

## Caffeinating the PBL Return Session: Curriculum Innovations to Engage Students at Two Medical Schools

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### Abstract

At the David Geffen School of Medicine at the University of California, Los Angeles, and the George Washington University School of Medicine and Health Sciences, authors observed that problem-based learning (PBL) return sessions for first- and second-year medical students often lacked the energy and engagement of first sessions. Unlike in first sessions, where students took on the physician's role and actively problem solved, in return sessions students spent much of their time passively, listening to research reports on learning objectives. Time spent

listening to reports dilutes return session impact, with the patient receding from view as the level of abstraction increases and learning issues take center stage. In this Perspective, the authors present innovations, developed separately at their respective medical schools between 2009 and 2012, designed to reenergize the return session.

To frame the discussion of the return session slump and their innovations in response to it, the authors used self-determination theory (SDT) and active

learning theory (ALT), both of which are supported by a considerable body of evidence. SDT provides understanding of how to maximize PBL learners' motivation, and ALT sheds light on how to promote PBL learners' incorporation of concepts into long-term memory. As motivation and memory are key factors in learning, both theories are appropriate tools to help understand and maximize the effectiveness of PBL. Finally, guided by these theories, the authors present reflections on future directions for the development of PBL.

**P**roblem-based learning (PBL) has been widely incorporated into medical education over the past 40 years, mostly as one component of a traditional curriculum, but in some instances as the primary curriculum structure. PBL was originally designed to provide opportunities for active learning in a small-group setting with contextual material that simulates real-world medical problem solving. Through active engagement, students research and solve clinical problems—thus, in theory, deepening their knowledge and improving clinical performance. It should be noted, however, that these theoretical benefits over traditional curriculum have yet to be definitively demonstrated in outcomes studies.<sup>1</sup>

At the David Geffen School of Medicine (DGSOM) at the University of California, Los Angeles, and at the George Washington University School of

Medicine and Health Sciences (GWU), we were struck by how student energy and engagement differed between the first and the return sessions, especially in the second year, when the novelty of PBL has worn off. Although there are some differences in the way PBL is implemented in medical schools, our institutions have a similar structure. During the first session, the group works through a case as a team, creating and then narrowing a differential diagnosis as they receive increasing information about the patient. As they proceed, the students identify important questions that they cannot answer about the related basic science, psychosocial, ethical, and clinical issues. They list these as “learning objectives” and assign them to individual students or groups of students to research before the return session. In contrast, during the return session students spend most of the time in a passive mode, listening to a series of mini-lectures given by the members of the small group of students on the learning objectives. Whereas the first sessions, driven by the tension to solve diagnostic mysteries, brim with energy and excitement, the return sessions often give way to tedious presentations, sometimes with little connection to the patient. At our institutions we separately developed new approaches to reenergize

the return session, which we piloted with first- and second-year medical students. In this Perspective, we come together to present these innovations and our views of how they work to invigorate PBL. To address the return session slump and to explain our responses to it, we use self-determination theory (SDT) and active learning theory (ALT). We believe that SDT and ALT are particularly relevant to our efforts because they provide a framework within which to understand return session problems and because they offer evidence-based methods to make the return session a more powerful learning experience.

### Self-Determination and Active Learning Theories

SDT provides an understanding of how to maximize PBL learners' motivation,<sup>2,3</sup> and ALT<sup>4</sup> is focused on how to promote PBL learners' incorporation of concepts into long-term memory. As motivation and memory are key factors in learning, both theories are appropriate tools to help us understand and maximize the effectiveness of PBL.

SDT espouses that humans are intrinsically motivated toward growing, mastering challenges, and integrating new experiences into a coherent sense

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of self. Self-determination is achieved by fulfilling three psychological needs—*autonomy, competence, and relatedness*.<sup>2</sup> They have special utility for educators because, as Kusrurkar and colleagues<sup>3</sup> note, they are dependent variables that can be influenced positively or negatively through varying an educational approach. How educators construct PBL sessions in regard to these needs can increase or decrease students' motivation to learn. In PBL, these needs play out in two domains—*patient-centered*: students' interaction with their PBL patient; and *team-centered*: students' interaction with their peers and teachers in their PBL group.

