



The Harvard Connection: How the Case Method Spawned Problem-Based Learning at McMaster University

Virginie F.C. Servant-Miklos*

Erasmus University College, Erasmus University Rotterdam, the Netherlands

Aalborg Centre for Problem-based Learning in Engineering Science and Sustainability, Aalborg University, Denmark

Received 25 April 2018; received in revised form 12 July 2018; accepted 19 July 2018

Available online 25 July 2018

Abstract

This paper proposes a historical analysis of the connection and differences between the Harvard case method in medical education and business education and the original problem-based learning method of McMaster University as it was developed in the late 1960s. The article focuses on the pedagogy of Harvard Medical School in 1900, Harvard Business School in 1920 and McMaster University in 1969, giving an account of how the respective approaches of these institutions became entangled yet divergent. Using data from archive materials and oral history accounts, a history of the pedagogical connection between Harvard and McMaster is drawn focusing on the use of cases versus problems. The paper concludes by arguing that specific innovations in PBL compared with the case method justify considering them as separate educational methods rather than more of the same.

© 2018 King Saud bin AbdulAziz University for Health Sciences. Production and Hosting by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Keywords: case method; problem-based learning; harvard

1. Introduction

To anyone familiar with both the case method (CM) and problem-based learning (PBL) in higher education, the similarities are obvious: both the case method and problem-based learning focus the learning experience on realistic or real-life situations, which are tackled by small groups of students under the guidance of a teacher or tutor. The case method, born in 1870 at Harvard University Law School, antedates problem-based learning by a century, and it has been assumed in

the literature on PBL that the latter was somehow derived from the former (Schmidt cited the case method as an antecedent without giving specific indications or evidence for this claim).¹ The connection is however not obvious, given that the method referred to as “PBL” in medical education was first implemented in 1969 at McMaster University Medical School in Canada and the programme managers were neither Harvard alumni nor students of law (Mueller lists the names of all twelve of the founding fathers in his article, however, this paper will only consider the roles of Evans, Spaulding, Anderson, Walsh and Mustard on the grounds that they began planning two years before the rest were involved).² In addition, the difference in terminology needs to be explained: is there a historical difference between a case and a problem; did they come from different pedagogical approaches? This is a

*Correspondence to: Aalborg Centre for PBL in Engineering Science and Sustainability, Aalborg University, Rendsburggade 14, 9000 Aalborg, Denmark.

E-mail address: servant@euc.eur.nl (V.F.C. Servant-Miklos)

Peer review under responsibility of AMEEMR: the Association for Medical Education in the Eastern Mediterranean Region.

subject of particular importance given the confusion that reigns surrounding the “case” versus “problem” terminology in higher education circles today (The claims made about PBL (that it is an unguided learning method) that justify the difference between PBL and the case method in this article had been disputed in the article by Schmidt et al. in 2007).³ Confounding terms such as “case-based problem-based learning” have emerged, as well as misconceptions as to both the nature of the case-method and the nature of PBL.⁴ Such confusion does great disservice to both methods and their specific underlying purpose. The purpose of this paper is therefore to retrace the historical ties between the Harvard case method (or rather, case methods, as we shall see) and PBL, and clarify the historical similarities and differences in the principles behind and applications of the methods. The period of interest for this purpose begins in 1900, the date of the opening of the Harvard Medical School case-based programme, and ends in 1972, the date of graduation of the first class of McMaster School of Medicine and resignation of its founding Dean. The paper will begin by outlining the differing developments of the case method in medicine and business at Harvard University, then retrace the channels through which these developments came to influence PBL at McMaster University, concluding on the historical similarities and differences between the two.

2. Two case methods

The original CM was developed by Prof. Christopher Columbus Langdell, Dean of the Harvard Law School in 1870, who is said to have acted under the intellectual influence of inductive empiricism to create a learning system for law based entirely on the use of case law.⁵ This case method became extremely popular in legal education and was widely adopted in the United States. Kimball has written a comprehensive history of the legal case method in which these historical developments are chronicled so they shall not be repeated here.^{6,7} The most important aspect of the legal case method's development for the history of PBL is that it spawned case method programmes in the Medical School (HMS) in 1900 and in the Business School (HBS) in 1908 along similar lines; and then a revamp of the method at HBS in the late 1920s along different pedagogical lines. Those programmes, which in fact constitute not one but two case methods, directly and indirectly influenced the founders of PBL, and shall therefore be expounded in the following section.

