LITERATURE ASSESSMENT

Do We All Mean the Same Thing by "Problem-based Learning"? A Review of the Concepts and a Formulation of the Ground Rules

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ABSTRACT

Problem-based learning (PBL) has emerged as a useful tool of epistemological reform in higher education, particularly in medical schools. Indeed, PBL has spent most of its career inducing revolutionary undergraduate medical reform. Nevertheless, obtaining informed agreement on the characteristics of the PBL "genus" is a challenge when the label is vulnerable to being borrowed for prestige or subversion. Many "PBL" single-subject courses within traditional curricula do not use PBL at all. Such semantic uncertainty compromises the evidence-base on the added value of problem-based versus traditional approaches and the main messages for good practice. This literature review explores what is meant by the term PBL by aiming to answer the following questions: What difficulties are inherent in the "problem-based" tag? What does the term "problem-based curriculum" imply? How has PBL been characterized and validated by focusing on its purpose? How else has PBL been characterized? How does PBL relate to problem solving? How does PBL relate to epistemological reform? In conclusion, what ground rules can be formulated for PBL? Despite much conceptual fog lingering over the PBL literature, useful ground rules can be formulated. Acad. Med. 1999;74:178-185.

As higher education curricula reorient toward lifelong learning and different notions of knowledge,[1] problem-based learning (PBL) has emerged as an important reform tool with an impressive record. Margetson noted that undergraduate medical education provides the best examples of PBL in this higher education reform role.[2] Pioneered in the North American medical schools of Case Western Reserve University and McMaster University in the 1950s and 1960s, respectively,[3] PBL has ar-guably been *the* most important innovation since educational institutions became responsible for professional education.[3,4]

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Barrows and Tamblyn collaborated to promote and develop PBL at McMaster in response to the impoverished knowledge-base that medical students accrued during their neurology clinical clerk-ship.[5] Presenting PBL as a (not the) major method for undergraduate medical education, Barrows saw it as a way for students to integrate knowledge across subject boundaries and develop problem-solving skills. Schmidt described Barrows' unique contribution as recognizing the potential for students to blend new information from external sources with their existing knowledge, and with its application. PBL differed from the educational concept called discovery learning, in which students tackle a problem by sharing prior knowledge with their peers, and discovering new perspectives without reference to external sources.[6] PBL also moved on from the educational approach called case study, which focuses on students applying new learning to a problem *after* knowledge acquisition[6] Within a decade, many other professional curricula (e.g., nursing[7] and engineering[8]) and other medical schools (including pioneers Australia's Newcastle and Limburg/Maastricht) had adopted PBL.[3]

PBL remains innovative.[9-11] Nevertheless, its definition is elusive, [4,12,13] and its relationship to problem' solving is unclear. To characterize PBL involves deconstructing inherent notions of knowledge and thinking, and unraceling semantic knots. This literature review explores what is meant by the term PBL by aiming to answer the following questions:

- What difficulties are inherent in the "problem-based" tag?
- What does the term "problem-based curriculum" imply?
- How has PBL been characterized and validated by focusing on its purpose?

- How else has PBL been characterized?
- How does PBL relate to problem solving?
- How does PBL relate *to* epistemological reform?
- In conclusion, what ground rules can be formulated for PBL?

Key publications were identified by searching English-language abstracts from Medline (1990-97), the Educational Resources Information Center (ERIC) (1983 through September 1997), and the British Educational Index on International ERIC (1976-97). Searches were conducted using variations on keywords such as "problem-based learning" and "problem-based curricula" combined with keywords such as "concept," "educational change," "epistemology," "philosophy," and "review." To balance the avoidance of ascertainment bias with pragmatism, papers relevant to undergraduate medical education were selected if their titles or abstracts suggested that they analyzed the nature of problem-based learning/education in-depth theoretically or empirically. From the bibliographies of these articles, further publications, including book contributions, were identified.

what difficulties are inherent in the "problem-based" tag?

