

Smoothing Out Transitions: How Pedagogy Influences Medical Students' Achievement of Self-regulated Learning Goals

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Abstract. Medical school is an academic and developmental path toward a professional life demanding self-regulation and self-education. Thus, many medical schools include in their goals for medical student education their graduates' ability to self-assess and self-regulate their education upon graduation and throughout their professional lives. This study explores links between medical students' use of self-regulated learning as it relates to motivation, autonomy, and control, and how these influenced their experiences in medical school. Subjects were medical students in two distinct medical school environments, "Problem-based learning" and "Traditional." PBL students described a rough transition into medical school, but once they felt comfortable with the autonomy and control PBL gave them, they embraced the independence and responsibility. They found themselves motivated to learning for learning's sake, and able to channel their motivation into effective transitions from the classrooms into the clerkships. Traditional students had a rougher transition from the classrooms to the clerkships. In the first two years they relied on faculty to direct and control learning, and they channeled their motivation toward achieving the highest grade. In the clerkships, they found faculty expected them to be more independent and self-directed than they felt prepared to be, and they struggled to assume responsibility for their learning. Self-regulated learning can help smooth out the transitions through medical school by preparing first and second year students for expectations in the third and fourth years, which can then maximize learning in the clinical milieu, and prepare medical students for a lifetime of learning.

Key words: intrinsic and extrinsic motivation, learner autonomy, lifelong learning, self-assessment, self-regulated learning.

Introduction

Medical school is both an academic and a developmental path toward a professional life that demands independent self-regulation and self-education. Given the links between self-assessment of knowledge and skills, decisions about self-regulated learning throughout professional life, and medical

proficiency, it can be argued that self-assessment and self-regulated learning have important long-term implications for the quality of patient care (Lowenthal, 1981). Thus, many medical schools include in their goals for medical student education the ability of their graduates to self-assess and self-regulate their education upon graduation and throughout their professional lives.

Researchers have populated the medical education literature with studies designed to explore where students stand vis-à-vis learning to learn on their own; reports on these studies almost always begin with statements about recognizing “the need for students to become lifelong learners” (e.g., Sullivan et al., 1999). However, these efforts have focused mostly on isolated exercises to measure self-assessment accuracy (which is one tool among many self-regulated learning strategies); i.e., many medical schools have not comprehensively integrated formal programs into their curricula to promote or enhance self-regulated learning skills (e.g., Gruppen et al., 2000; Sullivan et al., 1999; Ward et al., 2002).

Zimmerman (2000) described three cyclical phases and processes of self-regulation in learning: (1) forethought – feelings, thoughts and plans prior to undertaking a learning task, (2) performance/control – specific actions taken while engaging in a learning task, and (3) self-reflection – feelings, thoughts, and actions subsequent to the task. Information acquired through self-reflection then “feeds back” into the cycle, influencing forethought and performance/control. Zimmerman (1996) also points out that a defining condition of self-regulated learning (SRL) is the availability of choice and control for the learners.

Motivation, autonomy, and control in learning all have powerful external influences, particularly in formal educational settings and the pedagogical structures and approaches embedded within them. How educators use their influence can determine important outcomes for students in terms of how they will approach and experience their learning. Many programs now support learning approaches that help students achieve some degree of autonomy. Such approaches encourage intrinsic motivation for learning tasks, student participation in decision-making and regulation of learning processes and outcomes, and milieus where feelings about learning are discussed openly so that positive feelings can be reinforced through pedagogy and feedback and negative feelings can be reflected upon and addressed (e.g., Boud, 1998; Candy, 1998; Kersson-Grip et al., 2003).

Specific SRL techniques that can be used to control and enhance learning include simple steps such as choosing an optimal time of day for studying and an environment that allows for concentration, higher order self-monitoring observations, such as awareness when attention has diminished and recognizing negative emotions about learning and turning them into productive ones, and more advanced techniques including monitoring and assessing

progress and learning, and using and adjusting techniques for “taking apart” notes or assignments to assure personal learning (Trawick and Corno, 1995; Zimmerman, 2000). It would be difficult, if not impossible, to engage in these techniques without the underlying intrinsic motivation to learn and the expectation of assuming responsibility for one’s own learning with the eventual goal of achieving autonomy (Boud, 1998).

