Integrated Problem-Based Learning in the Neuroscience Curriculum—

The SUNY Downstate Experience

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ABSTRACT

**Rationale:** This paper reports our initial experience in converting a conventional curriculum into a problem-based learning model (PBL) for teaching psychopathology. As part of a wide initiative in curriculum reform, psychopathology, which was a six-week course in the second-year medical school curriculum, became integrated into a combined Neuroscience block. We also review the experiences at other medical centers that have instituted similar curricula reform.

**Method:** We rated student satisfaction with both the Conventional and the PBL components. The PBL experience in Psychopathology was also compared with that of the Neuroscience Block which used large student groups and expert facilitators while the Psychopathology was taught in small groups.

**Results:** Students appeared to indicate a preference toward the use of expert facilitators in contrast to small group mentors who were not experts.

**Conclusion:** We examine the pitfalls of the P.B.L. system when applied to a Neuroscience curriculum on early career development. Through analyzing the SUNY Downstate Medical School experience and citing published data from other PBL tracks at recognized schools, such as McMasters and Michigan State, the author offers a cautious and balanced suggestion of a more effective implementation initiative.

Key words: PBL, Curriculum, Psychopathology.
INTEGRATED PROBLEM-BASED LEARNING IN THE NEUROSCIENCE CURRICULUM-THE SUNY DOWNSTATE EXPERIENCE

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INTRODUCTION:

Problem-based learning, otherwise known as “PBL,” has been incorporated into the curriculum at many medical schools around the world. The main purpose of this method is to help students acquire new information by providing a context to apply their knowledge to clinical problems. A further aim of PBL is to provide students with resources in self-directed learning skills that will persist throughout their careers. However, when compared with the conventional curriculum, the PBL method generally increases use of limited resources at medical schools, increasing their costs, and has not been definitively shown to enhance students’
performance. The effectiveness and purported advantage of PBL has not yet been proven. Therefore, the architects of the PBL method have encouraged the creation of different methodologies to assess its effectiveness, which has provoked a broad debate on what medical education is attempting to achieve.

In 1999, the Dean of the Medical School at SUNY undertook an initiative to transform the format of the second-year curriculum away from a conventional didactic model, and move towards one that was PBL-based. This directive was applied to all the courses in the second-year curriculum, which were divided into distinct blocks, most of them from four-to-six weeks.

As Course Director in Psychopathology, the author joined a panel representing a cross-section of the new integrated Neuroscience Block. This paper will present the way SUNY Downstate Medical Center implemented the psychopathology segment of the curriculum. We will address the methodologies involved in the implementation of the Problem-Based-based learning method, student satisfaction ratings, and test performance results.

Psychopathology in a PBL format would no longer exist as a separate entity. Instead, it would become incorporated into a Neuroscience block, consisting of Neuropathology, Infectious Disease, Microbiology, Psychopharmacology, and Clinical Neurology. Of the 70 hours dedicated to the Neuroscience curriculum, 20 hours consisted of psychopathology lectures and P.B.L. cases. Nine of the twenty hours were devoted to lectures in Child and Adolescent Psychiatry, somatoform disorders, sleep and eating disorders, personality disorders and drug and
alcohol abuse. Eleven hours were devoted to PBL modules in psychosis, mood disorders, anxiety disorders and the dementias.

Prior to this initiative, the 20-hour independent course of Psychopathology had consisted of three clinical videotapes, each containing a one-hour interview followed by an informal discussion, addressing the three core areas of psychopathology, namely psychosis, mood disorder, and anxiety disorders. Fourteen hours were devoted to lectures covering the rest of the spectrum of psychopathy.

In the new curriculum, the Psychopathology PBL track was integrated in that the Neuroscience lecture syllabus was structured to synchronize with the appropriate Psychopathology PBL group. For instance, the lecture on neuron receptor functions, which falls under Psychopharmacology, would precede the Schizophrenia workshop. Likewise, the lecture on tranquilizers and hypnotics would precede the Anxiety workshop. The neuropathology of the dementing disorders would precede the Dementia workshop.

**METHOD:**

The psychopathology curriculum was organized around four case-based modules, which defined the core psychopathology curriculum. These consisted of the psychotic disorders, mood disorders, anxiety disorders, and the dementias. These modules were chosen because they were judged by the committee as central to the psychopathology course, and because they lent themselves to problem-generated discussions, using a problem-based learning model.
Nine hours were left for other aspects of the curriculum that either required specialty knowledge, not easily acquired by most mentors, or because they were regarded as less essential to the training of physicians (an example of this would be the personality disorders). These disorders were maintained in lecture form.