PBL is a recycled idea[14] with an identity crisis. Like its parent approach, experiential learning, PBL has been used to describe heterogeneous educational activities. Even Barrows doubted those people who, by asserting that they used the very same approach, professed to understand his method.[15] Barrows considered his own PBL to be merely a species in "a genus for which there are many species and subspecies."[13,p.485]

Few rationally agree on the basic characteristics of the PBL genus. The label is borrowed for prestige or subversion, adorning many narrowly-focused "PBL" single-subject courses within traditional curricula that do not use PBL at all. Indeed, subversive language games potentially contribute to the failure of curricular reform.[16,17] As noted in Schwartz and colleagues' refreshingly honest exposé of the failed attempt at comprehensive transformation to PBL at New Zealand's Otago Medical School, the staff spoke the language of PBL yet meant very different things.[16] Schwartz and colleagues recognized in this the cosmetic .response of "conciliation" (as described by Pitman[17]). The staff were rationalizing differences between previous practice and that pro-posed by innovators so that, while educational terminology was modified, educational practice changed little.

Various claims are made for PBL concerning gains in knowledge, under-standing, and thinking. Margetson distinguished between PBL and the more traditional subject-based learning by their different conceptual origins of knowledge, understanding, discovery, and education.[18] Margetson preferred "problem-focused" to "problem-based," but acquiesced to the latter's popularity.[1] He considered problem-*based* to imply foundationalism; that is, certain knowledge is a prerequisite (foundation) for learning other knowledge,[2] as in "theory before application" curricula exemplified by the preclinical/clinical divide in traditional undergraduate medical curricula. Naive Western notions of foundations, certainty, and separateness of knowledge thwart attempts at educational reform, maintain subject divisions, and en-courage such either/or pairings as liberal/vocational,[19] pure/applied, and theory/practice.2 Higher education then clings to the former word in any pair and government to the latter, both claiming foundational priority.[2] An un-helpful fact/value dichotomy is also encouraged, which "masks other vital qualities of educative teaching and learning. Qualities of critical, reflective, imaginative and sensitive thinking do not appear simply to be matters of 'fact,' and therefore one seems forced to regard them somehow as matters of value."[2,p.16]

The word "problem" itself raises dis-quiet,[19] not least because of its negative connotations, and the way in which it is characterized tends to reflect whether authors equate PBL with problem solving. Barrows and Tamblyn described the PBL "problem" as "an unsettled, puzzling, unsolved issue that needs to be resolved."[5,p.18] Dolmans and Schmidt described it as a "set of phenomena in need of some kind of explanation. It is a situation that is unacceptable and needs to be corrected."[21,p.372] Others focused on scenarios that, to be understood, re-quire learning (rather than solutions).[22] Walton and Matthews summarized the nature of the PBL "problem" as "a set of circumstances in a particular setting which is new to the student, where the use of pattern recognition alone is in-sufficient, but where specific items of knowledge and understanding have to be applied in a logical analytical process in order to identify the factors involved and their interaction."[20, p. 543] While preferring terms like "learning in a functional context," "task-dependent learnning," and "problem-generated leaming,[1]' they accepted that "PBL" was entrenched and quoted Simon (who was referring to another unwanted label): "It may be easier to cleanse the term than dispense with it,"[23]

In summary, there are some semantic reservations about the "problem-based" tag, arid "PBL" is open to misappropriation beyond the limits of acceptable variation in its practice and philosophy. Nevertheless, rather than . being re-placed, maybe the term can be reclaimed, perhaps through reaffirming its basic characteristics.

WHAT DOES THE TERM "PROBLEM-BASED CURRICULUM" IMPLY

"PBL" and "problem-based curriculum" are often used interchangeably, the former being applied to isolated methods for parts of curricula and individual subjects and to guiding philosophies for whole curricula ("problem-based curricula").