Intrinsically motivated students find learning to be challenging and rewarding in and of itself. They look beyond assignments and delve deeper into material to understand underlying concepts and structures. Thus, intrinsic motivation is often associated with deep learning, characterized by higher order cognition including analysis, synthesis, and evaluation (Entwistle and Ramsden, 1983). On the other hand, extrinsically motivated students model certain learning behaviors, hoping to achieve a specific outcome that is externally controlled, such as passing a test, or getting a high grade. Extrinsic motivation has been linked to surface learning, which is characterized by lower order cognition such as knowledge (recall, memorization) and comprehension (summarization, rewriting) (Entwistle and Ramsden, 1983). Intrinsic motivation is also closely correlated with feelings of being in control of one’s learning outcomes, whereas helplessness and futility are feelings associated with perceptions that others wield power, and one has little control over his/her own outcomes. Because these feelings have great influence over an individual’s expectations about future outcomes, this is an extremely important issue, particularly in the context of lifelong learning.

Research also provides evidence of more advanced cognitive and behavioral outcomes yielded by SRL. Such outcomes are identical to the qualities and skills many professions, including medicine, view as most desirable and most effective in individuals within their ranks, such as critical thinking or problem solving (Zimmerman and Paulsen, 1995), moral, emotional and intellectual independence (Candy, 1981), ability to self-assess and self-monitor knowledge and skills effectively (Pintrich, 1995), and a positive perspective about their abilities and their autonomy in controlling and enhancing what they need to learn in a professional work setting (Zimmerman, 2000). Approaches and expectations that encourage intrinsic motivation and student autonomy set the stage for use of self-regulated learning strategies that test how well students can rely on themselves as essential elements in their own learning.

Using the literature above – which defines and describes self-regulated learning characteristics, contexts and outcomes – as a foundation, this study explores links between medical students’ use of self-regulated learning strategies, particularly as they relate to motivation, autonomy, and control, and how these influenced their experiences in medical school.

Methods

The study probed how medical students in two distinct medical school environments were experiencing their curriculum. Interviews were “snapshots” of the students describing their previous and current experiences at a single point in time. The interview-based, qualitative approach is particularly useful for investigating differences between participants’ experiences and outcomes (Sewell, 2005), and for determining how individuals perceive their situations (Krathwohl, 1998).

The protocol was a semi-structured instrument designed to focus on how students thought about and experienced self-regulated learning in a medical student curriculum. Interviewers ($n = 4$) were professionals from a university medical school and school of education, with credentials in higher education and social work/public health. The interviews were conducted at each of the two medical schools and tape-recorded. Interviewers also kept field notes (which were of variable value). Without using the term “self-regulated learning” (i.e., to avoid cuing) the interviews sought to determine what motivated these students to learn, whether they were engaged in specific SRL behaviors, and whether/how their learning strategies changed over time (Table I). From that, the intent was to determine differences in outcomes (i.e., experiences in the curriculum). For some questions, interviewers were given prompts to avoid simple (e.g., “yes” or “no”) answers and to draw more reflective responses from the students, again, without cuing. Students were not discouraged from venturing off-topic, in anticipation that other unexpected, relevant topics might emerge. The interviews ranged from 45 to 90 min.

The medical students interviewed for this study were from two medical schools representing two different approaches to medical education in the pre-clerkship phase: problem-based learning (PBL), which blends constructivist and independent learning pedagogies, and a more traditional approach, which is largely behaviorist (i.e., lectures and objective tests) with some constructivist elements (more active and student-centered approaches, particularly in clinical skills training). The third and fourth years of medical

Table I. Sample of questions from semi-structured interview protocol

| | |
|----|--|
| 1. | What motivates you to learn? |
| 2. | Do you set personal goals for learning? |
| 3. | How do you prioritize what you study? |
| 4. | Do you self-monitor your learning? |
| 5. | Do you use the same strategies now that you did as an undergraduate student? |
| 6. | How do you learn best? |
| 7. | Is medical school what you expected it to be? |
| 8. | Do you think the curriculum is preparing you for lifelong learning? |

school are very similar across most of medical education, blending social learning, situated cognition (apprenticeship) and independent learning pedagogies, with some component of objective testing to assure achievement of intended knowledge outcomes.