In the patient-centered domain of PBL, autonomy, the freedom to make one's own decisions, requires students' taking on the MD role and making decisions that have consequences for the patient. Competence also manifests itself in the patient-centered domain via clinical practice simulation. PBL provides students with opportunities to assess their clinical capabilities in creating hypotheses, arriving at diagnostic and treatment plans, applying their knowledge in a clinical context, and ultimately, practicing the role of physician. Relatedness is the emotional connection for students with their "patients." Educators can intensify this connection and facilitate learning by enhancing patient reality—for instance, through substituting a video, simulated patient, or standardized patient (SP) for a paper case patient.<sup>5</sup>

Different in the team-centered domain, autonomy involves taking actions within the team structure that influence group function as well as group decisions that affect the case.

In the team-centered domain, PBL addresses competence needs through providing students with the opportunity to assess their cognitive capabilities as well as their teamwork skills, considered critical for physicians of the future.<sup>6,7</sup> Relatedness plays out with students deriving motivational energy through their connections with peers and faculty instead of patients.

SDT fits well as a means to understand the motivational dynamics of PBL and is supported by a considerable body of evidence.<sup>3</sup> A growing literature also

supports ALT. One definition of active learning is "The process of keeping students mentally, and often physically, active in their learning through activities that involve them in gathering information, thinking, and problem solving."<sup>8</sup> Making the learner an active part of the learning process stimulates the incorporation of concepts from working memory into schemes stored in long-term memory.<sup>8,9</sup> Evidence suggests that more passive means of education, such as lecturing, result in less effective learning than active means, such as small-group activities.<sup>10</sup>

SDT and ALT give us a framework to assess why first sessions work and return sessions do not. They also give us a means to assess the educational soundness of the innovations we have implemented for return sessions at our home institutions.

### Why First Sessions Work and Return Sessions Don't

First sessions create a powerful learning environment: a stage on which SDT and ALT come together to both motivate and activate through projecting students into their future clinical roles. At both of our schools during the initial session students "become" doctors, encountering a "patient" and collaborating to define and refine a differential diagnosis as additional information about the case is revealed. In PBL return sessions, however, students function more as reporters than interpreters with fewer opportunities to act autonomously, demonstrate competence, and relate to patients and peers. Though students can choose what to research, decide how to report it, and test their competency with additional challenges presented by their patients, these challenges do not seem as compelling as addressing the patient's presenting complaint. Time spent listening to reports dilutes return session impact, with the patient receding from view as the level of abstraction increases and learning issues take center stage. As students focus on intellectual tasks, the patient becomes more remote, and, consequently, so does the emotional connection.

Our impressions of first and return session differences are supported by research as well as theory. Recent studies, using a microanalytic approach,<sup>11,12</sup>

have evaluated educational sessions in real time: Students completed short questionnaires immediately following critical points in the learning event. Unlike traditional end-of-course evaluation, which provides summative evaluation distant from course action, microanalysis offers the advantage of assessing each element immediately after it happens.

In one microanalytic PBL study, Schmidt et al<sup>11</sup> administered short measures of situation interest five times: before the problem presentation (baseline), after the problem presentation, after the discussion of the problem/generation of learning issues, after independent researching of learning issues, and after the final discussion. They found that situation interest peaked after discussion of the problem/identification of learning goals and then steadily decreased to baseline: "[I]t seemed as if the initial increase in situation interest created by the problem was slowly consumed over the course of the learning event."<sup>11</sup> In another microanalytic PBL study, which measured concept retention rather than situation interest, a decline (this time in concept recall) was seen in the reporting phase.<sup>12</sup> Though these PBL studies were not performed with medical students, we feel it is reasonable to extrapolate that studies with medical students would yield similar results.

### New Approaches to the Return Session

At the DGSOM and GWU we independently developed a series of innovative activities to energize the return session. These were introduced over each school's PBL program as a whole between 2009 and 2012, not in specific courses. Borrowing from our previous scheme, the innovations are categorized as predominantly patient-centered or team-centered. Patient-centered innovations make heavy use of role-play to put students in the clinical "driver's seat." Team-centered innovations, less predicated on activating through "patient" care, stimulate learning through team-based cognitive activities. The relationship of our innovations to ALT is straightforward: They all bring students into a more active learning mode than traditional return session activities. Their relationship to SDT,

however, is more complicated, and we have summarized it in Chart 1.

