

Problem-based Learning, Multimedia, and a Paucity of Behavioral Issue Learning

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Abstract - Although the Institute of Medicine attributes significant mortality in the United States to behavioral and social issues, these topics are commonly not prioritized areas of learning by medical students. A common belief is that problem-based learning (PBL) is an effective method to stimulate learning in these areas. While examining the effects on behavioral and social issue learning of a multimedia case implementation in an established PBL curriculum, it was discovered that PBL was not effective in stimulating learning in these areas. Furthermore, the lack of improvement with the multimedia case highlighted the fact that case sequencing in the curriculum is part of the curriculum. The findings highlight the need for better ways to stimulate learning of behavioral and social issues in problem-based learning.

Keywords: Problem-based learning; computer-assisted instruction; behavioral issues

According to a recent report by the Institute of Medicine, “Roughly half of all deaths in the United States are linked to behavioral and social factors.”¹ The report highlights the need for medical schools to educate future physicians about behavioral and social issues related to medicine. The important nuances of clinical encounters, including the behavioral issues surrounding the clinical presentation, are important, yet difficult to teach to first and second year medical students in a traditional academic setting.^{2, 3} One reason is that lectures on the subject often lack clinical context.

While some institutions have addressed teaching behavioral issues through instituting a new course,^{4,5} others describe the beneficial effect of problem-based learning (PBL) in stimulating discussion of behavioral issues. Abdul Ghaffar Al-Shaibani and colleagues⁶ found the implementation of PBL resulted in student identification of behavioral issues more than structural issues. Nandi and colleagues⁷ found that in comparing PBL with conventional teaching, PBL students demonstrated a better fund of behavioral knowledge compared to their peers who underwent a more traditional curriculum. Peters and colleagues⁸ report Harvard Medical School’s experience with students in a PBL-focused versus the traditional curriculum. The students in the PBL curriculum reported more confidence in helping patients with behavioral issues than their traditional-

curriculum colleagues reported. These findings indicate that, PBL is more effective in stimulating discussion of behavioral issues than traditional lecture-based curricula. However, our faculty’s experience with teaching behavioral issues at our own institutions, are not entirely consistent with the PBL literature cited above. Our experience is more in-line with that described by Pham and Blumberg,⁹ that “even when cases are intended to integrate multidisciplinary topics such as behavioral sciences or prevention, the biological aspects are emphasized.”

In an attempt to encourage learning and discussion of behavioral issues (including psychosocial and communication skills), we piloted a simple experimental test in the form of a multimedia healthcare problem (HCP) in an existing PBL course. We hypothesized that the rich non-verbal cues observed in the physician-patient interactions would stimulate more discussion regarding the behavioral aspects of the case than traditional, paper-based PBL. Our objective was to assess the impact on student learning of behavioral issues through use of multimedia in a PBL setting.

Methods

Setting - The curricular delivery during the first 2 years at the John A. Burns School of Medicine at

the University of Hawaii (JABSOM) is focused around PBL. The third and fourth years have a stronger clinical focus, using the traditional clinical clerkship and elective model prevalent in the United States. In the pre-clinical years, students meet twice per week for 3 hours in groups of 5 or 6, facilitated by a clinician or basic science faculty member. PBL at JABSOM follows the sequential disclosure model, first introduced at McMaster's University.¹⁰ On day 1, students proceed sequentially through a paper case, with each page providing more information about the problem. Students identify and discuss facts and problems, form hypotheses, identify further information needed to refine their hypothesis list, and identify gaps in the collective group knowledge base that need to be addressed to help in formulation of the case. These knowledge gaps are stated as learning issues. Students are taught, and PBL facilitators encourage, identification of learning issues in 4 domains: Populational, Behavioral, Biological, and Clinical. However, in upholding the self-directed learning philosophy of PBL, students are allowed to generate their own learning issues which they will be responsible for studying during the intersession between PBL sessions. On day 2, students present the knowledge gained on the learning issues they generated and engage in peer teaching. The PBL facilitator helps facilitate group function, critical appraisal of material, and evaluation and feedback. For a more detailed description of PBL at JABSOM, please refer to Kasuya, Greene, Sakai, and Tam.¹¹

Experimental test - A multimedia PBL case developed and tested by the University of Colorado^{12,13} was modified and implemented in Unit 5: "The Lifecycle", the last PBL course for second year medical students at JABSOM. The modifications from the original primarily consist of substitution of the digital text portions of the case (recounting birth and medical history) with typewritten text on paper. All video components were retained. The curriculum of Unit 5 consists of 19 cases in which topics are sequentially introduced in the following order: reproductive health, pediatrics, adolescent, and geriatric medicine. The innovative multimedia case replaced one of the existing pediatric cases in this course. This multimedia PBL case has been used by several other schools in a consortium agreement. The case was developed by a group of medical education experts with experience in problem-based learning case writing. The case is about an infant who presents to a new physician with symptoms of difficulty feeding and poor weight gain. The physician diagnoses the patient with a genetic disorder that has a poor

prognosis and must communicate this sensitive information to the young mother. The case utilizes traditional paper, computer-based videos of doctor-patient interactions, video demonstration of physical exam findings of the patient and a normal infant for comparison, and an interactive section where students can select specific physical exam elements and laboratory test results to view.