The total purposive study sample was 36 students – 18 from the PBL medical school and 18 from the more Traditional medical school (Table II). The schools were chosen because one was representative of a “traditional” approach to learning, and one was representative of a “pure” PBL approach to learning. Also, they were similarly competitive in admissions criteria selectivity and their matriculants were similar in terms of academic preparation (Table III). Volunteers were recruited from both schools; within both sub-samples the subjects chosen were equally divided across level, and gender within each sub-sample was representative of the gender distribution at each school.

For PBL medical students, their first year and a half was a combination of tutorials where they met in small groups and learned the biomedical sciences mostly through solving problems within the context of (paper-based) patient cases. Students were responsible for learning and teaching in their tutorial groups; with some guidance from a faculty tutor, they decided what was essential to learn in order to “solve” the case and then set about to learn it. They were mostly on their own to set objectives, identify resources for learning, learn the material, and teach the material to each other. Assessment was through peer review (each student received detailed feedback from the other members of the group), tutor evaluations (feedback and a grade on a Satisfactory-Unsatisfactory scale) and a series of un-graded indices they could use to measure their knowledge and their clinical reasoning skills. PBL students also had opportunities to begin clinical electives when they first

Table II. Distribution of students interviewed

| | Pre-clinical (early) | Clinical (mid) | Senior (late) | Total Students |
|-------------|-------------------------|-------------------|------------------|-------------------|
| PBL | 6 students | 6 students | 6 students | 18 students |
| Traditional | 6 students | 6 students | 6 students | 18 students |

Table III. Comparison of applicant/matriculant data

| | Applicants | Undergraduate GPA (matriculants) |
|-------------|---------------------------------|-------------------------------------|
| PBL | 3,862 for 138 spaces (28/space) | 3.76 |
| Traditional | 4,479 for 170 spaces (26/space) | 3.73 |

entered medical school, and there were several “blocks” of electives prior to the required clinical clerkships, so they were involved in clinical work at the same time they were involved in learning through their tutorial groups. After completing the series of units covered in the tutorial groups and the electives, students progressed into the clinical clerkships, which were mostly identical in discipline (Internal Medicine, Family Medicine, Obstetrics/Gynecology, Pediatrics, Psychiatry, Surgery) and format (hospital and ambulatory experiences) to the clerkships in the more traditional medical schools except at the PBL school the only grading scale throughout the curriculum was Satisfactory-Unsatisfactory.

In the Traditional program, students spent the first two years mostly in the classroom learning the biomedical sciences mostly from discipline-based basic scientists (first year) and then within some clinical contexts from a combination of basic scientists and clinicians (second year). There was also hands-on laboratory enhancement and some small group discussion. Assessment was mostly through objective, multiple-choice quizzes and examinations. Clinical skills laboratories to learn about medical interviews and physical examination were interspersed throughout both years. The grading scale was Pass-Fail in the first year and Honors-High Pass-Pass-Fail in the second year (clinical skills sessions were Pass-Fail in both the first and second years). The third and fourth years comprised learning in an apprenticeship (situated learning) format through a series of clinical clerkships followed by clinical electives, with students assuming increasing responsibility for patients as their knowledge of clinical care progressed. The grading scale in the third and fourth years was Honors-High Pass-Pass-Fail.

DATA ANALYSIS/CODING

All data analysis and coding was done by the author, who asked one of the interviewers to review the processes used and the results. Each interview was fully transcribed and each transcription was read twice, line by line, beginning with the Traditional pre-clinical students, then the Traditional clinical students, and then the Traditional senior students. The same process and order were repeated with the PBL transcripts.

At this stage, the focus of the transcript review was on tone and reading critically for general relevance to the study research question, and also getting a broad impression of language used by the students – key words and concepts – that could be re-visited in the coding process.

Each transcript was then read a third time for coding and sub-coding. Within each transcript, passages could be selected, coded, and stored within that code. A single transcript passage was coded with as many categories as

was necessary to represent the ideas embedded within it. Once every transcript had been fully “mined” for all potential coding, the data could be reviewed by assigned code. For example, by selecting Motivation (code)/Grades (sub-code) all of the relevant passages would be selected, organized by a list of student identifiers (a unique number for each student with his/her level and a letter representing which school).