2.1. Cases at the Harvard Medical School, 1900–1920

The appellation “case method” is so commonly associated the Business School's problem-oriented interpretation that it is often forgotten that the analogical interpretation of the case method that still dominates legal education was also initially adopted by the HMS, and briefly by the HBS. We shall here consider the adoption of the case method by the Medical School and the (indirect) impact that this had on PBL at McMaster, but shall not consider the early and brief experiment of the HBS with analogical cases given that it had no bearing on PBL. The analogical case method was introduced at Harvard Medical School by Walter Cannon, a young up-and-coming basic scientist, in 1900.⁸ Perhaps the disappearance of Harvard Medical School's experiment with cases from collective memory can be explained by the fact that it fell out of use some time in the 1920s.⁶

We know of the early experiments with the analogical case method in medicine since Cannon published a paper in the *Boston Medical and Surgical Journal* in 1900 that detailed his method, purpose and provided examples of cases for the reader.⁹ Cannon opened his paper with a long tirade against didactic lectures and recitations, citing them as inefficient, ephemeral and generally disconnected from the practice of medicine. It is clear from the text that lectures were not included in the proposed system.⁹ It is also clear that he expected that students would require prior knowledge in relevant background fields of study prior to using this case method. The second element of the method that comes through from the text is the order of study: first, students should deconstruct and analyse the case on their own, using whatever resources they could find, and then only did they gather in a group and in the presence of their instructor to discuss their findings:

Now, the intent of the proposed case system is, in short, to give the students printed data from actual histories. These data are then to be studied and analysed by the students, who shall be required to consider in every detail the differential diagnosis, the principles of prognosis in the case, and the rational treatment. The students, after having studied the case, shall come to a conference with the instructor, in which all the points in a particular problem shall be discussed. Such in outline is the scheme of study.⁹

Thirdly, the students were expected to behave like quasi-professionals, and the instructors to lead the students using a form of Socratic questions and answers

(although the words ‘Socratic Method’ are not used by Cannon, they are used several times to refer to the case method by Wallace Donham).¹⁰ Looking at a case from the HMS, which Cannon provides, it seems that there was not much difference with some of the cases that were provided to McMaster’s PBL students.

A boy of seven years had no noteworthy illness until, at five years of age, he had scarlet fever, with acute nephritis in complication. He was seen six months before the present illness, when he had grippe, with acute middle ear. His general condition has been fairly good since. The present illness began with vomiting and high temperature, 104 °F. He was seen by a consultant two days later. During these two days, he had grown worse. The temperature had remained above 104 °F. The vomiting had continued at intervals, but was not so severe or frequent at first. He had become apathetic but complained of pain when handled. The bowels were constipated. The tongue was coated. At the examination on the third day of the illness he was found fairly developed and nourished. Though somnolent, he could be roused and he cried out when handled. There was no retraction or rigidity of the head. The pupils were equal and retracted normally. The face was flushed. The breathing was rapid and superficial. The pulse was strong and rapid. Nothing was detected in the lungs except diminished vesicular respiration in both backs below the scapulae. The cardiac impulse was felt in the fourth space just inside the right mammary line. It was somewhat increased in strength, the heart sound was not accentuated, there was no impulse felt to the left of the sternum or in the epigastrium. The abdominal muscles were so tense that palpitation was impossible, not from any localized tenderness but apparently from all over the abdomen. Rectal examination was negative. Urine was negative. Opiates were required to relieve pain. There had been no vomiting for twelve hours. A large movement of the bowels followed the administration of calomel on the previous day.⁹

The lessons to retain from these descriptions are that the pedagogical specificity of the case method in medical education at Harvard was in suppressing the role of the teacher as the direct transmitter of knowledge, and requiring quite some self-direction on part of the participants who were expected to study the material on their own before submitting to questions from their teachers.

It may come as a surprise, given the innovative approach, that it was so rapidly discontinued. Kimball explains this by suggesting that at the time, medicine, like law, was considered a comprehensive and stable body of knowledge, and medical education an established and

“formalistic” field of study. Medical cases were considered as close-ended problems with “right” and “wrong” diagnoses. Given this, the demise of the analogical case method at the Medical School correlated with the sudden explosion of discoveries in medicine at the turn of the twentieth century that destabilised the conception that medical education was a closed field of study.⁷ Medicine called for a more open approach to knowledge that was provided by PBL.