All PBL groups received the experimental test. The authors felt that a randomized controlled trial would not be ethical since the material presented in the case was on the final exam, and the effect on learning of the multimedia case was unknown. PBL facilitators were trained during a 30 minute session on how to proceed through the multimedia case. Further instructions were distributed with the case on the PBL facilitator notes, which are given to facilitators for every PBL case at this institution. Two authors (JJ, MTL) conducted all training sessions, and one author (JJ) installed all software. As PBL groups did not meet at the same time or location, seven different computers were used, rotated among the twelve PBL groups. These computers included five laptops and two desktops, all running Windows 2000 or XP operating systems. LCD projectors and externally powered speakers were used for all systems. Computers were necessary only for the case presentation on day 1, and not for learning issue presentation and case wrap-up on day 2.

The experimental test was implemented during weeks 10 and 11 of a 12-week course, after all traditional paper PBL cases in this unit were completed. To prevent bias from student cross-talk, all 12 PBL groups worked through the experimental test case simultaneously during the same week. As in all PBL cases in this unit, each group posted their selected learning issues as free-text entries via an online web-interface to a database.

Evaluation Methods - All learning issues entered by all groups in the web linked database were independently categorized by 2 PBL facilitators. The facilitators have over 8 years of experience each in facilitating PBL and are not involved with Unit 5. Learning issues were categorized into one of the following categories: Populational, Biological, Behavioral, and Clinical. Of note, case authors create a "Suggested Learning Issues list," sorted into the above mentioned categories. This list is distributed as the final page of each case so that all students know which learning issues each case is intended to address. Students may select learning issues from this list or generate their own. Tallies of the

categorizations from the 2 facilitators were combined to produce an average for the total number of learning issues per HCP, and for the mean number of behavioral learning issues, as reported in Table 1. The percent of behavioral learning issues was calculated by dividing the mean number of behavioral learning issues generated by the groups by the mean number of total learning issues generated by the groups for that HCP. The agreement between the 2 expert facilitators in categorizing the learning issues was measured and reported.

Student attitudes were measured by a written survey given prior to starting and immediately after completing the case. This survey was designed by the authors (JJ, MTL) and an evaluation expert (ML) to assess the effect on student perception of the impact of the case in three domains: PBL session process; confidence in skills; and satisfaction with the multimedia format and case presentation. Survey item responses consisted of a Likert scale, 1=strongly disagree, 4=strongly agree. Roughly equal numbers of survey items were designed to address each domain, and were the same on the pre and post surveys.

Additionally, a focus group comprised of PBL facilitators was conducted to elicit more in-depth subjective feedback and impressions of the case. This 1 hour focus group was conducted by an evaluation expert (ML), who was not directly involved in the teaching or administration of the Unit 5 course. The focus group occurred approximately 2 weeks after the multimedia case, and included 12 of the 19 PBL facilitators. Focus group questions were designed to elicit discussion in the same 3 domains targeted in the student survey. The focus group discussion was recorded and transcribed for subsequent content analysis. All data was collected under IRB approval.

Results

Learning Issue Categorization - As shown in Table 1, the mean number of behavioral learning issues generated per case, per group, as categorized by the 2 expert facilitators, was less than 1. Although the multimedia HCP (HCP S) had the second highest (7.7%) percent of behavioral learning issues, there is insufficient power to determine if this finding is significant. Table 1 also shows that not all PBL groups reported their learning issues for each case.

Table 1 - Learning Issues (LIs) generated in each Unit 5 Healthcare Problem (HCP) by problem-based learning (PBL) groups and categorized by Two Expert PBL facilitators as "Behavioral".

Health Care Problem	Number of PBL groups reporting	Number of author-suggested LIs	Mean # of LIs generated by PBL groups	Mean # of Behavioral LIs generated by PBL groups	Percent of Behavioral LIs out of all LIs generated by PBL groups
A	12	12	8.6	0.08	0.9
B	12	17	7.3	0.29	4.0
C	12	18	8.3	0.00	0
D	12	20	8.1	0.25	3.1
E	12	39	9.3	0.21	2.3
F	12	30	9.5	0.08	0.8
G	11	26	6.7	0.41	6.1
H	11	24	7.3	0.08	1.1
I	12	14	6.1	0.08	1.3
J	12	25	8.7	0.21	2.4
K	11	34	7.3	0.18	2.5
L	9	20	6.3	0.84	13.3
M	12	25	6.1	0.38	6.2
N	12	22	6.3	0.38	6.0
O	12	20	6.2	0.42	6.8
P	9	18	6.7	0.06	0.9
Q	10	22	6.8	0.25	3.7
R	9	22	5.9	0.34	5.8
S	10	27	5.2	0.40	7.7
(multimedia HCP)					

Agreement between the 2 expert PBL facilitators who categorized the learning issues, as measured using Kronbach's alpha, was 0.78. The mean number of behavioral learning issues generated by all groups, across all 19 healthcare problems was 0.26. No effect of HCP grouping (by reproductive, pediatric, adolescent, geriatric subunits) was observed for the measured mean number of behavioral learning issues.