Ross distinguished three overlapping types of problem-focused curricula in terms of their process and philosophy":

• In problem-based *curricula,* students work wholly or partly on relevant problems.

- In *problem-orientated curricula,* con-tent and method are selected using such problems.
- In problem-solving curricula, problem-solving skills are addressed specifically, requiring prior knowledge about the problem.

Problem-based curricula vary according to the method of selecting problems and identifying resources, the purpose and format of problems, and the specific processes.[24] As Ross highlighted, in "the most significant approach"[24,p.36] to problem-based curricula, knowledge arises *form* working on a problem rather than, as with problem-solving, being a prerequisite *for* working on a problem.[24] Engel summarized the essential characteristics of a problem-based curriculum differently," describing it as cumulative (repeatedly reintroducing material at increasing depth), integrated (de-emphasizing separate subjects), progressive (developing as students adapt), and consistent (supporting curricular aims, e.g., self-directed, adult learning for understanding, through all its facets). Implicitly, the methodological and philosophical mainstay of Engel's problem-based curriculum is PBL.[25]

In summary, combining Ross's and Engel's definitions, problem-based curricula can be defined largely philosophically. First, knowledge is acquired in an active, iterative, and self-directed way, predominantly by working on a progressive framework of problems unconstrained by subject divisions. Second, acquiring new subject knowledge is not the starting point for learning. Third, process details may vary but only *within* this philosophy, which should not be undermined by other curricular elements.

HOW HAS PHOBLEM-BASED LEARNING BEEN CHAHACTERIZED AND VALIDATED BY FOCUSING ON ITS PUHPOSE?

Norman and Schmidt highlighted the irony of medicine, which is grounded in scientific method, strongly supporting PBL when, at a whole-curriculum level, the evidence to recommend PBL over traditional approaches is controversial.[14] Even without compelling evidence, however, perhaps it is progress to reach the standards required for good medical practice by the more humane and enjoyable route provided by PBL. The evidence supporting PBL is tantalizing but undermined by the diverse goals in use. From cognitive psychology, Norman and Schmidt[14] distilled three likely roles for PBL from, respectively, research on (1) memory, (2) problem solving and case-based reasoning, and (3) the "instance" theory of concept formation and categorization; that is, acquiring

1. factual knowledge in context: activating prior knowledge, elaborating knowledge (discussion, note taking), matching context lo facilitate recall;
2. principles transferable to other problem solving: via two prerequisites: (1) learners knowing little of the do-main of the solution or underlying principle (no advance organizers, Insufficient prior knowledge for initial understanding); *(2)* immediate feed-back after working through the problem;
3. prior examples: by accumulating many instances for use in future practice.

Engel[25] attributed two aims for a curriculum that is driven by PBL. The first is to provide a method by which students become capable in generalizable competencies; for example, to deal with change, to tackle problems and unfamiliar situations, to reason critically and creatively, to be holistic, to be empathetic, to collaborate in teams, and to learn by self-direction. The second is to provide a philosophy of adult learning conditions for cognitive and affective elements (by being active, integrated, and cumulative, and by focusing on understanding).

Barrows[11] gave the four main objectives of PBL as structuring pf knowledge in clinical contexts, clinical reasoning self-directed learning skills, and intrinsic motivation. He believed that students progressively meet these objectives by moving through the following taxonomy:

- Lecture-based cases: cases are used to demonstrate the relevance of information provided by lecture.
- Case-based lectures: cases are used to highlight material to be covered in the subsequent lecture.
- Case method: cases are studied in preparation for class discussion, a traditional approach in law and business education. (The cases organize and synthesize material to direct the application of learning.)
- Modified case-based method: cases provide opportunities for deciding between a limited number of options for action (clinical inquiry and/or clinical intervention).
- Problem-based learning: cases are used in a problem simulation format encouraging *free.* inquiry.
- Closed-loop, or reiterative,

problem-based learning: a reflective phase complements the problem-based format.