2.2. Problem-cases at the Harvard Business School, 1920s onwards

It appears that the foremost reason for developing cases in the Business School was precisely to deal with the rapidly changing business environment of the time in a field where there was no readily constituted body of academic literature (primary evidence concerning the case method at the Business School consists in a few scattered papers, some of which were collated by Harvard professor Cecil Fraser into a booklet on the Case Method in 1931. Bruce Kimball’s history of the case method provides us with the most extensive secondary source material on the subject).¹¹ A contemporary description of the purpose of the curriculum by a professor at the School implies that acquiring relevant analytical and problem-solving skills was more important than acquiring knowledge through cases.¹² In addition, cases seem to have served a secondary purpose of increasing interest and motivation in students, who, it was thought, would enjoy their role as active participants in their education far more than the passivity required by lectures.¹³

Beyond general principles, it is important to understand how these ideas panned out in practice. In a chapter entitled *The Use of Cases in the Classroom*, Fraser presented four different ways in which cases were used concretely at the HBS.¹⁴ The four uses of cases have divergent pedagogical implications, best summarised in the following table (Table 1):

As we can see, only the first use explicitly mentions lectures. The implication from the text is that lectures were not generally desirable, except in the case of “inexperienced” and “immature” students. Thus, only the first configuration utilised a deductive form of reasoning: general principles were outlined first in a lecture, and students were expected to crystallise their ideas about these principles using specific cases. The other three configurations of cases implied induction: students, through more or less guided discussion, should induce general principles from the starting point of a specific case. Fraser cited the fourth configuration as the most commonly used, given, he said, that “it not

Table 1
Four uses of cases at Harvard Business School in 1920.

The Harvard Business School use of cases	Purpose	Teaching method of process	Relation between knowledge and application
	<i>As illustrative material</i>	For young students, when lectures and standard texts are desirable, cases serve to illustrate the Lecture first, followed by a case.	General knowledge used for specific application
	<i>As a basis for general discussion</i>	Students have to develop solutions to the problems themselves. Prompted by an instructor who asks questions, followed by student discussions	Specific application allows to move to general knowledge
	<i>As a basis for specific questions and answers</i>	Instructor targets specific students with specific questions	Order depends on instructor and questions
	<i>As a basis for detailed cross-examination</i>	Instructor prepares a question with two possible answers, then sub-questions related to both answers. Then encourage other students to provide reasoning for answer and draw out general principles.	Specific application allows to move to general knowledge

only forces the student to make a thorough and practical analysis and to substantiate both the method and results of that analysis under cross-examination, but to separate from a large amount of detail the important principles on which the theory of business must be developed".¹⁴ Thus, the primary function of the problem case method was not, as might first appear, to apply knowledge acquired in lectures to cases, but instead, "to acquire a broad acquaintance with both technical and general information about diverse fields of industry, not by the study of dissociated facts but as an incident in the intellectual process of working out decisions".¹³ Vanderblue and Gragg further developed this point in their chapter on *The Case Method of Teaching Economics*, in which they stated:

Sharply in contrast with the illustrative use of cases is the method of presenting cases without a simultaneous statement of the principles inherent in the facts of the cases. This method requires that the student himself analyse the case facts and indicate the conclusions of general significance. (...). The student must understand the facts of the case and then perform for himself the task of inducing from them one or more principles. His text-book provides a guide, but it does not tell the whole story.¹⁵

It is interesting to note that the uses of cases here mandated looking outside of the textbook for answers, thus denoting the open nature of the problems in use. Like in the Medical School, lectures were no longer used as a means of transmitting knowledge, as outlined by Donham: "this classroom discussion largely or wholly displaces the lecture as a medium for the presentation of principles".¹³ This finding has quite some implications: it invalidates the proposition that the pedagogical specificity of PBL is the use of a problem as the trigger for learning – clearly the problem case method also featured this aspect. In order to clarify this point, we would do well to look at the structure of a case. A case specification is highly enlightening in this regard (Table 2):

The case in question was clearly based on a real company and its lived situation, as indicated by the provision of potential sources for the material.¹⁶ The case specification implies that the instructor already knew which principles he intended for the student to induce – in this case: "the questions of prompt delivery, adequate store control, merchandise accounting, and control of store operations". But this specification only gives us a partial understanding of the nature of cases. Fortunately, McNair went on to describe the presentation of business cases more in depth:

Table 2

A case specification from 1931 at Harvard Business School.