Although the original set of coding categories and sub-codes was pre-identified from primary study research question (use of self-regulated learning by medical students), new sub-codes (concepts that seemed important in the study but had not been pre-identified) were added during this coding process.

When the initial coding process for each interview was completed, the coded passages stored in the TamsAnalyzer system were reviewed, grouped within the codes/sub-codes by individual student (anonymous identifier), school (Traditional or PBL), and level (Pre-clinical, Clinical, or Senior). The process used for initial analysis was to look within each code (e.g., Learning Strategies code/self-monitoring sub-code) at Traditional students and then PBL students by level, proceeding in order from pre-clinical, clinical, and finally to senior students. This facilitated comparison of impressions within schools (i.e., level) and across schools.

THEMATIC ANALYSIS

The first step in analyzing qualitative data is that of data reduction (selecting, simplifying and abstracting the data from transcriptions and field notes), the second step is data display (organizing and compressing data to allow conclusions to be drawn), and then actually drawing conclusions “stepping back to consider what the data mean and their implications for the question at hand” (Miles and Huberman, 1994).

After coding, analysis was continued with a review of the passages within each category (e.g., Motivation/Learning), by group (e.g., Traditional pre-clinical), searching for a general tone or theme. Within each group, passages were reduced to 2–3 sentences for each student. For all of the students within each group (so, moving from individual students to all students within a group), a précis of the comments that reflected the general tone of that group related to that particular sub-code was created. The précis was then reduced to a one-phrase or one-sentence theme code. For each, a direct quote that represented the unifying tone of the group (where such existed) was added. The process used to reduce the data within each group and sub-code is shown in Table IV below; sample data display of the précis, representative quote, and theme phrase for one code/sub-code is shown in Table V.

Table IV. Process used for reducing and summarizing data

| Group (1–2) | | Process: Each Student (2–4) | | Process: All Students in Group (5–8) | | | |
|---------------------------|--------------|-----------------------------|-----------------|--------------------------------------|-------------------|-------------------------------------|-------------------------------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| School | Level | Code | Sub-code | Sub-code passage | Summarize Passage | Sub-code Précis | Theme Code |
| Traditional (for example) | Pre-clinical | Learning Strategies | Self-monitoring | 2–4 paragraphs | 2–3 sentences | 2–3 sentences for up to 6 summaries | 1 sentence summarizing Précis |

Results

Students in both programs described themselves as highly motivated to achieve excellent grades so they could successfully matriculate into medical school. Prior to entering medical school, the two groups shared an orientation toward extrinsic motivation based on the indisputable value of grades in admissions processes in most medical schools. It was at the point of entry into medical school that the two groups began having very different experiences. These experiences influenced the students' transitions from their introduction to medical school, through the basic sciences and finally into the clerkship years, revealing important differences between the two groups.

PBL STUDENTS

Although the PBL students were aware that the PBL curriculum would be very different than their previous educational experiences, many of them described a significant transition right at the start of medical school. One student said that in spite of reading extensively about the program, he assumed faculty facilitators in the small groups would at least set learning outcomes, or give the students lists of resources. Instead, they were told it was their responsibility, individually and with their small groups, to define learning outcomes and to identify resources. Several students described how they struggled to adapt their learning strategies, because their undergraduate strategies would not work in the PBL curriculum. One student described how, as an undergraduate, he knew if he went to lectures and studied old tests he would do fine – but PBL was entirely different.

PBL pre-clinical student:

You hear a lot about PBL's curriculum from the outside but you never truly understand what it is about until you get into it. Initially it was difficult not only because it was a new style of learning, but because everything we were learning was new.