Only the last—closed-loop PBL—potentially achieves all four of Barrows' objectives,[13] so this taxonomy is "as much a taxonomy of teaching-learning methods, within which problem-based learning fits, as it is of problem-based learning iself."[24,p.38] In other words, Barrows' taxonomy may be *a* self-fulfilling analysis that uses his own objectives to justify the supremacy of "closed-loop" PBL,[24] ostensibly uniting educational approaches sharing use of problems. Nevertheless, Bairows[1] taxonomy drew useful distinctions in a confused field.

Despite semantic uncertainty and different study designs, there contemporaneous reviews of two decades of literature were cautiously optimistic about the effectiveness of PBL in undergraduate medical education compared with traditional approaches.[4,26,27] While more robust evidence is needed,[28,19] PBL has survived unprecedented scrutiny in undergraduate medical education.

In summary, PBL Is both method and philosophy with the purpose of promoting efficient knowledge handling and transfer in a stimulating context.

HOW ELSE HAS PROBLEM-BASED LEARMNO BEEN CHARACTEHIZEDT

In his explanatory text for students, Woods distinguished PBL and subject-based leaming[30]:

- Problem-based learning is driven by problems, from which students identify and pursue their own learning needs and then reapply what they have leaned to the problem.
- Subject-based *learning* uses problems to illustrate the application of knowledge after students have learned as directed by others.

Subject-based learning is intuitively suspect. "How can subject-based learning be considered efficient in the long run if patients do not present themselves as isolated examples of information from one discipline?"[5,p.12]

The PBL literature is understandably bedeviled by the practical and philosophical constraints of discipline-specific labels and "preclinical/clinical" terminology. Even Barrows' pioneering work originated in a neurology clerk-ship. The McMaster factor, however, is undeniable. Woods acknowledged the medical school's influence on his approach, as a chemical engineering academic at McMaster, i.e., focusing on "self-assessed, serf-directed, interdependent, small group PEL"[30,p.ix]

Norman's description of PBL as learning on a "need to know" basis is simplistic but useful. "PBL is simply a case of learning 'stuff as the [students work their] way through a clinical problem. . . . Some of it is the usual stuff of medicine—Krebs cycles and [Star-lings] Laws. However, the problem is unbounded, and the stuff also encompasses epidemiology, psychology, pharmacology, and just about any other -ology you care to name." [12,p.2] To refine the characterization of PBL beyond "learning stuff" raises difficulties, and differing stances on problem solving become notable.

Two of the three previously mentioned systematic reviews of PBL versus traditional approaches selected literature according to working definitions,[4,26] and all three emphasized different characteristics [4,26,27] : Albanese and Mitchell [4] highlighted using problems before, not after, learning baste concepts; using problems that do not provide or synthesize all the information needed to salve the problem (at least initially); and using problems to focus and integrate learning of basic science, clinical knowledge, and clinical reasoning (citing Walton and Matthews[20]). Vernon and Blake[76] defined a method of learning focused on using real or hypothetical clinical cases, small-group work, collaborative independent study, hypothetico-deductive reasoning, and faculty direction that is about process not imparting information. While Berkson[27] did not rehearse this particular semantic debate, she described PBL as an alternative to the first two traditional basic science years, using student-led small-group work facilitated by tutors (not providing information} to stimulate hypothetico-deductive problem solving.

Boud and Feletti[1] gave a more process-oriented explanation of the main components of PBL. PBL work involves only one problem at a time. Stimulus material, usually interdisciplinary, sets the context A tutor, usually "non-expert," facilitates small-group work. Students are not told how to approach the problem, but resources are available for its clarification. Learning objectives are generated and researched by the students. The explicit complementary assumptions were that students want to solve problems, the curricular cote comprises a framework of problems stimulating and focusing learning (replacing exposition of disciplinary knowledge), and learning is reapplied to the problem.