**Patient-centered innovations**

**Multiple short clinical vignettes**

(DGSOM, year 2). At the end of a case,

students encounter brief vignettes of other patients with the same complaint but different diagnoses. For example, in the primary PBL case a young woman presenting with nausea, vomiting, and abdominal pain has pancreatitis, but in

a contrasting clinical vignette during the return session, a patient with a similar presentation has diabetic ketoacidosis. Students use clinical reasoning skills to transfer what they have learned in the primary case to this new situation. This

Chart 1

**Motivating Factors, as Determined by Self-Determination Theory, in Patient-Centered and Team-Centered Innovations for Return-Session PBL Sessions for First- and Second-Year Medical Students<sup>a</sup>**

| Type of innovation   | Autonomy  | Competence   | Relatedness   |
|--|---|--|---|
| <b>Patient-centered innovations<sup>b</sup></b>  |   |  |   |
| <i>Multiple short clinical vignettes:</i><br>Vignettes presented at the end of a case illustrating the same surface features but possessing very different pathophysiologies | STRONG<br>Students make decisions as MDs and transfer their experience from the first case to care for new "patients" | STRONG<br>Students discover the medical consequences of their decisions  | MODERATE<br>Students connect with multiple paper case patients  |
| <i>Choose your own outcome:</i><br>Students choose from multiple treatment plans and see the consequences of their choices   | STRONG<br>Students act as MDs, make treatment decisions   | STRONG<br>Students discover the consequences of their treatment decisions  | MODERATE<br>Students connect with a paper case patient  |
| <i>Milestone case:</i><br>Students must interview, diagnose, present to faculty and treat a standardized patient in this combined first-return session                       | STRONG<br>Students act as MDs, make decisions in multiple aspects of the MD role                                      | STRONG<br>Students discover the consequences of their decisions; they also test their oral presentation and interviewing skills                  | STRONG<br>Students interact with a standardized patient   |
| <i>Professional round table:</i><br>Students come together in the roles of professionals from many disciplines to make patient care decisions                                | STRONG<br>Students take on decision-making in varied professional roles   | STRONG<br>Students discover the consequences of their decisions  | MODERATE<br>Students do not relate directly to the patient, but the patient does serve as the central focus of the conference; students do relate extensively to each other |
| <b>Team-centered innovations<sup>c</sup></b>   |   |  |   |
| <i>Debate:</i><br>Students debate both sides of controversial issues in health care  | WEAK<br>Debaters take on professional roles in advocating for their side; they make few independent decisions         | STRONG<br>Students test their reasoning and verbal skills  | STRONG<br>Debaters interact vigorously with team members  |
| <i>Compare and contrast: Mechanistic case diagramming:</i><br>Students map patients with similar presentations to discover differences                                       | WEAK<br>Students make few decisions   | STRONG<br>Students test their strengths and weaknesses in analyzing and synthesizing   | WEAK<br>Focus is on intellectual activity, not on relating to patients or peers   |
| <i>Compare and contrast: Same disease, different manifestations:</i><br>Students compare features: e.g., child and adult with different rashes, same cause (zoster).         | WEAK<br>Students probe similarities and differences, make few decisions   | STRONG<br>Students discover their strengths and weaknesses in understanding diseases, pathophysiology, diagnostic procedures and treatment plans | WEAK<br>Focus is on intellectual activity, not on relating to patients or peers   |
| <i>Pre-return session blogging:</i><br>Students interact electronically to prepare for return sessions   | MODERATE<br>Students make decisions about the positions they will take on issues                                      | WEAK<br>Competence is not evaluated  | STRONG<br>Students interact vigorously with team members  |

Abbreviation: PBL = problem-based learning.

<sup>a</sup>Ratings determined by author consensus based on the authors' experience in implementing the innovations at the David Geffen School of Medicine, University of California, Los Angeles, and the George Washington University School of Medicine and Health Sciences, 2009–2012.

<sup>b</sup>In patient-centered innovations, students fulfill their need for autonomy through taking on the MD role and making clinical decisions. They fulfill their need for competence through seeing the results of those decisions. They fulfill their need for relatedness through connecting with their PBL patients.

