

# Prerequisite for Enhancing Student Learning Outcomes in Medical Education

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## المستلزمات المطلوبة لتعزيز نتائج تعلم الطالب بالتعليم الطبي

سي بي هازليت

**الملخص:** كل من يحصل على درجة (أ) يعني أنه عمل بمستوى جيد جدا. بينما يستخدم مؤشر (أ) الثلاثي في بعض الأحيان لتمييز الأشخاص فائقي الأداء. نناقش في هذه الورقة تقنيات التعليم التي تساعد البالغين للحصول على مؤشر (أ) الثلاثي. هناك الكثير من الأدلة التي تؤكد بأن تعلم الطالب يجب أن يكون فعالا ومقيما وعلى الطريق الصحيح من أجل أن يحصل على تلك المرتبة.

مفتاح الكلمات: التعليم . طبي . تعلم فعال.

**ABSTRACT:** Anyone achieving a grade of "A" has performed at a very good level. The label, "triple A", is sometimes used to distinguish those who are particularly outstanding. In this paper, teaching techniques that facilitate adults becoming triple A learners are discussed. A large volume of evidence has established that, in order to achieve this rating, student learning must be Active, Assessed and Aligned.

**Keywords:** Education, medical; Active learning

**M**OST MEDICAL STUDENTS HAVE BEEN exposed at some point to teaching that requires them to be *passive* learners. The classical example occurs in the lecture theatre in which the instructor, with or without audio-visual aids, addresses the class from a lectern and students take notes. Occasional questions may be raised, but often the goal is to cover as much material as possible within the scheduled time, and thus question periods and discussions are minimised. Most learning that occurs in the lecture theatre is simply an orientation to subject matter that the instructor considers worthwhile and that the students assume may be assessed in a subsequent examination.

Both experiential and experimental research has established that passive learning modalities are the least effective, not only in terms of the amount of material that can be learned by students, but also in terms of acquisition efficiency and in the length of time that the material will be retained. Teaching modalities that require students to be actively involved in learning new knowledge and skills have been shown to be ten to sixteen times more effective.<sup>1</sup>

## Active Learning

There are three principal features to active learning: the new material needs to be *constructed*, *contextualized*, and *cooperatively* acquired. These three components will be described and followed with some illustrative examples.

If new subject matter is presented in a manner where the learner can logically organise it, i.e., build upon previously learned content and skills, then the learning is said to be *constructed*.<sup>2</sup>

No matter how novel and unique the material being taught, an instructor needs to present information so that the learner can make a logical connection to what s/he has previously learned. If this is done, the learner will be able mentally to organise the new information within a personalised, conceptual framework. Subsequently, this framework is easier to recall than any of the details that have been organised into the framework. After the framework is recalled, retrieval of the specific details within the framework is facilitated.

If new subject matter is presented in a manner that the learner can determine how the content will be relevant to one's work or experience, then it is said to be *contextualised*.<sup>3</sup>

In terms of medical education, students need to

see in which practice environment, with which type of patient or at which disease stage new information will have its use. For example, basic medical science content can be presented by illustrating how the underlying mechanisms for a disease stage work; or new social sciences material is illustrated by how one's clarity of communication or the impact of interacting with patients can be enhanced; new clinical science material is presented by clarifying its applicability for patient assessment, interpreting laboratory findings, making a diagnosis, managing care or projecting a prognosis.

Consider the following seemingly random pieces of information:

Standing sometimes helps. Rain adds danger. Leaning forward helps a lot but leaning a lot in other directions can hinder. You can't go backwards easily. Nails are obstacles.

Trying to remember this information is obviously difficult. However, if you are informed that these are factors that one needs to remember in learning *how to ride a bicycle*, the information is much easier to learn. That is, the information can be attached to previous experience of seeing people on bicycles; and if one is intending to learn how to ride this form of transportation, the relevance of each point is enhanced. Without accompanying constructed and contextualised data, the myriad of basic science information encountered in a medical programme (physiology, biochemistry, anatomy, pharmacology, biostatistics) can appear to students as disjointed and difficult to remember as the isolated details initially illustrated for riding a bicycle safely.