Example of a case specification at Harvard Business School

Issue	Whether a variety chain or dry goods chain should operate one or more warehouses or whether it should have good shipped directly to its stores by vendors.
Background	Describe company as to type, merchandise, number of stores, geographical distribution, and operating results. Describe methods of purchasing merchandise, especially in connection with securing shipments to warehouses or to stores directly. What experience has company had in securing price concessions on advance orders, and to what extent must it bear carrying charges on such orders if made in advance? Describe methods of controlling store inventories, orders, reorders, new merchandise. Explain price policy and method of fixing retail prices: that is, whether by store manager, superintendents, or central office. Give methods of accounting for merchandise, sales, mark-downs, short-ages, and returns; and show how the case would bear on these factors. Are vendors willing to give quantity or other discounts on orders which have to be shipped to individual stores? Could deliveries be made more effectively and under better control by company's warehouse, or by vendors? Are some lots of merchandise bought from a number of vendors, or does each vendor supply the entire requirements? The questions of prompt delivery, adequate store control, merchandise accounting, and control of store operations seem to be the chief ones to be covered in this case. In addition, costs of warehousing and reshipments are important. Find out whether stores have sufficient capacity to care for direct shipments.

No one best formula has been evolved for the presentation of a business case. One fairly common type of case begins with a succinct statement of the type of concern involved and the particular issue faced; follows this with a brief statement of the immediate circumstances leading up to the emergence of the issue; goes on to a description of the general background of the concern, the nature of its products, markets served, channels of distribution, size of company, organization, corporate and financial structure, and the like; presents a fairly detailed statement of the pertinent facts and reasons bearing on the particular issue; and ends with a statement of the company's decision or, if a decision has not been reached, with a question as to what the decision should be. The term 'cases' is used to denote a case where the decision is stated, while 'problem' is used to denote a case which ends with a question rather than a statement of the company's decision. Although the tendency at the outset was to use 'problems' almost exclusively for teaching purposes, experience indicates that for most pedagogical purposes, 'cases' are equally useful.¹⁶

As well as confirming that general principles were not given in the case and should thus be worked out by students, this case description by McNair clearly indicates that the Business School faculty were already thinking in differentiated terms between "problems" and "cases". This marks the central point of departure between Cannon's analogical case method and the Business School's interpretation. While the reluctance to use teachers as knowledge transmitters and the use self-directed study and of questioning methods seems to have been similar, the business method, driven by problems rather than closed cases, was oriented toward a more experiential, process-

driven, problem-solving form of education, explicitly influenced by the education philosopher John Dewey and the "problem-method" developed by his followers in the 1910s, 1920s and 1930s.⁷ The essence of Dewey's problem method was to consider as a problem: "whatever – no matter how slight and commonplace in character – perplexes and challenges the mind so that it makes belief at all uncertain".¹⁷ The learner, piqued and intrigued by the problem, would be guided through questioning by a teacher who was both a content expert and an expert in the art of pedagogy towards a resolution which resonated with the learner's prior experience (the book was re-edited in 1933 but the original from 1910 already contained the descriptions that inspired the problem-method).¹⁷

However, there did not appear to be a dogmatic dedication to the problem method at the Business School, since the use of resolved cases was introduced and found to be "equally useful" – useful for what? That is an interesting question, because it cannot be "for problem-solving", if the solution was presented with the material. It seems that the Business School may have been flirting with analogous reasoning too.

3. The origin of problems at McMaster University: 1966–1969

The use of problems as the starting point for learning was decided upon by Dean John Evans at the very start of the preparations for the medical programme. In 1966, he defined the most important learning objective for the undergraduate curriculum as: "The ability to identify and define health problems, and search for information to resolve or manage these problems" and "given a health problem, to examine the underlying physical or

behavioural mechanisms”.¹⁸ Evans described this goal as follows:

The medical sciences option will deal specifically with problems of human biology emphasizing an integrated approach to normal structure and function and the basic tissue and system reactions which lead to abnormal structure and function. In conventional programmes, most of this information would be presented in courses of Anatomy, Physiology and General Pathology.¹⁸