<sup>c</sup>In team-centered innovations, students fulfill their need for competence through cognitive activities and their need for relatedness through interaction with peers and faculty. Not much autonomous decision-making occurs.

activity gives additional dimension to the physician role, challenging students to further exercise their autonomy by applying information just acquired in a new patient context.

**Choose your own outcome (DGSOM, year 1).** Creating alternative endings to a case stimulates learners to directly experience the consequences of their decisions. For example, for the young woman with pancreatitis mentioned previously, the group chooses from six sets of hospital discharge instructions. The group's choice determines which outcomes will occur. One set of discharge instructions results in the optimal outcome; the other sets result in a return trip to the emergency room 12 hours later or other negative patient consequences. This realistic activity, which offers opportunities for students to make decisions and test their competence while caring for their patient, creates authentic responsibility, which in turn creates meaning, relevance, and motivation.<sup>13</sup> Finally, research in learning for transfer suggests that the construction of such schema is associated with greater accuracy in accessing and applying prior instances to new situations.<sup>14</sup>

**Milestone case (GWU, year 2).** The final event for second-year students is a combined first and return session called a milestone case. Students first interview an SP presenting with shortness of breath and work through a differential diagnosis as a group. In a dynamic real-world way, they ask the SP additional history questions to help prioritize their differential diagnoses, after which they receive the physical exam findings, request tests, agree on management, and present the patient to their faculty attending. Ultimately, the SP is hospitalized with a diagnosis of pulmonary embolism and treated with heparin followed by warfarin. After hospital discharge, the SP presents for a follow-up visit, and the students research in real time the latest guidelines for anticoagulation for pulmonary embolism. They then apply this evidence-based medicine, counseling the patient on duration of therapy and diet issues related to warfarin.

This activity (enhanced by encountering an SP instead of a paper case) provides

students with multiple opportunities for feedback on a diversity of clinical skills (interviewing, differential diagnosis, case presentation, real-time research, patient counseling). The clinical realism and multiple challenges bring the student closer to the autonomy, competence, and relatedness of actual clinical practice than most PBL activities, thus heightening the SDT motivational effect.

**Professional round table (GWU, year 2).** In this return session activity, students exercise their autonomy and competence by taking on roles of medical and nonmedical professionals. These roles are assigned after the first session, and students research them and prepare to present opinions from the perspective of their "profession" during the return session.

For example, in the first session a 76-year-old Chinese American business owner is diagnosed with tuberculosis, and at the conclusion, students are randomly assigned roles to play for the following session: a pulmonologist, a radiologist, a pharmacologist, a social worker within the Chinese community, and a public health officer involved with direct observation therapy.

Students come prepared to discuss and debate the case from their acquired viewpoint. Following each student's individual discussion, the group confers about how the care of the patient should change given the new information and concludes by reaching group consensus on a treatment plan.

**Video and standardized patients (DGSOM and GWU, years 1 and 2).** The use of videos and SPs are not innovative activities per se, but are techniques to increase the realism and three-dimensionality of the patient-centered experiences. Adding video clips at any point in the PBL process, especially in the return session, increases authenticity,<sup>5</sup> and motivates student relatedness to the patient and involvement with the problem, and makes the case more memorable.<sup>15</sup>

At GWU in the first year, during the initial session students view a video of the initial presentation of a 14-year-old patient with type 1 diabetes (portrayed by an SP). In the return session, students

interview an SP, the "same patient 4 years later." The students discover that this patient, now 18 years old and in college, is struggling with managing her diabetes and a newly developed eating disorder. Creating a continuity relationship using video and SPs increases student-patient connection and relatedness.

### Team-centered innovations

In contrast with patient-centered innovations, team-centered innovations rely less on role-play and simulated clinical reality to motivate students and more on within-group cognitive challenges. SDT comes into play by students fulfilling their need for autonomy, competence, and relatedness through team intellectual activities and relating to peers and mentors.

**Debate (GWU, years 1 and 2).** Before the return session in this active learning method, two teams of students research their respective viewpoints on a controversial topic and plan their debate strategy. The debate concludes with all students encouraged to voice their own opinions. Though this debate model is well suited for controversial social topics, it can also be employed to explore competing patient treatment methods or diagnoses. Unlike receiving information from a report detailing both sides of a controversy, students through this sort of active learning engage in critical thinking and prepare themselves to become the autonomous decision makers they will need to be as physicians. It also provides them with the opportunity to experience the collegial relatedness with peers with whom they may not agree that will be an essential part of their future professional work in teams.