Table V. Sample précis, quote and theme

| Learning Strategies | | | | | | |
|---------------------|---|---|--|------------------------------|---|---|
| Setting | PBL Pre-clinical | PBL Clinical | PBL Senior | Traditional Pre-clinical | Traditional Clinical | Traditional Senior |
| Précis | Use objectives to set priorities | Based on time available first and then concepts; group objectives | Patients they are seeing and clerkship learning objectives; address weaknesses and fill gaps | Study everything (1 passage) | Based on exams and patients; difficult to distinguish what's important | Based on patients and attending comments |
| Theme | Objectives | Time, concepts and objectives | Patient care; gaps and weaknesses | - | Clerkship exams and patients | Patients and attendings |
| Quote | "I prioritize based on covering one specific objective first, then another, and so forth" | "Your first priority is to group objectives" | "First I make sure I know what the patients I'm seeing have" | - | "[Priorities are based on] what I need to do to get through the shelf exam" | "[Priorities are based on] what you need to know to present your patient to the attendings" |

PBL students learned to set personal learning goals and priorities, and they constantly monitored their progress.

PBL pre-clinical student:

I will learn something from one resource that's quite comprehensive, and then I'll go to a different resource that covers the same material but lays it out in a different fashion. I go through the second resource to see if I've learned the concepts from the first resource.

At the same time, they were nervous about whether they were learning all they needed to learn, especially in the absence of formal assessments like tests, or grades other than Satisfactory and Unsatisfactory.

PBL pre-clinical student:

Every time I sit down – and I read almost every day – I think the one thing that keeps driving me is this constant feeling of I don't know a thing and there's not some sort of evaluation.

However, as they progressed through medical school, basically after the first semester of the first year, PBL students described a growing sense of comfort with the control and autonomy they now associated with their learning. They knew how to develop broader learning goals and more detailed learning outcomes, both in the groups and individually, and they made independent decisions about resources and methods that suited their individual learning styles.

PBL pre-clinical student:

I really think I have developed the skills to prioritize my learning over the last few months, skills that I thought I had but didn't really have. It was frustrating in the beginning but things are better now.

They described learning because they wanted to learn, and said they were happy they were not learning for a test or competing for higher grades.

PBL pre-clinical student:

Here, I really started to learn because I wanted to learn, not because I was studying for a test. Here I work harder because I want to learn for myself, instead of feeling like I have to get a good mark on the test.

This growing comfort with self-regulated learning translated smoothly from the basic science phase into the clinical phase, as autonomy for learning in the context of clinical care grew and became more complex. And, although faculty preceptors in the small groups had ensured that educational goals were met, the students had controlled much of their learning through finding resources to understand and address clinical problems. Thus, the milieu in the clinical clerkships provided them with similar opportunities and expect-

tations, except now with real patients instead of paper-based ones, and with increasing responsibility for patient care.

PBL clinical student:

I found right from the beginning, right from the groups before getting into clerkships, that this program really helped you learn how to find resources you didn't know, and how to develop an approach to any sort of problem. I find it helpful now during clerkships and I have a feeling it will serve me well later on.

Clinical and Senior PBL students spoke about how clerkship evaluations were facilitative rather than punitive, how feedback helped them to monitor and adjust as needed, and how in the absence of competition for grades they could focus on learning, and specifically on achieving learning goals they had set for themselves.

PBL clinical student:

“Here you have a bunch of students less driven by getting a higher mark than their buddy, and more driven to be competent.”

Because of early electives where they had carried some responsibility almost as soon as they entered medical school, by the time they began clerkships the clinical culture was familiar and comfortable, as was their role within it. They felt able to “put it all together” as they tackled clinical problems in this environment, setting goals and priorities for learning, and monitoring their own progress in addition to receiving and using feedback to adjust their approaches and address their weaknesses. They expressed satisfaction with the increasing autonomy their skills earned them in this setting, and confidence drawn from their own self-monitoring and from feedback from physicians that they possessed excellent skills. They were satisfied with and very positive about their education, and felt well prepared to transition to residency.

PBL senior student:

How I know if I am learning and progressing is when I am seeing patients and I feel comfortable managing the patient; I know what is going on from the physiological point of view, the pharmacological point of view, from the treatment standpoint. I felt that I can actually make this person's stay here comfortable and actually make the person healthier.

TRADITIONAL STUDENTS

Many of the Traditional medical students interviewed for this study described the first two years of medical school as similar to undergraduate school, except with more to learn in the first year, and even more in the second year. Strategies they had used for learning and studying as under-

graduates served them pretty well in the first two years, once they understood – as one student put it – that there was no free time. However, although they described having to memorize huge amounts of material, none described specific strategies for setting goals or priorities, or for monitoring their own progress.

