

# Pathology for Pharmacy Students: Practical measures that enhance the learning experience

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## Abstract

**Background and Aims:** Pathology forms an important part of the Pharmacy undergraduate program. Several interventional measures were introduced to enhance the module and the possible effects on students' perception of the module assessed.

**Methods:** From the 2009 cohort, lecturers and core topics were introduced during the orientation lecture. Periodic 'meet-ups' were arranged between the module coordinator and the students. From the 2010 cohort, tutorials were made more clinically-relevant and more concise textbooks were recommended. The perceptions of the 2009-2011 cohorts of students ('post-intervention') were compared with those of 2006-2008 ('pre-intervention').

**Results:** The proportion of the students rating the module as good/excellent was 50% in the 2006-2008 cohorts and rose to 62% in the 2009-2011 cohorts ( $p=0.0079$ ).

**Conclusions:** This analysis reveals significant improvement in the students' evaluation of the module. Practical measures that build up teacher-student rapport and that provide clarity of the subject material are likely factors that helped improved the students' perception of the module.

**Keywords:** *pathological science, medical education, pharmaceutical science*

## Introduction

Pathology - the study of disease - is an essential medical subject that bridges the basic sciences and the clinical disciplines. An understanding of the pathophysiological processes will greatly enhance the appreciation of clinical disease manifestations in patients. Pathology is thus an essential component in the curriculum of various healthcare disciplines, including Medicine, Dentistry, Pharmacy and Nursing, amongst others. For Pharmacy students, it builds upon the foundations of normal human biology, providing the essential disease underpinnings, to build a future career in patient care and therapeutics.

In the National University of Singapore, Pathology teaching has been delivered as a module in the third year of a four-year Bachelor of Science (Pharmacy) programme. Topics on the basic pathological principles of disease and selected areas in Systemic Pathology were covered. The broad objectives of the module were for the students to understand the aetiology, pathogenesis and key morphological and clinical features of major disease conditions, as well as to correlate these with the fundamental principles of therapy. Specifically, the topics covered within the Pathology module were as follows: cellular injury and adaptation, haemodynamic disorders, basic haematologic conditions, inflammation and repair, immunopathology, infections, heart disease, liver disease, diabetes and lipid disorders, renal disease, cancer biology and pathology of adverse drug reactions. Spanning a three month

period, the module was delivered in a traditional lecture and tutorial format. Total contact time was 31 hours for lectures and 15 hours for tutorials. There were two multiple choice question (MCQ)-type continuous assessments interspersed during the course of the module; together they constitute 30% of the total assessment marks. This is capped by a final module examination comprising MCQs and a selection of structured essay questions, making up the remaining 70% of the total assessment marks.

Having had the opportunity to study the feedback of prior cohorts of students as well as to benefit from the advice of the previous module coordinator, the authors progressively introduced a selection of practical intervention measures, seeking to improve the students' learning experience. There has previously been a relative paucity of published data documenting curriculum evaluation of Pathology as a module for Pharmacy students (Anderson & Bickley, 1976). As such, the aim of the study was to compare student feedback scores obtained in 2006-2008 (pre-intervention) and 2009-2011 (post-intervention) and to comment on the possible usefulness of the various measures introduced.

## Methods

Curriculum intervention measures were introduced progressively over two annual student cohorts while the core

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module content remained unchanged. In the 2009 cohort, the emphasis was on optimization of communication and rapport. Lecturers, including their brief profiles and their corresponding topics, were introduced during the orientation lecture, giving students a heads-up on what was to come. Lecture notes were also routinely uploaded via the Integrated Virtual Learning Environment (IVLE) platform, the e-learning management system of our institution, for students' review. Periodic meet-ups were arranged between the module coordinator and the students to find out how they were doing and to brief them on the nature of upcoming continuous assessments.

In the 2010 cohort, enhancing structure and relevance of the course was the priority. The tutorials were made more structured and also more clinically or therapeutically-relevant. Textbooks recommended were also more concise in nature, in keeping with the relatively limited module duration of three months.