Walton and Matthews[20] synthesized the components of PBL in three categories. First, PBL has essential characteristics: curricular organization around problems—not disciplines, integration of basic and clinical sciences, and emphasis on cognitive skill as well as knowledge. Second, it has facilitating conditions: small-group work, student-centered, active learning, independent study, simulation, and problems comprising relevant, high-priority, community-oriented issues. Finally, it has facilitated outcomes: functional knowledge, motivation, lifelong-learning skills, and self-

assessment skills.

For the process of PBL, Schmidt described the "Seven Steps"[31,32]: (1) clarifying and agreeing on working definitions of unclear terms/concepts; (2) defining the problem(s), agreeing which phenomena require explanation; (3) analyzing components, implications, suggested explanations (through brain-storming), and developing working hypotheses; (4) discussing, evaluating, and arranging the possible explanations and working hypotheses; *(5)* generating and prioritizing learning objectives; (6) going away and researching these objectives between tutorials; and (7) reporting back to the next tutorial, synthesizing a comprehensive explanation of the phenomena, and reapplying synthesized newly acquired information to the problem(s).

Walton and Matthews produced an enhanced set of steps[20]: (1) addressing realistic problems; (2) applying prior knowledge and experience; (3) rehearsing a logical, analytical, scientific approach; (4) identifying learning gaps and perceiving ignorance as a challenge, not as something shameful; (5) recognizing that learning is never finite and needs to be shared; (6) discussing the relative values of information sources, and presenting to and questioning others; and (7) applying knowledge to the original and new problems. Clearly, definitions of PBL will vary with intended goals and settings. True" PBL is synonymous with a problem-based curriculum, being a comprehensive curricular strategy and not just a method.[20,25] Oversimplifying the essence of PBL to convince potential detractors can be counterproductive. While outlining innovative educational approaches to a general medical audience, Lowry implied that "PBL" is jargon masking a simple concept.[33] At-guably, however, one person's topic-specific language may be another's jargon; the audience rather than the term could be more accommodating, To justify Lowry's consequent assertion that, for the United Kingdom, PBL is already in use by "most medical teachers,"[33,p.38] the defining boundaries of PBL are stretched beyond utility.

In summary, PBL implies that knowledge is acquired, synthesized, and appraised out of working through and reflecting upon—in facilitated small-group work and self-directed learning— a progressive and stimulating frame-work of context-setting problems.

HOW DOES PROBLEM-BASED LEARNING RELATE TO PROBLEM SOLVING?

The hypothetico-deductive model of clinical reasoning,[34,35] as championed by Barrows for medical students,[36] has been used to advocate "serial questioning-justification-interpretation" educational approaches,-" but needed adapting to address criticism.[38,39] The potential for PBL to develop such problem solving[5,13] has also been doubted.[5,13] The medical literature attributes the hypothetico-deductive model of systematically generating hypotheses (guided by probability, serious-ness, treatability, and novelty[40]) and testing hypotheses to Elstein and colleagues' empirical work on clinicians' reasoning strategies to reduce uncertainty.[40,41] It was used to counter the "progressive constraint-seeking inquiry strategy generally taught by medical schools,"[40,p.91] but Elstein has subsequently highlighted the model's "vicis-situdes."[39,p.121] The model's relation-ship with the concept of clinical judgment is highlighted, dependent as it is on clinical experience, problem complexity, and setting.

The empirical evidence[38,39,42] suggests that clinical experts use forward reasoning (i.e., from data to diagnosis)[43] with familiar problems, thus matching the current case by pattern recognition with previous cases and retrieving the relevant knowledge. The backward reasoning hypothetico-deductive model (i.e., from possible diagnosis to expected data) involves working back-wards from a hypothesis to find confirmatory or falsifying data. This more time-consuming approach is used by novices, but experts resort to it when outside their expertise or with complex problems or settings. Indeed, Norman and colleagues showed that, compared with novices, when diagnosing complex cases, clinical experts mix forward and backward reasoning, generate multiple hypotheses, rely more on scientific principles, and "chunk" data around these.[38] Experts' experience[44] and the quality of their diagnostic hypotheses characterize their problem-solving abiliry,[34] with efficient retrieval and processing of con-tent-knowledge being crucial. "[W]e have [not] identified general, problem-independent strategies related to expertise. Rather ... the result of an expert's comprehensive knowledge base is a judicious and comprehensive choice of alternative diagnosis and a highly efficient search for additional data to use in ruling in or out competitors….To observe expert problem solving, it is essential to place the expert in a setting in which the routinized shortcuts will *fail*"[38,pp.119-20]