Traditional clinical student:

“It was harder in the sequences that had only one exam, because then I’d have to go in blind and hope I’d studied enough.”

Several of them relied on the faculty to tell them what they needed to learn, and on the weekly quizzes and end of course examinations to tell them if they had succeeded.

Traditional clinical student:

I don’t really have any internal checks. I don’t think I had my own learning objectives apart from what they (the faculty) said, because I don’t think I know what I need to know. I just trust the faculty.

A substantive change between the first and second years for the Traditional students was a switch from Satisfactory and Unsatisfactory grading to Honors, High Pass and Pass grading. The increase in material to be learned and now a more discriminating grading system motivated some of the students to focus their studying on what would be on the upcoming quiz or exam.

Traditional pre-clinical student:

“I would just try to cram in the material for the quiz and take the quiz and try to pass it and that is all I had to do.”

Several students said that if they passed the quiz or exam they kept moving forward, focused on upcoming assessments. Some of the students said they were motivated chiefly by their desire to achieve an Honors grade, and one of the students described how classmates now competed for grades and challenged the faculty on quiz and exam questions because a few points here and there might ultimately make the difference between a High Pass and an Honors grade.

Traditional pre-clinical student:

“It is just a matter, in second year, of clawing more for that extra point because that extra point might tip you over from High Pass to Honors.”

Unlike the PBL students, the Traditional students described a more major transition from the second year of medical school into the third year clinical clerkships. This new and largely unfamiliar environment was very different from the first two years. They perceived some expectation that they had already made a developmental shift that enabled them to synthesize their previous learning with patient care, and some need for more preparation with feedback from faculty.

Traditional clinical student:

Maybe lacking was some more physical diagnosis type of skills. You have a lot of time to practice your clinical skills in the third and fourth years but very little of that is supervised. Maybe learning more of these skills earlier, in small groups and getting feedback from faculty, that would be beneficial before you are set loose third year.

They described frustration with not knowing what they didn't know, and with insufficient information about what they needed to know to improve their performance. They also described frustration with expectations that were implied but not specifically articulated, as they struggled to understand the clinical culture and their role within it, all the time worried about how they were perceived by those in power who determined grades. The learning techniques they had used in the first two years were only partially applicable, their clinical skills only partially learned, and the knowledge they had gained from all their studying only partially remembered. Some students reported the clerkships as "scary" in that they did not know what to study and found it difficult to prioritize when they could not distinguish what was important from what was not.

Traditional clinical student:

I really had no clue how I was doing performance wise and I had no clue how to improve; I'd ask questions and get one or two word answers. The grades were really poor compared to how I thought I was doing and I had no idea. It's kind of frustrating.

With what they described as insufficient and inconsistent feedback to guide them, most focused their learning on the two things they knew were stable in each of the clerkships: patients and exams. This left them with a lot to study, which was not unfamiliar by now, but with clerkship responsibilities they also had limited time to study. Some of them said they were still very focused on grades, and they eventually realized it was up to them to figure out what to study and how to compete for Honors.

Traditional clinical student:

Second and third year, your personal goals are how many Honors do you want to get, or High Passes or Passes, and of course a Pass makes most people in medical school feel like they got a Fail. In third year you just hope you can pull it off, because grading is very subjective.

In spite of the rough transition from the pre-clinical to the clinical phase described by the Clinical and Senior Traditional students, a few of them described having made a transition from dependence on others to independence – they were beginning to feel prepared to take responsibility for

learning what they needed to learn to be good house officers and good clinicians.

Traditional clinical student:

I am looking more toward my residency and being a good clinician, a good house officer, knowing that I'll be competent and comfortable doing it. My goals for the fourth year are to learn what I need to know. I want to do well in the rotations, but whatever (grade) they put on paper won't matter as much as knowing I did a good job and I learned what I needed to know.

SUMMARY OF RESULTS

Although both groups of students expressed similar motivation (good grades) as pre-medical students, and both groups felt prepared to begin their residencies, the PBL and Traditional students described two very different medical school experiences.