In order to adhere to the principals of small workshop formats, where faculty would function in the capacity of facilitator rather than teacher, the psychopathology portion of the Neuroscience block was divided into 20 small groups of 10 students. This involved the sustained participation of 20 faculty members over a six-week block of time. Few of the preceptors had previous experience with PBL. In contrast, the remainder of the Neuroscience curriculum divided the PBL classes into 8 groups of 25 students. This decision was imposed by pragmatic realities: Other Neuroscience departments at this institution simply lacked the manpower to run 20 PBL groups. The module of 8 groups with 25 students each, (as a comparison construct) exposed students to a much more consistent level of faculty expertise, and also served as a normative comparison for the psychopathology course.

A fundamental premise of the PBL method is that problem-solving and self-directed acquisition of knowledge creates a dynamic tension that leads to a more active, gratifying, and effective education. In order to achieve this, each committee was charged with selecting a prototypical case report containing clinical and basic science principles, with a design that would impose a progression of challenges and decisions for the student based on evolving data.
In order to create a problem-based learning paradigm, a committee of experts was set up for each module. Each committee was charged with the mission of: 1) generating a case report, 2) using the case as a springboard for fruitful exploration and discussion, 3) providing questions and references for the students that would encourage self-directed reading, 4) creating a user-friendly manual for the mentors, and 5) generating a set of examination questions that would be based upon students attendance and participation in the case-based learning module.

It should be noted that the PBL model employed at SUNY differed from the “pure” PBL model which evolves over several sessions and where the learning tasks are defined by the participants and are not faculty-generated.

**RESULTS:**

A questionnaire was circulated at the end of the entire Neuroscience course, probing levels of student satisfaction with conventional lectures, PBL mentors, handout materials and perception of PBL effectiveness in Psychopathology, and the rest of the Neuroscience curriculum. Prior to the change of curriculum, students’ attendance at lectures ranged from 25% to 30%. Attendance of the informal video sessions ranged from 85 to 90%. Attendance at the lectures in the new curriculum increased to 85% and remained at the 85 to 90% level for the PBL workshops. The enclosed Table summarizes the students’ response to the psychopathology component of the new curriculum and the mean response to the entire Neuroscience curriculum. The Questionnaire assigned a score of 8 for “strongly agree,” 6 for “somewhat agree,” 4 for “somewhat disagree,” and 2 for “strongly disagree.” Favorability was endorsed as positive for a
score of 6 or higher. The ratings were subjected to a chi square analysis to assess statistical significance.

The course directors subsequently had a formal feedback meeting with the elected student body to obtain a more specific and elaborate critique of the new curriculum. All second year students were encouraged to pass on general comments to their representatives in the student body, in an attempt to upgrade the course. From the feedback questionnaire and subsequent in-depth discussion with the student body, the following salient points emerged regarding the psychopathology course:

1. Many students believed that in our haste to convert from a conventional curriculum to a PBL model, faculty had placed too much reliance on the PBL workshops in an overambitious attempt to disseminate a core knowledge base. Many students, unprepared for this method, were left floundering and frustrated, having to use their own resources to acquire a core knowledge-base. This is reflected in Question 4 of the Table. Students complained that PBL segments in psychopathology were not adequately supported by didactic handouts, believing that the architects of these modules presented a list of esoteric references which students found time-consuming and arduous.

2. Traditional lectures were still endorsed as highly favorable by a majority of students, as reflected in Questions 6 and 7 in the Table. Students believed that the PBL format should
not replace all conventional lectures in the fundamental areas of psychopathology for preclinical second year medical students. Rather, once a core knowledge-base is acquired via effective lectures, PBL workshops might be more useful during subsequent clinical years.

3. Many students rated the psychopathology mentors (who had previously functioned as clinical supervisors) as inadequately trained in the PBL format. Students reported that these mentors would frequently revert defensively to a conventional teaching format, using the clinical case studies provided for the PBL groups as templates for question-and-answer sessions, neither adequately conveying a critical base of knowledge, nor fulfilling the philosophical objective of the PBL method.

4. Students in psychopathology assigned to groups led by senior faculty had a far more gratifying experience. These results resembled the positive responses elicited in the other Neuroscience modules, where the student groups were larger but the faculty were more highly trained and qualified to run PBL groups. This was reflected in the students’ responses to Questions 5 and 10 in the Table.

**DISCUSSION:**

PBL provides a potentially challenging, more motivating, and enjoyable approach to medical education, and may promote lifelong habits of self-directed learning. PBL is, however, more expensive than conventional curricula, especially in larger medical schools.
graduates tend to rate their basic science background weaker than do conventional curriculum graduates. These results suggest that PBL may not develop in the students an adequate cognitive foundation.\textsuperscript{5}

Our PBL model diverged from the original purist construct, where problems are defined by the participants and evolve in a linear progression through a series of workshops dedicated to a single case. Time restraints in our revised Neuroscience curriculum imposed a limit of sessions per topic, and therefore problems were faculty-generated, not student-generated. This modification was made to impose structure and for time containment purposes. Other studies have indicated that while students favor PBL curricula, they also express dissatisfaction about a lack of a structure or direction.\textsuperscript{6}