Beyond this, Evans had no specific idea of how these problems would look in practice. To determine how these ideals should pan out in practice, the Chair of the Education Committee of McMaster Medical School William Spaulding and his colleagues Drs. Jim Anderson, William Walsh and Fraser Mustard took to the road between 1966 and 1968 to find inspiration in medical schools and universities across North America prior to the opening of the school in 1969.¹⁹ It was in this quest for inspiration that they discovered the HBS case method and set about adapting it to their purposes. Evidence points to William Spaulding as the origin of the Harvard connection thanks to a fraternity brother who studied at HBS.²⁰ This is the most direct connection that can historically be traced between the case method and problem-based learning. Importantly, it shows that the founders of PBL borrowed not from the *original* legal method by analogy and even less from Walter Cannon, but from the adapted case method that was developed in the business school in the 1920s in which the cases were open problems. The founders of PBL seem to have been oblivious to the fact that the case method by analogy had been tried and tested at the Harvard Medical School. An important consequence of this finding is that PBL, through its Harvard Business School connection, was indirectly influenced by the ideas of John Dewey and his “problem-method”. This is of specific importance because the connection between PBL and Dewey has often been cited but never backed up by evidence.²¹ There is in fact scant evidence that the founders knew anything of John Dewey directly (this was the one written reference to John Dewey found in all of the Education Committee archives from 1965 to 1972 that were analysed for this research. It consisted merely in a quote used to introduce the report: ‘Science has been taught too much as an accumulation of ready-made material, with which students are to be made familiar, not enough as a method of thinking, an attitude of mind, after the pattern of which mental habits are to be transformed’ (Dewey: Science as Subject-Matter and as Method. Science xxxi, No. 787, p. 122’).²² The likeliest explanation for the resemblance between PBL’s principles and Dewey’s ideas is therefore the Harvard connection;

though some argument may be made for Dewey’s influential ideas simply being “in the air” at the time of McMaster Medical School’s founding. The influence of Dewey on PBL merits an essay in its own right and will not be treated further here.

However, even though they did not know of Cannon, the lessons of the Harvard Medical School experiment with cases were not completely lost on the founders of PBL thanks to a secondary connection via Western Reserve University School of Medicine (WRU). In 1967, Spaulding visited WRU, and what he saw there directly shaped the interdisciplinary structure of the PBL curriculum at McMaster.²³ In 1952, WRU (located in Cleveland, Ohio) overhauled its medical curriculum, creating a series of interdisciplinary “subject committees” instead of disciplinary courses throughout the undergraduate programme.⁸ Spaulding admitted that he took the idea wholesale and mapped into onto the curriculum at McMaster, such that PBL problems were structured in sequential thematic “units” rather than parallel disciplinary courses.²⁴ The interesting thing about WRU’s leadership team is that both the reforming Dean of WRU, Dr. Joseph Wearn, and his most influential reformer, Dr. T. Hale Ham, were Harvard educated. Wearn had grown at Harvard under the tutelage of Prof. Peabody, a “humanist” physician whose educational methods were very much in the tradition of Walter Cannon.⁸ As for Ham, he personally ran a course in Laboratory Examinations in Clinical Diagnosis at Harvard Medical School, which was built on the Cannon case method.⁸

Although Wearn and Ham were inspired by their Harvard mentors to shake up the medical curriculum, WRU still maintained a very high ratio of lectures to alternative pedagogical methods, so even though the Harvard influence inspired Ham to push the envelope to some extent, by his own admission it was not radical enough to leave a lasting trace on medical education.²³ Therefore, the Harvard connection via the medical case method only influenced PBL to the extent that their Harvard experience made the founders of the WRU programme rethink the structure of their own medical curriculum, and that structure was adopted wholesale into PBL. In terms of the nature of the problems and the pedagogical approach, PBL owes a lot more to the Business School approach. In that regard, concerning the innovative use of problems, PBL made its mark on the World – but if problems came from Harvard, why was McMaster’s method named “problem-based learning” and not just another adaptation of the case method? Was the problem approach used in the business case method, identical to McMaster’s problem-based learn-

ing? In the final section of this paper we shall consider the way in which problems ended up being used at McMaster and why this warrants considering PBL as a separate pedagogical tool.

4. The use of problems in McMaster's founding problem-based learning programme, 1969–1972

Spaulding was adamant that the problem-based format should begin from day one of the curriculum, thus echoing Harvard's use of cases from day one:

The students will be introduced to patients and their problems during the first weeks of the first year of the course. It is hoped that students, stimulated by this experience, will see the relevance of what they are learning to their future responsibilities, will maintain a high degree of motivation and will begin to understand the importance of responsible professional attitudes.²⁵

It is interesting that he called upon student motivation to justify his stance – the founders of PBL were seeking a motivating approach to medical education as a reaction to their own tedious and boring experience as students.²⁶ The fact that the “motivation” justification *was also* present in the Harvard Business School may have inspired Spaulding to investigate this method for his new school.

