

are predominantly tAPPS, most likely due to their complexity for both students to complete and for staff to construct and mark.

Marking arrangements

The iRAT and tRAT are auto-marked. The mark allocation is set up in a way that is as safe as possible for students; even if an individual student performed very poorly in the iRAT, the team-based component would protect them, making it virtually impossible for the student to fail the module. That being said, for the tRAT, the marking system is quite punitive, with students being allowed four attempts to select the correct answer.

Correct Answer on ' ' Attempt	Marks
First	+4
Second	+1
Third	-2
Fourth	-5

The tAPP segment is marked by staff and is just as complex to mark as the questions themselves. There are usually more than eight individuals marking tAPPS, and they are all double marked.

Feedback arrangements

For the iRAT and tRAT, students have a post-assessment 24-hour window where they are given the opportunity to challenge questions for any reason. Once all challenges are accrued, the module staff will sit down, work through the challenges and collectively decide on their outcome.

The tAPP feedback, being marked manually, generally takes longer. It is typically a 2 week turnaround.

Management of the process

The module is managed by leads and fellows with one Science Lead (interviewee), one Clinical Lead, one Science Fellow and one Clinical Fellow. In a typical in-person session, there are five to six people who assist



in delivering the content to students. These will be clinicians (i.e. medical practitioners), scientists (i.e. staff members involved in scientific research) etc. to encourage a range of perspectives for better delivery of content to students. Having clinicians and scientists in the room to assist in delivering sessions means that most questions asked by students can be answered.

Online adaptations

During Covid the module and assessments were delivered online. Student groups were placed in breakout rooms with tutors invigilating by moving in and out of breakout rooms. Overall, student performance did not change, but student behaviour did change. Teams allowed students to turn off their cameras and microphones, which many of them did, allowing for student disengagement in groups.

Student perspective

The student view of TBL is generally positive. There is a recognition of this way of learning being linked to real life practice in MDT (multidisciplinary) meeting where you are expected to express your opinion which is then discussed further with others. The students recognised that the varied tAPPs were a lot more difficult to prepare for.

The actual style of the CSI questions were thought to be quite difficult. There was a feeling of questions lacking clarity and that they were not really testing the knowledge, but testing students' ability to pick up on those tricks.

There also seemed to be a lot of disparity between the groups with some groups having 5 members and some seven. When it came to doing the tAPP tasks, smaller groups would often struggle because of less people working in a time pressure environment.

Advantages of the assessment type

- Students often question why they learn certain pieces of clinical and scientific knowledge in the curriculum. This assessment helps them to understand that as the knowledge is integrated in realistic cases;
- The teamwork segment allows students to be challenged at a high level, and complete tasks

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that are clinically relevant. Students therefore engage with a lot of highly clinical material that they wouldn't necessarily come across in the rest of the curriculum;

- Team working is an essential skill in the medical profession and develops clearly in medical students with this module assessment style;
- Students are well accustomed to digital assessments. Even some traditional exams in other modules are done with college provided iPads rather than pen and paper, so the digital setup of CSI works well with students;
- The running of the module online is easier for everyone as everything is stored securely, easy to access and easy to work with;
- Digital assessments allow for unprecedented instant access to various data that can be exported, manipulated, processed, and used for various other purposes;
- The team-working elements are an authentic representation of what students will be doing in professional world;
- TBL has been shown to have positive impact on how students view teamwork and collaborative learning (Koles et al., 2005) and is an effective method for preparing students to conduct collaborative project work (Greetham & Ippolito, 2018). In addition, there is evidence of high engagement (Haidet, O'Malley & Richards, 2002) and positive feedback from learners (Parmalee et al., 2012; Zgheib, Simaan & Sabra, 2010) and faculty (Conway, Johnson & Ripley, 2010). TBL has also shown to be effective in enabling learners to identify gaps in their knowledge and improve their understanding (Behling et al., 2017).

Behling, K.C., Kim, R., Gentile, M., & Lopez, O. (2017). Does team-based learning improve performance in an infectious diseases course in a preclinical curriculum? *International Journal of Medical Education*, 8, 39–44.

Conway SE, Johnson JL, Ripley TL. Integration of team-based learning strategies into a cardiovascular module. *Am J Pharm Educ*. 2010 Mar 10;74(2):35. doi: 10.5688/aj740235. PMID: 20414450; PMCID: PMC2856428.

Greetham, M. & Ippolito, K. (2018) Instilling



collaborative and reflective practice in engineers: using a team-based learning strategy to prepare students for working in project teams, *Higher Education Pedagogies*, 3:1, 510-521, DOI: 10.1080/23752696.2018.1468224

Haidet P, O'Malley KJ, Richards B. An initial experience with "team learning" in medical education. *Acad Med*. 2002 Jan;77(1):40-4. doi: 10.1097/00001888-200201000-00009. PMID: 11788321.