McMaster students identified a lack of definition of core material as a weakness in student-directed P.B.L.\textsuperscript{7} Neame & Powers, in an article titled “Assisting Students to Learn How to Learn,” concluded “It is impractical to suggest that an unstructured, undergraduate medical course be designed in which the onus is entirely upon the student to define and undertake his own program of studies.” What these authors recommended is a gradual progression towards independent learning, via a graded reduction of imposed structure.\textsuperscript{8}

In the Psychopathology module, favorability ratings of levels of student satisfaction varied greatly between mentors. There was much more consistency in the rest of the Neuroscience block, where groups were larger, and facilitators more qualified. Our results coincided with the findings of Davis, et. al. that experienced mentors trended towards directive behaviors, and that
was positively endorsed by students, while junior faculty tended to be more student-centered (possibly because of their lack of knowledge base). Students related experienced clinicians as being more able to identify relevant learning issues and gaps in knowledge. While this may be considered undesirable by the original architects of PBL, students with expert mentors were more likely to positively rate their PBL experience. Our findings concur with this. Students rated conventional lectures very positively, since the lecturers were seasoned clinicians with strong academic backgrounds. In contrast, running twenty small PBL workshops required enlisting numerous faculty members with varying knowledge, depth, and teaching expertise. This was identified by students as a weakness in the new Psychopathology curriculum. Course directors are cautioned to address the need to allocate sufficient time for faculty development in PBL before embarking on this method.

Our findings confirm the opinion expressed by Albanese & Mitchell, that caution should be exercised in implementing comprehensive curricula with rapid conversions to PBL. The use of didactic sessions by clinical experts, at least early in medical student education, may be vital to develop a basic science foundation. An optimal framework may be one that captures the benefits of both conventional and PBL components, with the early dominance of conventional teaching and the introduction of PBL, in increasing complexity, commensurate with student development and faculty resources.

Finally, one should comment on the limitations of the study. Although student satisfaction with PBL in psychopathology as a whole was disappointing, feedback from student representatives indicated greater favorability correlating with the level of faculty expertise. In the General
Neuroscience PBL track with large student groups and expert mentors, favorability ratings were consistently high. The long term consequences of PBL experience on career choice has not been evaluated at our school. Although exam scores were higher in students with larger groups and expert mentors, the difference was not statistically significant.

The divergence in style from that of the original proponents of problem-based learning because of time restraints deprived the participants from the full depth of the experience proposed by these proponents; so unfavorable responses may not be a valid rebuttal of the PBL method.

Medical schools throughout the world have adopted a PBL learning approach in their curriculum. Variations in success may be confounded by sampling and the impact of other variables, such as culture, prior learning experience, and educational expectations.

**Conclusions:**

The author reports the logistics and methodological difficulties in making rapid curriculum reform at SUNY Downstate Medical School in which the Psychopathology course for second year medical students was converted from a conventional lecture format into a PBL track. A comparison was made with the rest of the Neuroscience course which underwent a similar conversion into a PBL model. While the Psychopathology track used small student groups with mentors of varying experience and expertise, the Neuroscience track conducted large groups confined to senior faculty functioning as expert mentors.
Second year medical students indicated a preference towards large groups with experienced mentors which enhanced their appreciation of PBL learning but failed to significantly affect test results in final examinations.
REFERENCES


### Student favorability responses to Psychopathology and entire Neuroscience Curriculum

<table>
<thead>
<tr>
<th></th>
<th>Psychopathology Course</th>
<th>Entire Neuroscience Course</th>
<th>Analysis of Differences Across Age Groups (df=1)</th>
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<tr>
<td></td>
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<tr>
<td>1.</td>
<td>There were enough lectures.</td>
<td>88/160</td>
<td>94/160</td>
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<tr>
<td>2.</td>
<td>There were enough PBL workshops.</td>
<td>138/160</td>
<td>118/160</td>
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<td>3.</td>
<td>The quality of the handout material at the lectures was adequate.</td>
<td>118/160</td>
<td>120/160</td>
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<td>4.</td>
<td>The quality of the handout material at the PBL workshops was adequate.</td>
<td>72/160</td>
<td>124/160</td>
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<td>5.</td>
<td>The mentors were competent in running PBL workshops.</td>
<td>84/160</td>
<td>132/160</td>
</tr>
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<td>6.</td>
<td>The lecturers were competent.</td>
<td>142/160</td>
<td>144/160</td>
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<td>7.</td>
<td>The lectures well-delivered.</td>
<td>142/160</td>
<td>138/160</td>
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<td>8.</td>
<td>Lectures should precede PBL seminars.</td>
<td>118/160</td>
<td>94/160</td>
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<tr>
<td>9.</td>
<td>Preference for more PBL seminars.</td>
<td>42/160</td>
<td>47/160</td>
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<tr>
<td>10.</td>
<td>PBL seminars were effective.</td>
<td>92/160</td>
<td>115/160</td>
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<td>11.</td>
<td>Average Exam Scores.</td>
<td>71.6%</td>
<td>77.2%</td>
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