the role of PBL in facilitating clinical problem solving also has its vicissitudes. Norman challenged the "from carpentry to cardiology"[22,p; 279] assumptions about problem-solving skills, doubting their existence in this quixotic search if skills were general strategies, applicable in various situations, and independent of specific situational knowledge.[12,22] Norman also considered that "PBL as an instructional strategy is unrelated to the learning of problem-solving skills…the majority of problems in clinical medicine are solved through mental strategies that do not fit into the conventional definition of 'problem-solving skills'…. It is unlikely that the process. of working through the problem adds to 'any repertoire of general problem-solving skills."[22,pp.279,283] Indeed,

Norman also noted that "The expert is an expert primarily because he has seen it all before."[12, p.2]
Supporting this, Berkson found no evidence for problem-solving skills being acquired better in problem-based rather than traditional curricula.[1'] She concluded that problem-solving skills and their- communication develop serendipitously in such curricula.[27] Norman found it ironic that PBL might emerge as the way to learn problem solving, but for the wrong reasons; that is, not by affecting the problem-solvingprocess per se but by making knowledge more accessible to it.[34] PBL has been used 10 address problem-solving skills specifically with new medical sru-dents,[45] but this is unusual.
Conceptual and technical difficulties with problem solving are compounded by terminology. Berkson admitted that prevailing definitions are inadequate guides to develop tools for measuring, let alone tools for teaching problem solving.[27] Semantic discomfort when relating problem solving to vocational practice or PBL is not, however, exclusive to medicine. Describing an undergraduate agricultural curricular review lo introduce experiential learning, for example, Packham and colleagues preferred the term "situation improver" to "problem-solver," emphasizing that single solutions do not characterize complex projects.[46]
In summary, the definition and tools for measuring problem solving are poorly developed. If PBL does enhance problem solving, this may well be by improving accessibility to knowledge rather than improving the process itself.

HOW DOES PROBLBM-BASED LEARNING RELATE TO EPISTEMOLOGICAL REFORM?

Margetson considered PBL to be a tool of reform at many levels.[2] PBL potentially redresses, for example, the "triple bind" in higher education in Australia, New Zealand, and United Kingdom of "self-defeating government educational reform policy, unconvincing grounds for resistance to reform in higher education, and a mainly hostile relation between the two parties inhibiting serious dialogue and effective cooperation."[2, p. 9] Boud and Feletti commended PBL's harmony with adult learning theory, emphasis on acquiring learning skills (not the impossible, ever-growing knowledge-base), high face validity, responsiveness to changing professional practice, and flexibility.[3] PBL embodies "andragogy"[47,48] in helping learners lo learn actively using process-oriented, rather than content-oriented, approaches, thus addressing core criticisms of traditional approaches. Margetson noted that PBL potentially fulfills Biggs' four crucial criteria for a deep approach to learning: a well-structured knowledge-base, learner activity, learner interaction, and motivational context.[2] PBL also prepares professionals to tolerate uncertainty and work with probabilities.[20] PBL aims for efficient acquisition and restructuring of knowledge, e.g., demonstrating relevance in context, and fostering semantic networks and internal motivation (epistemic curiosity).[49]
For efficient learning, Halpern highlighted the potentially positive role of prior knowledge, metacognition (knowing what we know), meaningfulness of material and subsequent knowledge, and the potentially negative role of prejudices (stereotypes),[50] and these factors can be tackled using PBL. Halpern emphasized the centrality of activating prior knowledge: "We build on the knowledge created by others to create new knowledge."[50, p. 5]
Halpern found lack of knowledge in students less disturbing than them being metacognitively challenged, e.g., betraying superficial understanding by scattering labels rather than insights into discussion.[50] Problem-based undergraduate medical curricula have had a turbulent reception related to their knowledge perspective and aspirations. They are not afforded the automatic legitimacy of their traditional counterparts. Even new problem-based medical schools (which should encounter less resistance than traditional medical schoob[51] undergoing comprehensive conversion, e.g., Sherbrooke[52] and Hawaii[53]) can slip backwards towards classical didactic teaching when early pioneers leave[54] Public assurances of support for PBL can prove leas forthcoming in practice.[55] Glick likened PBL to experimental new drugs that receive overly enthusiastic early reports until side-effects supervene,[56] a rather harsh critique given PBL's decades of history and its more considered educational foundations compared with traditional approaches: "Problem-based learning b not a mere method to be taken up and discarded as just another passing fashion" [25, p. 31]