In our institution, students are required to participate in the online teaching feedback assessment system before they attend their final examinations. Both individual lecturers and tutors as well as the module as a whole are rated by the students. The general opinion of the module is rated on a 5-point Likert scale: 1 – poor, 2- unsatisfactory, 3 - satisfactory, 4 – good and 5 - excellent. The students are also able to enter free text comments.

To evaluate the effectiveness of the above teaching measures, the general opinion of the module of the 2006, 2007 and 2008 cohorts of students (pre-intervention) was compared with those of 2009, 2010 and 2011 (post-intervention). The Fisher exact test (2-tailed) was used to assess for any significant difference in proportions (GraphPad Software). Confidence intervals (95%) using the Wilson procedure were also calculated in assessing the differences in proportions (VassarStats).

This study was evaluated ethically by the National University of Singapore Institutional Review Board (IRB) (11-298) in September 2011 and was deemed to be exempt from full IRB review.

## Results

The response rate for the 2006 - 2008 cohorts was 85% (262 of 308) while that of the 2009 -2011 cohorts was 79% (293 of 373).

One hundred and thirty three of 262 students (51%) rated the module as good or excellent (4-5 out of 5) in 2006-2008. This rose to 181 of 293 students (62%) in 2009-2011; the difference was statistically significant ( $p=0.0079$ ) (95% Confidence Interval for difference in proportions [CI] = 0.0275 to 0.1908). Correspondingly, 32 of 262 students (12%) rated the module as unsatisfactory or poor (1-2 out of 5) in 2006-2008. This dropped to 17 of 293 students (6%) in 2009-2011 ( $p=0.0103$ ) (95% CI=0.0166 to 0.1142). Table I illustrates the detailed distribution of overall module student feedback scores for the 2 periods under study.

As for the student assessment results, 302 of 308 students (98%) obtained an overall pass for the module in 2006-2008, comparable to the 371 of 373 (99%) achieved in 2009-2011 ( $p=0.1498$ ) (95% CI= -0.0034 to 0.0368).

**Table I: Comparison of the overall student ratings for the module between the 2006-2008 and 2009-2011 cohorts.**

	2006-2008 cohorts n (%)	2009 -2011 cohorts n (%)
<b>Overall module feedback ratings</b>		
Excellent (5/5)	10 (4%)	19 (7%)
Good (4/5)	123 (47%)	162 (55%)
Satisfactory (3/5)	97 (37%)	95 (32%)
Unsatisfactory (2/5)	22 (8%)	12 (4%)
Poor (1/5)	10 (4%)	5 (2%)

**Figure 1: Haemodynamic Disorders: Match the items in (A) with those in (B)**

(A) Pathological processes

Coronary artery thrombosis	Deep vein thrombosis	
Nasal congestion	Haemorrhagic shock	Oedema
Septic Shock	Cardiogenic shock	Anaphylactic shock
Disseminated intravascular coagulation	Haemorrhoids	

(B) Therapeutic modalities

Antibiotics	Dopamine / Dobutamine	Flavonoids
Plasma expanders	Adrenaline	Pseudoephedrine
Tissue plasminogen activator	Fresh frozen plasma	
Warfarin	Limb elevation	

## Discussion

This analysis reveals significant improvement in the students' overall opinion of the module following the introduction of the above-described interventional measures. The module score distributions appeared comparable to those reported in a previous study on Pathology studies in a Pharmacy programme (Anderson & Bickley, 1976). The interventional measures used were based on empathy and were simple to implement and of negligible cost. Notably, the standard of the assessments in the module and the overall student passing rates were maintained for the cohorts under study. The latter observation, in particular, was not surprising, as the module has been an essential part of the Pharmacy curriculum for many years, with most, if not all students, expected to achieve or exceed the threshold for passing, as long as steady work has been done.