In one example, a young woman has a strong family history of breast cancer but tests negative for breast cancer genes. She is considering her options and seeks advice on prophylactic bilateral mastectomy. Students debate the pros and cons to arrive at how to counsel the patient.

**Compare and contrast: Mechanistic case diagramming (DGSOM, year 2).** Mechanistic case diagramming, also referred to as concept mapping, can be used during either the initial or return sessions.<sup>16</sup> In this activity, students



visually create connections, associations, and comparisons with flowchart-like boxes, circles, and arrows. All case data can be “mapped” in one visual field that connects clinical content to basic science content, and vice versa. Creating such a “map” is a motivational learning tool for visual and associative learners which fosters autonomy and competence in critical thinking.

**Compare and contrast: Same disease, different manifestations (DGSOM, year 2).** Two cases are chosen to stimulate comparison and contrast across deep features. For example, two patients present with a rash: one, an older man with a reactivation of a zoster viral infection; the other, a girl with an acute zoster viral infection. The return session focuses on the similarities and differences in the two cases related to patient age and gender, diagnostic testing, treatment, prognosis, and recurrence. Though case based, the tasks are mainly cognitive: Contrasting the two manifestations of the same virus is an active learning method that enhances remembering the important basic science and clinical information. It also fosters autonomy and competence in critical thinking.

**Pre-return session blogging (GWU, year 2).** In this team-centered exercise, relatedness stems from students’ interactions with each other. In one example, the first session focuses on a case involving options for a woman with an unplanned pregnancy. Between the first session and the return session, students post about this controversial topic on an online discussion board, anonymously if they wish. As a result of the priming and preparation from the blogging, the PBL return session becomes animated, driven more by active discussion and less by passive report presentation.

### Further Thoughts

In this Perspective, we have described eight innovations to reenergize first- and second-year students’ return PBL sessions. They have been piloted fairly recently at two medical schools and have been observationally, not formally, evaluated. An energetic, positive student and tutor response has been noted. As one student commented at GWU:

We did do oral feedback with our PBL group on the last day, and there were very positive comments, particularly about the level of engagement as well as making the cases more “real life,” which made preparing for the activities less of a burden... Being given the opportunity to “be the doctor” in some of the activities was a fun and engaging perspective that increased participation, both in preparation and during the activity.

Another representative comment from a first-year student at DGSOM was:

Anything that can help bring these patient cases to life is helpful, and makes learning clinical information, as well as basic science concepts, far more interesting and relevant.

Faculty at both institutions also report being more deeply engaged and invested in the case content when energizing return session enhancements were provided. One reason was that PBL became more of a learning experience for us as well as for students. Implementing novel approaches, such as the round table and debate formats, enriched our own knowledge about interprofessional perspectives and controversial issues.

In the future, we plan to expand our PBL innovations and integrate them into a developmental sequence. Instead of the traditional single-case format with its single clinical motivational peak, we plan to restructure PBL sessions to present students with a primary paper case followed by a cluster of related cases (cluster cases) in an objective structured clinical examination format, maximizing PBL impact through multiple motivational peaks<sup>11</sup> and deliberate practice.<sup>17</sup> Also, we plan to add more milestone cases, which are another example of a PBL exercise heightened with multiple clinical challenges. In accordance with SDT and ALT, both cluster cases and milestone cases are examples of high-impact PBL, designed to maximize PBL’s intrinsic motivational and long-term memory effects by actively engaging students in authentic clinical tasks. To navigate these more advanced types of cases, students need foundational experience, which raises the issue of how PBL should be developmentally integrated into the undergraduate curriculum. To establish a developmental progression, beginning students could be given a series of traditional PBL cases to acclimatize them to the method. These could be

followed by problem cluster cases and milestone cases, which would serve as a logical preparation for and transition to their clerkship years.

In summary, the innovations described here bring active and self-determination learning to PBL. To determine their value, however, research is needed to assess educational outcomes to see whether they yield better-prepared students than the traditional curriculum or PBL as usually presented.

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