Woods described a grieving process expected from changing to PBL.[30] Margetson questioned the "remarkably strong, even vehement, reactions… [and] a surge of passionate hostility" [18, p. 42] to PBL from staff. Explanations included the perceived association of PBL with PBL evangelism, intangible outcomes, new work patterns (e.g., becoming tutors who facilitate learning rather than dispense information), and change generally. Most blame, however, was focused on inadequate conceptions of expertise, knowledge, teaching, and learning in education, grounded in the separationist view of scientific discovery highlighting products over the inquiry process. According to Margetson, those adopting these inadequate views uncritically and unreflectively show deep, albeit misplaced, antagonism when challenged explicitly byPBL.[18]
In summary, resistance to PBL lies in the assumptions about the nature of knowledge that it challenges.

IN CONCLUSION, WHAT GROUND RULES CAN BE FORMULATED FOR FROBLEM-BASED LEARNING?

As PBL has emerged as a useful tool in reforming higher education and in revolutionizing undergraduate medical education, it has encountered epistemological and semantic resistance. The conceptual clarification of PBL must advance if it is to complement, rather than undermine, the growing empirical evidence on PBL's impact. Neither oversimplification nor elitism is tenable for the PBL label, and its utility is very context-specific. The assumption that PBL is a term by which people mean generally the same thing cannot go unchallenged." Indeed, Charlin and colleagues recently demonstrated the "many faces" of PBL along ten dimensions: problem selection, problem purpose, student versus teacher control, nature of task, presentation of problem, problem forma t, process followed, resources used, role of tutor, and outcomes assessed.[58] They also identified three core principles of PBL, that is: the starting point of learning is a problem, it is an overall approach, and it is student-centered. Attempting to avoid polarizing views and be all-inclusive, Harden and Davis recently described 11 points on a "continuum of PBL" that relates the timing of the example (applying concepts to a problem) to the rule (learning concepts).[59] By having only one point called "PBL," however, their continuum may add some confusion.

Despite much "conceptual fog" lingering over the PBL literature, obscuring the evidence-base on the added value of problem-based versus traditional approaches, useful "ground rules" can be formulated to describe the true PBL genus. These are that PBL:

- Is both method and philosophy, curriculum-wide, and supported by all curricular elements;
- Aims at efficient acquisition and structuring of knowledge arising *out of* working through (in an active, iterative, and self-directed way) a progressive framework of problems providing context, relevance, and motivation (problem-first learning);
- Builds on prior knowledge, integration, critical thinking, reflection on learning, and enjoyment:
- Achieves its goals via facilitated small-group work and independent study; and possibly
- Relates to problem solving only insofar as knowledge becomes more accessible, and can therefore be applied more efficiently, during this process.

Maybe the term PBL can yet be rescued.

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