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# From Flexner to Rogers: An Inquiry into the Intellectual Origins of Problem-Based Learning at McMaster University Medical School

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## 1. Introduction

Fifty years ago, McMaster University Faculty of Medicine developed a new approach to undergraduate medical education based on using biomedical and patient problems as the starting point of the student's learning process in a small group setting, guided by a tutor. The programme, which opened its doors in 1969, was developed by a team of Canadian doctors led by Drs. John Evans, Bill Spaulding, Fraser Mustard, Jim Anderson and Bill Walsh, who together comprised the first Education Committee (EC) of McMaster's Faculty of Medicine.[1] Between 1965, the date of Evans' appointment as Founding Dean of the Faculty, and 1972, the date that he left and the first cohort graduated, the EC met weekly to flesh out the new three-year undergraduate curriculum and its pedagogical approach. The characteristics of this learning method, which came to be known as "problem-based learning" (PBL), has been described in detail elsewhere,[2] warranting only the briefest of summaries here; namely that it was characterized by an interdisciplinary, organ-systems based unit structure to replace the traditional disciplinary structure; that students took a lead role in the learning process and spent the majority of their time engaged in personal study; a minority of their time in small group tutorials with lectures rarely occurring; and that there was no summative assessment during the entire undergraduate curriculum.

PBL has since been adopted and adapted by hundreds medical schools around the world, and spread far beyond medicine into disciplines as varied as psychology, law, economics, engineering and liberal arts. The upcoming fiftieth anniversary of the first class of McMaster is an opportune moment to reflect on the intellectual history of PBL; not least because a range of claims have been made about its theoretical underpinnings over the years, not supported by a thorough historical investigation into the thoughts and ideas of Evans and colleagues.[3] The issue with these claims is that they sweep through such a broad scope of literature that in the long run, PBL tends to become a hold-all expression for any educational approach inspired by progressive ideas on learning. The purpose of this paper is therefore to narrow down our historical interpretation of PBL to its original intellectual context. This will hopefully allow educators to handle *post hoc* interpretations of PBL in the light of various education theories as such, thereby staving off confusion about what PBL *was*. Though the present and future are not the focus of this paper, understanding the historical context of PBL will hopefully sharpen the focus in future discussions on what PBL *is* currently and *might be*.

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This paper offers a historical methodological approach, by identifying the theories and ideas whose influence is supported by direct historical evidence from the memos, unpublished proposals, papers, documents and minutes of the meetings held in the Education Committee of McMaster Medical School between 1966 and 1972 (note that the EC was expanded in 1968 to include the Chairs of the various components of the programme). Although the founding fathers have all passed away, the written evidence was cross-referenced with oral-historical accounts from their colleagues and students from our period of interest, which were collected, recorded and transcribed by the researcher at McMaster University, as well as journal publications emanating from McMaster over the same period. The data was processed using an inductive and hermeneutic approach, meaning that the researcher focused on inductively distilling meanings ascribed unfolding historical events by those who witnessed them. This approach consists in immersing the researcher into the historical world under scrutiny, until insights into the historical meaning given to an event or idea emerged, which was then tested against more data sources, with a preference for contemporary written sources over recollected oral sources.

This research was able to identify three explicit sources of intellectual inspiration for McMaster's original PBL model: Abraham Flexner, Johannes Comenius, and the Humanist Psychologists. We will discuss each in turn, explaining the extent to which their ideas contributed to PBL at McMaster, before closing on a discussion of the general historical context within which these findings should be read.

## 2. John Evans and the Flexner Report

Judging by the number of authors who have been credited with inspiring PBL, one would expect to find the archives of McMaster littered with references to Socrates, Erasmus, Dewey and Bruner. This is however not the case; references to any education theory were sparse, to say the least, and most surprisingly, considering his role as the Founding Dean of the medical school, an analysis of Evans' archives during his tenure as Dean produced exactly nil explicit source of inspiration. However, in an interview recorded *a posteriori* by Joan McAuley in 1979, Evans cited Flexner as an influence for his ideas on PBL:

> I think that the educational programme put into practice what people since Addison had been talking about, more than a century before, as the desirable goal - the things that Flexner was really talking about, I think and his ideas, but that didn't get translated that way.[4]

Evans implied that Flexner's message for medical education reform had been misunderstood by those who seized on the *Flexner Report* upon its publication in 1910 to promote the development of disciplinary basic sciences in undergraduate medical education. According to Evans, such an interpretation had led Flexner to be regarded as a man of the past whose ideas needed to be superseded, whilst (according to Evans) in fact Flexner was pointing the way towards the medical pedagogy of the future. Such a reading of Flexner was rejected even by people at McMaster in later years. For instance, one of McMaster's students stated, in his valedictory address of 1982: "McMaster exists because the Founders perceived a paucity in the traditional education of physicians (and by traditional I mean since the Flexner Report of 1912 [sic])".[5] Neither does Evans' interpretation chime with Flexner's writings after the *Flexner Report*.[6] However, the Founders of PBL, who were not medical education theorists, had their own ideas on Flexner, based on what seems like a somewhat cursory reading of the *Flexner Report*. Archival evidence shows that the Education Committee looked to the *Flexner Report* for general inspiration on pedagogical matters. The minutes of a meeting of the Ad Hoc Committee on Undergraduate Education, a sub-group of the EC, provide quotes of the following entire passages from the Flexner Report as inspiration for PBL:

> *Learning Methods*: […] There is no "one best" method or pace. 'Out and out didactic treatment is hopelessly antiquated: it belongs to an age of accepted dogma, or supposedly complete information, when the professor "knew" and the student "learned".7 (Flexner A., Medical Education in the United States and Canada, 1910, p. 61).
> *Faculty Responsibility*: If the education of students is a major objective of the University, then we feel it is imperative that the tutors responsible for working with the students should be assessed on their merit in this area. They should not be dependent upon research alone for funds and academic promotion. "… it will never happen that every professor in either the medical school or the university faculty is a genuinely productive scientist. There is room for another type - the non-productive assimilative teacher of wide experience, continuous receptivity, critical sense, and responsive interest" (Flexner, A.