PBL Facilitator Focus Group - Content analysis of the PBL facilitator focus group revealed a lack of consensus by the facilitators regarding the impact of the case on behavioral discussion. Many agreed the emotional content of the case was useful for learning. However, when asked directly, "Did it affect the discussion of behavioral issues?", the responses indicated that, although they could see the potential of the case, in actual fact, they did not see much difference in the quantity or quality of discussion for this case, as compared to the 18 cases that preceded it. When asked, "Were the students in your group emotionally moved?", the strong consensus was that the students were not emotionally engaged in the case. Quantification of the types of responses was not performed.

Student Surveys - Analysis of the students pre- and post-survey results (n=60) showed no change in the mean response (2.4 with 1=strongly disagree, 4=strongly agree) to the statement, "I feel confident in my ability to deliver bad news". This was the only item on both the pre- and post-survey with a behavioral context. Other post-survey results relating

to behavioral issues are shown in Table 2. For all items, n=60 (97% of the class). There were no additional items on the pre-survey addressing behavioral issues.

Table 2 - Post-survey Behavioral Results.

Item	Strongly Disagree	Disagree	Agree	Strongly Agree	Mean 1=strongly disagree, 4=strongly agree	SD
I feel the case format enhanced group discussion of behavioral issues.	5	6	38	11	2.9	0.8
I feel confident in my ability to deliver bad news.	8	24	27	1	2.4	0.7
I cared more about this patient than others in this Unit.	3	34	18	5	2.4	0.7
I feel the case format enhanced the depth of group discussion.	8	24	25	6	2.6	0.8

Discussion

Although the inherent limitations on study design and implementation constrain the power and robustness of the results as a research study, there are interesting trends that can be gleaned. Our results most notably demonstrate a marked paucity of behavioral learning issues generated by medical students at a traditional PBL medical school. Although others have described PBL as a preferred method of teaching behavioral aspects of healthcare, these studies compare PBL to traditional, lecture-based curricula. Our results suggests, however, that within a well-established sequential-disclosure PBL curriculum, self-directed study of behavioral learning issues may still be inadequate.

The learning issue and focus group analysis suggest the multimedia PBL case did not result in a notable increase in behavioral discussion or learning issue generation even though students felt the format of the multimedia case led to more discussion of behavioral issues. Factors which may explain this lack of an effect were explored during the focus group discussion and include: lack of familiarity with multimedia use, timing of case implementation, prior exposure to suggested behavioral learning issues, and student preoccupation with upcoming exams that focused on basic science concepts. Students were exposed to the curricular element “delivery of bad news” in several other HCPs prior to the one under study. As this was a major part of the behavioral content for the multimedia HCP, the discussion may have been sparse because it was not a new topic for the students. During the first year, students work through paper HCPs that involve telling a patient or family about the following: an adult female with

breast cancer; an adult male with new onset of diabetes mellitus type 1; a newborn male with Down’s syndrome; an adult female with chronic obstructive pulmonary disease, facing end-of-life-care issues; an adult male with chronic hepatitis B who develops hepatocellular cancer. During the second year, students work through more cases: an adult female with tertiary syphilis; a pediatric female with leukemia. As noted above, students had been exposed to several HCPs involving the delivery of bad news, and of other behavioral issues. Students may have felt the multimedia HCP was covering material already addressed in previous units. If the multimedia case was introduced earlier in the curriculum, results may have been different.

These findings highlight the fact that curricular timing (when to implement which cases) in PBL is indeed part of the curriculum itself. Because of the placement of the multimedia case, the effect on behavioral issue discussion and learning issue generation may have been blunted. Having students participate in or watch patient-physician interactions can provide a rich context for discussion of behavioral issues. However, the logistics along with concerns about privacy regulations, often make such an effort impractical. Additionally, live encounters cannot be scripted or repeated to teach specific curricula to a large number of students. Using real and standardized patients, a case scenario can be scripted and recorded, for later use with multiple groups of students. With appropriate permissions, rare disorders with important physical findings can be captured on digital media for broad dissemination in medical education. Additionally, concepts with poor coverage elsewhere in the curriculum can be highlighted with multimedia cases.

Future Directions - Future implementation of multimedia cases should include careful attention to timing and placement within the curriculum structure. Technical issues of video and audio quality need to be optimized. Comments during the focus group in the current study suggest that the use of multimedia and computers may distract and upset the normal PBL process, thus nullifying any potential beneficial effect of the technology. Analysis of the PBL session process and how it is affected by the use of multimedia should be undertaken. Continued development of these types of cases should be encouraged, including user interface and scripting of the case to maximize student involvement and discussion. As more multimedia cases are developed, further study will be undertaken to evaluate impact on learning. A case that is not part of the student assessment should be implemented, to allow for a

stronger study design such as a randomized controlled trial. With preparation and careful implementation, multimedia may yet prove to be a powerful addition to PBL. It appears that PBL is not the panacea for the woes of teaching behavioral and social issues we had hoped it to be.

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