The PBL students had a somewhat rough transition into medical school, but once they felt comfortable with the autonomy and control they had been given for their own learning, they embraced the independence and responsibility. They found themselves motivated to learn for learning's sake, and able to channel their motivation into effective transitions from the classrooms into the clerkships. They expressed a high degree of satisfaction with their program and the faculty who taught them.

The Traditional students had a rougher transition from the classrooms to the clerkships. In the first 2 years they had relied on the faculty to direct and control their learning, and they had channeled their motivation toward the highest grade. In the clerkships, they found faculty expected them to be more independent and self-directed than they felt prepared to be, and they struggled to find their place and assume responsibility for their learning. The struggle left some of the students blaming the program and the faculty for a difficult experience, and one that might have cost them an Honors grade here or there.

Discussion

Because of the importance medical schools have placed on skills for self-regulated learning that will be vital for lifelong learning in medical practice, this study was conducted to explore medical students' experiences with self-regulated learning in two different medical education programs. As expected, the two groups of students described very different perceptions about regulating their own learning, and the role the medical school played in helping them learn how to self-regulate. What was even more interesting, however,

was how self-regulated learning actually influenced students' experiences and transitions in medical school.

The PBL students described a substantive pedagogical shift during their first year from traditional science programs in large universities to problem-based learning in medical school. In addition to the pedagogical shift, they had to shift their learning strategies from reading/memorizing to problem solving, and shift their role as learners from passive/dependent to active/independent. Most of them described feeling reasonably comfortable with this three-pronged shift by the end of the first term of medical school, although they felt precious time had been wasted as they struggled through that term, trying to master techniques needed to engage in PBL. The next pedagogical shift for the students was in the third year – from problem-based learning to situated/apprenticeship learning. However, the learning strategies and active approaches these students now felt they had mastered worked well in the new learning environment, allowing for a smooth transition from classroom to clerkships.

PBL was developed to help students learn medicine by solving problems because that is what practicing physicians *do*. However, added benefits to this approach for the students in this study included learning strategies and learner roles that required students to regulate their own learning. Physicians do not just solve problems, they often solve problems and make decisions independently, and they must assess and weigh all kinds of complex evidence to do that effectively. As the students became more deeply involved in solving problems, they also became more and more independent, albeit in a framework that assured they were meeting the medical school's standards for learning. This independence, or autonomy, is an expectation in clinical clerkships, where increasingly busy faculty have little time to teach students how to synthesize and evaluate, higher order skills that can be learned in the first two years of medical school. The PBL students in this study, once they reached clerkships, were prepared to function effectively as clinical clerks. They could regulate their own learning, find and assess resources and evidence, and progress fairly autonomously with some level of feedback to help them monitor their progress.

The Traditional students described a fairly smooth transition into medical school, mostly because the traditional medical curriculum is not unlike the traditional college curriculum, a lot of which occurs in the lecture halls or classrooms. In these programs students are passive recipients of knowledge – they do a lot of memorizing and applying basic principles to problems defined by faculty – and their role as learners is mostly passive/dependent. The more Traditional medical curricula were designed to arm medical students with a formidable foundation of knowledge to be deployed as they begin caring for patients in the clerkships. Courses in the first two years are

rigorous in volume, and expectations for students – made explicit through quiz and examination format – were often aimed at the lower levels of the cognitive domains (memorizing, defining, and applying) rather than the higher levels (analyzing, synthesizing, and evaluating). Most importantly, the primary role of the students was to construct and add to their “knowledge databases,” thus they become dependent on faculty and on the traditional assessments (e.g., multiple choice questions) for everything else related to their learning. This dependency also allowed the Traditional students in this study to focus their energies on grades, something they could control. If they mastered enough facts and understood basic principles sufficiently, they could achieve Honors, just like they did as undergraduates.

The substantive shift for the Traditional students in this study happened in the third year where – like the PBL program – pedagogy changed to an active apprenticeship model. Unlike the PBL students, however, several of the Traditional students described feeling ill-prepared and even lost when they started clerkships. They expected clerkship faculty to act like faculty in the first two years – directing what they needed to learn, providing detailed syllabi, and controlling what happened in the learning environment. However, faculty on the clerkships expected students to take responsibility for a lot of their own learning. The students expected faculty to tell them exactly what they needed to do to get an Honors grade, however, faculty expected student motivation to be based on what they needed to learn to be excellent physicians, not on what grade they wanted to be assigned. The Traditional students had lost what little control they had – no amount of memorization was going to assure them an Honors grade on any of the clerkships. Their fear and angst was not unlike what the first year PBL students had experienced; however, the Traditional students had the additional pressure of competing for High Pass and Honors grades.