Lastly, if new subject matter is addressed by cooperatively working together in groups, it is said to be *cooperative*.<sup>4</sup>

World-wide, over 900 investigations have been done on cooperative learning; those rigorously conducted (randomised trials) number more than 160. A meta-analysis of these latter studies found cooperative learning to be more effective than independently learning new material as competitive individuals. The margin of gain was statistically significant and educationally meaningful. The benefit was evident across gender, social class, culture, ethnicity, geographic regions and the subject matter taught.<sup>5</sup>

In cooperative learning, members of the group must take responsibility for teaching each other, raising and answering questions that lead

to insightful discussions such as how the new information can be addressed when the underlying mechanism of disease, disease stage, type of patient, or practice environment are modified. Success by any one individual depends on all group members being successful in the course.

## Assessed Learning

The literature repeatedly notes the influential role that assessments have on students and the outcomes of their learning:

- a. To change student learning, change the methods of assessment<sup>6,7</sup>
- b. Assessment is a potent agent for enhancing or injuring the quality of higher education<sup>8</sup>
- c. Assessment dominates students' thinking and how they approach their learning<sup>9</sup>
- d. What students learn well is not what is taught, but what is tested.<sup>10</sup>

There are two principle types of assessments: summative and formative. Tests designed to determine if one should pass, be promoted, obtain a degree or qualify for professional licensure are *summative* assessments.<sup>11</sup> The information from high stakes tests are primarily designed for third parties (teachers, professional bodies, society) so that decisions about a candidate's qualifications can be made. Given the consequence of these decisions for the candidates, summative assessments normally serve as a significant motivator for the candidates to prepare by studying and practising.

*Formative* assessments have a different purpose. They are designed to provide the student with assistance before a summative test is taken so that they can independently determine, at anytime, how they are progressing. The goal is for the learners to be able to confirm for themselves how well they are or are not progressing and make adjustments, if needed, to their learning strategies (e.g. less time in the library and more time on the wards or in discussions with their peers or clinical supervisors).<sup>12</sup>

Certain prerequisites have to be implemented for an assessment to be formative.<sup>13</sup> First, provision of timely, appropriate feedback after an assessment is a necessity. Second, the feedback must be appropriately designed. Feedback has limited usefulness if it only

indicates that an answer is or is not correct. This form of feedback can help a candidate remember the answer to the same question, but will not be useful if a summative question incorporates variations. For example, a summative item may address similar signs and symptoms, as was assessed in a formative assessment, but the disease stage or type of patient is modified.

Third, to aid in developing life-long, self-learning skills, appropriate feedback needs to provide information for the student to reflect meaningfully on the answer they have given.<sup>15</sup> For example, if the answer was incorrect, an explanation is provided why the answer could not be correct and sometimes followed with an indication of a new direction for the candidate to consider. Depending on the test's format, the feedback may suggest further reading materials, relevant case notes or patients to clerk. Thus, the feedback does not provide the correct answer, but rather information for the student to discover independently or deduce the correct response or action.

Fourth, frustration develops if the student has to spend an inordinate amount of time researching every one of the incorrect answers made on a formative assessment. Thus, across the entire formative assessment, some feedback will be more prescriptive. In any case, provided the student has at least partial knowledge, the feedback should help the candidate solve the problem after reflecting on his or her previous incorrect response.

For example, consider the following on-line question (developed at the University of the Witwatersrand) that was submitted to IDEAL Consortium's formative item bank.<sup>16</sup>

"A 32-year-old diabetic patient wishes to have a second child. She developed gestational diabetes during her first pregnancy. Her blood glucose is now well controlled with insulin therapy.

What is the best treatment during this time?

- a. Insulin lispro administered with insulin glargine.
- b. Inhaled insulin.
- c. Intraperitoneal insulin with the implantable pump.
- d. Daily dosing with insulin dettimer Insulin aspart (subcut)."

The feedback appropriately varies, being matched to the answer specified by each candidate.