Spaulding's enthusiasm for the use of problems was received with some confusion by the plethora of sub-committees operating under the Education Committee, as shown by letter from the sub-committee coordinator Jim Kraemer to the Education Committee, aptly entitled “the problem-solving problem”:

Some of our curriculum planning groups have been giving considerable thought to the method of learning (teaching) that would be employed throughout their part of the programme. While they are aware of the model proposed by the education committee, namely that of a compromised tutorial system within a problem-solving framework, they seem to be having some difficulty in applying this model to their respective programmes.²⁷

This problem-solving problem was taken seriously by the Education Committee, resulting in further chaos and confusion:

The main question was whether or not the Education Committee ought to make clear its views on learning and then intervene wherever a planning group appeared to be departing from those guidelines.

The main difficulty was that committee members differed in their views on learning methods. In the end, it was noted that in time, the pressures of students and other faculty opinion on this matter will probably solve the question.²⁸

The last sentence in these minutes was likely a clever subterfuge to avoid making any decisions and hope that somehow things would work themselves out. In the resounding words of Dr. Fraser Mustard, the solution was often quite simple indeed: “eventually you just have to take over and simply put it into place and get your people to do the jobs and to hell with democracy!”²⁹

And so, decisions on problems fell into place, eventually, as the opening of 1969 was drawing near: students would begin their undergraduate medical career with patient problems. The students were provided with a long list of resources to help them work on the problems: detailed sets of notes, key articles (to be included with notes), a pertinent bibliography, plastic embedded dissections, micro-slides...³⁰ The idea seems to have been: give them all of the resources and let them sort things out.

In practice, in the early years of McMaster's programme, between 1969 and 1972, the concept of a “problem” varied wildly from unit to unit, depending on who the coordinator was. Some did indeed use standard patient cases not too dissimilar to the ones used by Cannon, but without providing the answers or the resolution of the case. But others got more creative. For instance, some began using medical situations from famous novels (In particular, Kinsey Smith recalled: ‘Barb Mueller developed a unit quite some distance down after the distance down after the beginning of the school. But it was called the Energy Unit. And instead of taking clinical cases, we took novels. So we took... what's the name, Camilla? (...) Where she dies a cachectic death of tuberculosis. (...) We talked about the Scott expedition to the South Pole, we talked about the ascent of Everest. We talked about, you know, things that came out of literary backgrounds but that described things which needed a physiological explanation. You know, why is it difficult to climb Mount Everest? Why do people dying of tuberculosis waste away and become thin?’),³¹ others used actors trained to simulate patients,³² and some simply gave out short statements describing a biomedical phenomenon and asked the students to explain it. Some of these statements were not cases at all, but short questions like: “what have Graves’ Disease and Cushing's disease taught us about normal physiology?” or rather imaginative question like “could the design of construction of the knee be improved?” We are here very far away from the sorts

of patient cases used at the Harvard Medical School, and even quite far away from the detailed business cases used at the Business School. That is not to say that classical cases were not used in PBL, but PBL offered a much wider span of possibilities with regards to the type of triggers, that were considered problems. The reason that this was possible in PBL and impossible in the case method hangs on one specificity of PBL that was absent from the case method both at Harvard Medical School and Harvard Business School.

5. The case method and problem-based learning: not just more of the same

We have established that in both case methods and in PBL, lectures were disused in favour of small-scale group discussions in which the students were given ample time to study on their own. We have also seen that unlike in the Harvard Medical School, the case method in the Business School and PBL tended to favour open problems for students to work on. We have just discovered that unlike both case methods, PBL offered a wide-ranging set of possibilities in terms of the materials used to trigger student learning. This key differentiator was made possible because of one key difference between the methods: the order in which the material was presented to the students. Indeed, at both the Medical School and the Business School at Harvard, the cases, having been distributed in advance, were discussed in small groups only *after* the student's self-study.¹³ The specificity of McMaster's method is that it presented problems for discussion in small groups *before* allowing students to delve into self-study. The key differentiating feature of PBL was therefore the inclusion of a problem discussion phase during which students conversed around an unknown problem prior to their self-study, guided by a tutor who could encourage them to look deeper into specific lines of questioning. The discussion phase was, it seems, the invention of Jim Anderson, the most creative of the Education Committee founders, who first suggested what it might look like in practice to the committee through a cleverly penned imaginary diary of a fictional student of PBL.³³

This difference with the HBS case method is not anodyne, as research has been done to show the impact of such a “discussion phase” on the activation of prior knowledge in students, thus stimulating a higher quality of self-study and knowledge retention.³⁴ Over the years, PBL in medical education has tended to shift towards a solely case-focused approach in which the only problems considered by students are patient cases,

and the discussion phase is reduced to a minimalistic list of questions or learning objectives while the emphasis is placed on reporting diagnoses and medical facts, which has rightly prompted medical educators to wonder about the purpose of PBL and to switch to the case method instead, or call it the “case based problem based learning” method and other such confusing variations. However, the invention of the discussion phase by the founders of McMaster Medical School in 1969 opened PBL up to a whole host of possibilities not afforded by the mere use of cases and it does not do justice to Evans, Spaulding, Anderson and colleagues' innovation to focus solely on a narrow set of pedagogical possibilities afforded by cases.