Koles P, Nelson S, Stolfi A, Parmelee D, Destephen D. Active learning in a Year 2 pathology curriculum. *Med Educ*. 2005 Oct;39(10):1045-55. doi: 10.1111/j.1365-2929.2005.02248.x. PMID: 16178832.

Parmelee D, Michaelsen LK, Cook S, Hudes PD. Team-based learning: a practical guide: AMEE guide no. 65. *Med Teach*. 2012;34(5):e275-87. doi: 10.3109/0142159X.2012.651179. Epub 2012 Apr 4. PMID: 22471941.

Zgheib NK, Simaan JA, Sabra R. Using team-based learning to teach pharmacology to second year medical students improves student performance. *Med Teach*. 2010;32(2):130-5. doi: 10.3109/01421590903548521. PMID: 20163228.

Limitations of the assessment type

- All marking comes at the end of term (Christmas, Easter, summer). This leaves a large volume of marking that needs to be done in a comparatively short space of time. Coupled with the complex nature of tAPP marking, this can be a lot of pressure for markers;
- Feedback is currently inconsistently delivered between individualised feedback and global feedback given in one document. A consistent method of feedback needs to be decided on and delivered;
- Generating the assessment needed at the level needed is a demanding task. The assessment style requires experienced leads with broad knowledge and skill base to deliver consistent, high quality assessments term after term;
- Writing questions for such an integrated assessment type is difficult and without careful attention it is all too easy to create material that does not work as well as it should. Some topics may not lend themselves well to SBAs, e.g.

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speaking to an Alzheimer's patient, or delivering bad news. The module is still relatively new and there is a possibility that as the assessment type ages, writing new original questions may become increasingly difficult;

- Most of the time, the technology works exactly as expected, but sometimes issues arise which need to be managed. Occasionally, login issues occur where servers take a long time to respond. This is most likely due to a large number of students (approximately 360) logging in at the same time – a self-resolving issue which would just require patience. During assessment, a student's iPad may freeze and disrupt their progress, but a quick refresh of the page would most likely sort the issue. A typical problem would be Wi-Fi connection issues, where the college Wi-Fi fails on the whole, and one would need to wait for routers to restart and work again. Such an issue is difficult to mitigate against, especially when one is not in charge of its infrastructure.

Advice for implementation

- Assessment design that allows students to build up the necessary skills that they can take forward can facilitate student learning. The main consideration is to ensure that the same task is not (in effect) assessed twice as part of a different module at a later stage; the nature and purpose of each assessment at each stage has to be sufficiently discrete to ensure that students are building / progressing on what they have done previously and not simply replicating it.
- The module must be properly resourced with the right staff; having leads with broad medical knowledge and skill base is essential. These leads need to be supported with a good team; minimum two leads two fellows for module team.
- Leads need to be able to handle the logistical intensity of the module; CSI is 3 years of constant teaching and assessment delivery alongside each other to 400 students in fixed groups, so it never stops.
- Students need to have some time to form groups and have some opportunities to establish ground rules and ways of working together
- When introducing group work some consideration needs to be given to how students with specific learning needs can successfully participate in group interactions. All students involved should



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benefit from inclusive practice, this means that inclusivity considerations can be embedded within standard practice around preparing students for group work. This can be done through discussion around the allocation of roles and better understanding how others, including those with specific learning needs such as dyslexia, autism, dyspraxia etc learn and communicate. Individuals should be mindful of that and think about the delegation of individual tasks that are appropriate to what individuals can do. Therefore part of preparation for group work is considering how others can be mindful and empathetic towards other group members.

- By-and-large, the technical issues are very small and have easy solutions. Regardless, for summative assessments, it is useful to provide information to both invigilators and students on how to troubleshoot the typical problems that arise.
- The teams should consult the digital team once they know what format their assessment is going to be and what it will look like. The role of the digital learning team is to advise on the best platforms and the optimal setups for their style of assessment, to show how to run assessments best and to train examiners and teachers on how to use the system optimally. If other colleagues have had experience with running similar assessments in the past, the digital learning team will put them in contact with the new assessment leads to facilitate the design of the new assessment.
- Some consideration could be given to the value of incorporating peer feedback into the TBL process

This case study outlines how all elements of TBL and associated assessment have been implemented. Teachers may decide to implement just parts of the TBL process depending on the aims and outcomes for a particular session or programme e.g., just the iRAT and tRAT. Variations can also be made to the assessment including what elements are awarded marks and how feedback is provided e.g., from tutors/peer/self or a combination thereof.