- "a. Tight glycaemic control is not achieved with this treatment.
- b. Variability on absorption, tight glycaemic control not achieved.
- c. Tight glycaemic control is achieved and thus is recommended in pregnancy.
- d. Insulin dettimer is a long-acting preparation and will not confer tight glycaemic control.
- e. Insulin aspart is an ultra-short acting insulin preparation that is used preprandially."

Lastly, performance on formative assessments should not be incorporated into determining a candidate's course mark or pass-fail status. If marks on a formative assessment are used for assigning grades, students will try to conceal their deficiencies in skill or understanding (since this will negatively impact their grade).<sup>17</sup> To be useful, formative assessments need to be seen as having a positive, not a negative, consequence. That is, students will be candid about any of their difficulties if the feedback aids in adjusting their learning strategies and further teaching is appropriately informed by the information gleaned from the formative exercise.

Thus, both forms of assessment are needed: summative assessments will motivate because they focus on the amount *of* learning, while formative assessments are aids *for* learning. If only summative assessments are used, the second criterion for active learning will not be met.

## Aligned Learning

The final requirement for generating triple A learners is *Alignment*.<sup>18</sup>

The principle components in delivering a medical education programme need to be logically aligned and consistent: the curriculum designed by the College; the course objectives set by the year coordinators; the teaching methods utilised by the teachers; the climate created for interaction among students and with teachers; the assessments used for and of learning; the feedback provided after tests are taken and the institutional policies and procedures that students and teachers have to follow.

Examples of misalignment in medical education

include:

- a. Programme and course objectives not being matched to material addressed in classes and rotations (often because the curriculum is not owned by the College, but by individual departments and instructors who may focus on other content and skills than those designated by the College).
- b. An inordinate amount of material is required by the curriculum which in turn prevents teachers from ensuring that there is adequate time for questions and answers and in-depth, relevant discussions.
- c. Formative assessments are omitted or no feedback is provided after a formative assessment.
- d. Summative assessments are not matched to course objectives or the content and skills that were taught in classes and rotations.
- e. Teachers have little incentive to expend the time and effort to learn and use active learning modalities because the university does not reward the use of active learning modalities (or conversely, does not penalise teachers who only use less effective passive learning modalities).
- f. The College provides little or no teaching enhancement support for its academic staff.

The inconsistencies evident in these types of misalignments interfere with successfully introducing and maintaining active learning; this in turn leads to students learning less, less quickly and less well.

Conversely, if there is an appropriate and adequate amount of alignment, the medical programme will find that:

- a. Teachers exhibit a professional approach to student learning, i.e., accepting responsibility for teaching not only medical knowledge and clinical skills, but also the skill of how-to-learn (i.e. self-learning or life-long learning skills).
- b. Courses and rotations include a range of assessments and students are exposed to increasingly sophisticated levels of tasks that require integrating skills and knowledge.
- c. Teachers allocate time for and make the needed effort to produce and provide timely and

appropriate feedback.

- d. Teachers are supported by their department in terms of reserved time and resources for learning and using active learning techniques.
- e. The university provides incentives and faculty enhancement support for teachers to pursue and achieve enhanced student learning outcomes.

## Conclusion

To summarise the key messages, consider the following questions and answers.

Q: What is active learning in medicine?

A: New information is presented and acquired in a manner that is constructed, contextualised and cooperative.

Q: Who is an excellent medical teacher?

A: One who facilitates students learning more, learning more quickly, learning more permanently.

Q: What is an excellent medical education?

A: Students learn (i) important medical knowledge and clinical skills, but also, (ii) how-to-learn skills so that they can teach themselves and remain effective practitioners throughout their medical careers.

Q: How is an excellent medical education delivered?

A: Student learning is active, assessed and aligned in the pursuit of new information and how-to-learn skill.

Medical academics have the responsibility and honour to help prepare future medical practitioners. These teachers only have access to their charges at the very beginning of the students' medical careers. If teachers simply prepare students for the beginning of these careers, then they do their students a disservice.

If the students are also taught how to learn more, more quickly and more permanently, the additional life-long learning skills will enable the novice medical doctors to remain up-to-date, i.e. keeping pace with on-going developments in medical practice after leaving medical school. More importantly, patients treated by these doctors will

more likely receive care that meets a rating of triple A in terms of quality of service.

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