6. Conclusion

It is fair to conclude that PBL owes its existence to the problem case method from the Business School, but inclusion of a discussion phase prior to the self-study period justifies considering PBL as a new and separate learning method. It is also apparent that McMaster's innovative PBL method came not from the early experiment of the HMS with the analogical case method but from the problem case method of the HBS. Because the original PBL method contained notable differences with the HBS case method, using terms such as “case based problem based learning” is eminently confusing for educationists. The simplest would be for practitioners to refer either to the case method by analogy, to the problem case method, or to problem-based learning. And if educators wish to use PBL, then particular attention should be paid to the discussion phase and the use of diverse problem triggers. But given that PBL split off into various models shortly after its inception at McMaster, even the term “PBL” hides more than one educational practice today.³⁵ A next step will be to clarify the history of the splits in PBL, until all of these acronyms and jargonistic names are tied back to their origins, purpose and underlying principles rather than being used haphazardly and often erroneously.

References

- Schmidt HG. A brief history of problem-based learning. In: O'Grady G, Yew EHJ, Goh KPL, Schmidt HG, editors. *One-Day, One-Problem, An Approach to Problem-Based Learning*. Singapore: Springer; 2012. p. 21–40.
- Mueller CB. McMaster University Medical School: the Little School that Could – and Did. *McMaster Univ Med J* 2008;5(1):29–33.
- (a) Srinivasan M, Wilkes M, Stevenson F, Nguyen T, Slavin T. Comparing problem-based learning with case-based learning:

- effects of a major curricular shift at two institutions. *Acad Med* 2007;82(1):74–82;
- (b) Schmidt HG, Loyens SM, van Gog T. Problem-based learning is compatible with human cognitive architecture: commentary on Kirschner, Sweller, and Clark. *Educ Psychol* 2007;42(2): 91–97 <http://dx.doi.org/10.1080/00461520701263350>.
 4. Carder L, Willingham P, Bibb D. Case-based, problem-based learning. *Res Strateg* 2001;18(3):181–190.
 5. Garvin DA. Making the case. *Harv Mag* 2003;106(1):56–65.
 6. Kimball BA. *The Inception of Modern Professional Education: CC Langdell, 1826–1906*. Chapel Hill, NC: University of North Carolina Press; 2009.
 7. Kimball BA. *Emergence of Case Method Teaching, 1870s–1990s*. Bloomington, IN: The Poynter Center, Indiana University; 1995.
 8. Williams G. *Western Reserve's Experiment in Medical Education and Its Outcome*. New York, NY: Oxford University Press; 60–61.
 9. Cannon WB. The case method of teaching systematic medicine. *Boston Med Surg J* 1900;142(2):31–36.
 10. Donham WB. Business teaching by the case system. *Am Econ Rev* 1922;12(1):53–65.
 11. Fraser C. *The Case Method of Instruction: A Related Series of Articles*. New York, NY: McGraw-Hill Book Company Inc; 1931.
 12. Dewey AS. An introduction to the use of cases. In: Fraser C, editor. *The Case Method of Instruction: A Related Series of Articles*. New York, NY: McGraw-Hill Book Company Inc; 1931. p. 1–11.
 13. Donham WB. Business teaching by the case system. In: Fraser C, editor. *The Case Method of Instruction: A Related Series of Articles*. New York, NY: McGraw-Hill Book Company Inc; 1931. p. 12–25.
 14. Fraser C. The use of cases in the classroom. In: Fraser C, editor. *The Case Method of Instruction: A Related Series of Articles*. New York, NY: McGraw-Hill Book Company Inc; 1931. p. 36–38.
 15. Vanderblue HB, Gragg CI. The case method of teaching economics. In: Fraser C, editor. *The Case Method of Instruction: A Related Series of Articles*. New York, NY: McGraw-Hill Book Company Inc; 1931. p. 107–121.
 16. McNair MP. The collection of cases. In: Fraser C, editor. *The Case Method of Instruction: A Related Series of Articles*. New York, NY: McGraw-Hill Book Company Inc; 1931. p. 142–158.
 17. Dewey J. *How we Think*. Lexington, MA: D.C. Heath and Company; 1933.
 18. Evans JR. *General Objectives. Objectives of the Faculty School of Medicine – HHS/FHS Archives, Box 145.8;1*. Hamilton, ON: McMaster University; 1966.
 19. Evans JR. *Confidential (Accreditation Visit). Accreditation Preparation Visit – HHS/FHS Archives, Box 144.2;1*. Hamilton, ON: McMaster University; 1967.
 20. Campbell EJM, Sackett DL, Adsett A, Mueller CB. *Founding Fathers Interview. Interviewed by Norman GR*. Hamilton, ON: McMaster University; 2003.
 21. (a) Savery JR, Duffy TM. Problem based learning: An instructional model and its constructivist framework. *Educ Technol* 1995;35(5):31–38;
 - (b) Savin-Baden M. *Problem-based learning in higher education: Untold stories*. McGraw-Hill International; 2000.
 22. Ad Hoc Committee On Undergraduate Education. Summary of Report of the Ad Hoc Committee on Undergraduate Education – Presented to the Council of the Faculty of Medicine, September 24, 1969. Educational Programme Committee – 1969 – HHS/FHS Archives, Box 232.5;5. Hamilton, ON: McMaster University; 1969.
 23. Spaulding WB. Visit to Western University School of Medicine, May 15th and 16th, 1967. Educational Programme Committee – 1966–1967 – HHS/FHS Archives, Box 232.4;1. Hamilton, ON: McMaster University; 1967.
 24. McAuley J. *McMaster Oral History – Dr. W.B. Spaulding – 25th October 1978; Interview Transcript. Founding Fathers Interviews – HHS/FHS Archives*. Hamilton, ON: McMaster University; 1978.
 25. Spaulding WB. *The Undergraduate Medical Curriculum: McMaster University – Oct 31 1968. Objectives of the Faculty School of Medicine – HHS/FHS Archives, Box 145.8;1*. Hamilton, ON: McMaster University; 1968.
 26. McAuley J. *McMaster Oral History – Dr. J.R. Evans – 28th September 1979; Interview Transcript. Founding Fathers Interviews – HHS/FHS Archives*. Hamilton, ON: McMaster University; 1979.
 27. Kraemer J. *Re: The Problem-Solving Problem. Education Committee Minutes – July-Sept 1968 – HHS/FHS Archives, Box 232.4;6*. Hamilton, ON: McMaster University; 1968.
 28. Kraemer J. *Education Committee Meeting – August 30, 1968. Educational Programme Committee – 1968 – HHS/FHS Archives, Box 232.4;6*. Hamilton, ON: McMaster University; 1968.
 29. Spaulding WB. *Revitalizing Medical Education, McMaster Medical School the Early Years 1965–1974*. Hamilton, ON: B. C. Decker Inc.; 1991.
 30. McNabb A. *To: W.B. Spaulding, M.D. Re: Phase III Curriculum. Educational Programme Committee – 1969 – HHS/FHS Archives, Box 232.5;2*. Hamilton, ON: McMaster University; 1969.
 31. Smith K. *McMaster Head of Nephrology in 1969* in interview with the author, by telephone, July 10, 2013.
 32. Barrows HS, Tamblyn RM. *Problem-Based Learning, An Approach to Medical Education*. New York, NY: Springer; 1980.
 33. Anderson JE. A week on the G.I. system, a mythical log of John Smith on his second week of systems teaching. In: Spaulding WB, editor. *Objectives and Outline of the Undergraduate Educational Programme. Educational Programme Committee – 1966–67 – HHS/FHS Archives, Box 232.4;1*. Hamilton, ON: McMaster University; 1967.
 34. Schmidt HG. Foundations of problem-based learning: some explanatory notes. *Med Educ* 1993;27(5):422–432.
 35. Schmidt HG, van der Molen HT, Te Winkel WWR, Wijnen WH. Constructivist. Problem-based learning does work: a meta-analysis of curricular comparisons involving a single medical school. *Educ Psychol* 2009;44(4):227–249 <http://dx.doi.org/10.1080/00461520903213592>.

Virginie F.C. Servant-Miklos is a senior lecturer at Erasmus University College in Rotterdam, the Netherlands, and a postdoc researcher at the Aalborg Centre for PBL in Engineering Science in Denmark.