In the subsequent phase of the implementation, the structured and clinically-orientated tutorials helped make the classes more focussed and relevant to the student. A wide array of classroom teaching strategies was used by the various tutors to facilitate understanding of the subject matter and to engage the students in active participation. An example of such a strategy employs an extended matching question exercise to illustrate the need for students to correlate basic pathological

processes and various therapeutic strategies (Figure 1). Another correlation exercise on cell injury requires the students to match important clinical conditions (e.g. acute myocardial infarction, pancreatitis, tuberculosis) with their classic clinical scenarios. Mind-mapping exercises were also used in some sessions to link concepts and to build deeper understanding (Laight, 2006). Yet another example of a classroom exercise on basic immunological processes and conditions requires the students to solve hypothetical problems via characters simulating various cellular and chemical players in the immune system. The questions and scenarios used are designed to link and integrate the different concepts taught.

The structured tutorials meant that the student groups could be larger, resulting in considerable saving in teaching staff manpower. Moving forward, such structured sessions could take the form of more scenario-based or problem-based small group discussions, incorporating impromptu student presentations, computer-based clinicopathological case discussions and formative assessments, adding to the repertoire of classroom teaching tools. Key objectives of such strategies would be to foster the integration of important concepts, enhancing student engagement and ultimately, the application of pathological principles to clinical or therapeutic problem-solving (Laight, 2006; Smith *et al.*, 2010; Antepohl & Herzig, 1999).

The submission of ample qualitative (free text) student comments also provided extremely useful information for module evaluation. Although there was general acknowledgement that Pathology was interesting and relevant to their programme of study, it was also frequently noted that the module was too content heavy, the subject matter difficult and the pace of several lectures too rushed. Some students also requested for post-continuous assessment reviews as a form of formative feedback. These comments were considered and taken on board for the current and future batches of students reading the module. The ongoing curriculum review has a consolidation theme, focussing on the streamlining of topics. Extra contact time was also offered to the specific lecturers who were considered to have 'heavy' topics. There was also introduction of post-continuous assessment reviews to revisit the problematic questions, reinforcing the notion that components of summative assessment can also be formative tools (Torrance, 2007). Wherever feasible, lecture webcasts have been made available to students via the IVLE platform, a facility that enables them to review the delivered material at a later convenient time. From 2010, the recommended textbook has also been changed from a previous more comprehensive text to one of a select few that are more concise or handbook-like in nature, a feature considered befitting of a compact one-semester module (Schneider & Szanto, 2009; Reid, Roberts & MacDuff, 2011; Lakhani, Dilly & Finlayson, 2009).

The main limitation of the current study is the use of a single measure of the effectiveness of curriculum intervention: student perceptions. While student feedback or ratings is probably the most widely used teaching evaluation tool, there exist many other strategies for measuring teaching effectiveness, notable examples being teacher self-ratings, peer or expert reviews and administrator feedback (Berk, 2009). The use of these additional methods of teaching evaluation would provide a more complete and balanced evaluation process. These methods do entail the use of additional resources and may be more suited for the individual

teacher by compilation into a comprehensive teaching evaluation portfolio for various formative and summative purposes.

It is imperative that a strong foundation in Pathology be laid in a Pharmacy programme. The graduates from our institution's Pharmacy programme proceed to take up varied positions in diverse but often related professional fields (website of the Department of Pharmacy, Faculty of Science, National University of Singapore). The bulk of the graduating students undergo pre-registration clinical internship and thereafter become clinical pharmacists in hospital-based and community settings. Many others embark on careers in the pharmaceutical industry, research and development. Some continue to advance their studies by attending post-graduate studies or studying medicine and some make significant contributions to academia. No matter the path chosen, the pathology module seeks to foster a firm grasp of the fundamentals of contemporary disease understanding to build such careers.

In summary, this study shows that in an essential but heavy module such as Pathology, the introduction of practical classroom interventional measures that enhance teacher-student communication and rapport, and promote clarity and accessibility of the subject material, helped improve Pharmacy students' overall learning experience in the course. Such curriculum-refining principles begin with a willingness to embrace student and staff feedback, analyse current teaching methodology and to make the necessary changes. These changes are neither cost- nor manpower-heavy, and are readily applicable in a variety of instructional settings.

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### Presentation at meeting

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