Although every clinical student in the Traditional program interviewed in this study talked about “no feedback at all” or “zero feedback” on the clinical clerkships, the problem might have been more a mismatch between student and faculty expectations. Because of the students’ dependence on the faculty to take primary responsibility for their learning rather than assuming responsibility for themselves, and their focus and motivation on grades rather than learning, it is possible the students did not recognize or maybe did not understand the feedback they received. So in a very real sense the students were correct; they were not prepared to begin the clerkships, and – at that point – in no way prepared for lifelong learning.

If medical schools want to achieve success in helping their students begin assuming the responsibility and autonomy for learning expected and indeed required as they become medical professionals, they can take a few specific steps. Formal and specific intended learning outcomes tell the students what

the faculty expects them to learn. Such outcomes can describe SRL skills and attitudes and can be reinforced with opportunities for learning and practicing SRL, role modeling, and feedback organized around the outcomes. Learning SRL can be integrated across the educational program, rather than compressed into the clinical years. This does not require re-inventing the wheel or adopting a PBL curriculum. Research by Pintrich (1995), Paris and Paris (2001) and many others (e.g., Hagen and Weinstein, 1995) tells us that self-regulated learning and self-assessment not only enhance learning, but pedagogy to foster these skills can be successfully implemented in the educational setting. Students need choices about and control over or responsibility for their own learning if self-regulation is to be mastered (Hagen and Weinstein). When learners rely on others for their learning they look for cues about what to learn and how to learn it; they focus on trying to figure out what teachers want from them, and on what they will be assessed. This is poor preparation for independent, lifelong learning.

Lifelong learning will require reflection and decisions about strengths and weaknesses; in training these do not and should not occur in a vacuum. Students need feedback about their progress against which to gauge their own self-assessments and plan adjustments they need to make to reach learning or mastery goals. Scores on quizzes and examinations are sufficient to tell students whether they are memorizing or comprehending information and concepts correctly, but these are lower order cognitive skills that do not automatically advance learners to higher order skills such as analysis, synthesis and evaluation. Self-regulated learning helps students take responsibility for their own learning, and helps them change from a focus on external measures (e.g., faculty and grades) to a focus on learning. Self-regulated learners can effectively use a broad array of measures – internal and external – to guide and enhance their own education. This approach can help smooth out the transitions through medical school by preparing first and second year students for expectations in the third and fourth years. Steps like these can maximize learning in the clinical milieu, and prepare medical students for a lifetime of learning.

Study Limitations

This study compared two similarly competitive medical schools whose students had above-average undergraduate GPAs, and whose admissions criteria included undergraduate performance (GPA), interviews, and personal essay (the Traditional school also used MCAT scores). This was done purposely to match as closely as possible (in terms of preparation and academic performance) students in the two schools. To the extent that student demographics were different and such differences relate to experience, their experiences with self-regulated learning might be different as well. Also, the

two schools had adopted curricula at two ends of a medical education spectrum: mostly traditional (classroom/lecture-based in the first 2 years) and collaborative/independent (problem based learning in the first 2 years). Many schools have now adopted “hybrid” curricula (elements of traditional approaches and elements of PBL in the first 2 years); students in such programs might have different experiences with self-regulated learning than those reported in this study.

A major finding was links between self-regulated learning (as defined in the educational psychology literature) and curriculum pedagogy, revealed through interviews with two groups of medical students. However, pedagogical approaches are often interwoven with assessment formats and with grading schemes, so sometimes it is difficult to separate completely the two (especially in terms of motivation) and their influences on student experiences.

Finally, although none of the students in the Traditional program said they chose their school because of its approach to learning, some of the students in the PBL program indicated they chose that school specifically because of the PBL approach to learning (in which self-regulated learning is integral). Thus, there might have been some level of selection bias with the PBL students.

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