> Medical Education in the United States and Canada, 1910, p. 57).[7]

To understand the origins of PBL and how this contradictory impact of the *Flexner Report* played out, we must investigate its contents. Remarkably for one associated so often with medical education, Flexner was no doctor and the medical world was rather foreign to him, but he was selected by the president of the Carnegie Foundation (possibly for his prior work on American Colleges) to compile a review of medical education in the USA. The crux of the *Flexner Report* was a critique of the over-abundance of poor quality medical schools in North America that did not meet the minimum standards of medical education but operated simply as businesses.[8] If one is to believe the report, this was indeed a sore problem in the early 20th century, with very few of America's 155 schools meeting the standards of medical education laid out by Flexner, who named the John Hopkins Medical School as the paragon of good medical education. However, buried beneath the commentary on the business model of medical schools in the early twentieth century was a strong critique of poor quality lecture-based education and a belief that laboratory sciences and clinical medicine shared the same methods. As Ludmerer pointed out in his critique of the work of Flexner:

It is not well known that Flexner had already developed a sophisticated educational philosophy that emphasized the importance of experiential learning ("learning by doing") at every level of study. It is also not well known that Flexner began his study with the conviction that universities and professional schools had the duty to promote original investigation, not merely to teach.[9]

When looking closely at the *Flexner Report*, one finds ideas on teaching methods and experiential learning that could be made to fit the ideals of the Founding Fathers. Flexner eloquently spoke against the decrepit lecturing model in use in medical education at the turn of the century:

Didactic lectures were given in huge, badly lighted amphitheaters, and in these discourses the instruction almost wholly consisted. Personal contact between teacher and student, between student and patient, was lost. No consistent effort was made to adapt medical training to changed circumstances.[8]

This statement correlates with the words of John Evans, who retrospectively analyzed his reasons for desiring a new model of education:

> I hate to admit it in retrospect, but we developed mostly out of negative situations. […] Remember this was the mid-sixties - the students were really disenchanted with professional education in medicine and yet it should be a terribly exciting experience. […] In our opinion, the problem was that they were the passive recipients of vast amounts of content knowledge and that they became saturated and bored by it and didn't see the relevance to professional practice.[4]

In fact, the correlation between what Flexner advocated and the policies that came out of McMaster goes beyond the mere criticism of rote learning. Flexner also had the idea that the world of the doctor was changing, that social and interpersonal aspects of the profession were becoming more important than ever before:

> The physician's function is fast becoming social and preventive, rather than individual and curative. Upon him society relied to ascertain, and through measures essentially education to enforce the conditions that prevent disease and make positively for physical and moral well-being.[8]

Teaching to meet the challenges of the changing role of the physician was one of the core tenets of Evans' vision for PBL, which he laid out in a short memorandum published internally in 1966. In particular, Evans called for his students to develop "the clinical skills and methods required to define and manage health problems of patients, including their physical, emotional and social aspects".[10] Such an intent was echoed by Bill Spaulding in 1968 when he drafted a memorandum that can be considered the first real sketch for PBL in practice. To introduce his proposal, he wrote that his objective was:

> To foster attitudes leading to behaviour as responsible physicians and scientists in their relation to patients, colleagues and society. Such behaviour is marked by compassionate concern for patients coupled with action to promote the public good when the physician is faced with ethical decisions.[11]

More controversially, it appears that at least some of the founders understood the Flexner report as condemning the separation of the basic sciences and laboratory sciences and advocating instead a more integrated approach to learning medicine – this interpretation seems to be at odds with the commonly understood message of Flexner, or indeed with what Flexner himself wrote later in his career.[6] There is no evidence that the founders read Flexner's work beyond

the 1910 report, so it is possible that they read passages such as the below and concluded that Flexner thought the distinction between basic and clinical sciences was artificial:

> For the purposes of convenience, the medical curriculum may be divided into two parts, according as the work is carried on mainly in laboratories or mainly in the hospital but the distinction is only superficial, for the hospital is itself in the fullest sense a laboratory.[7]

This perception was echoed by Fraser Mustard who stated: "I also believe that we should try to achieve as much integration as possible between the functions of research and education, research and service, and service and education".[11] This is a rather speculative interpretation, but such a misinterpretation would provide an explanation for the otherwise puzzling association between Flexner and PBL made by Evans in 1979, when the zeitgeist of medical education regarded Flexner as representing an outdated vision of medical education.

There is much else in the *Flexner Report* that is impossible to reconcile with PBL: Flexner was opposed to the idea of having people admitted to medical school who had no training in chemistry, biology and physics. By contrast, Evans suggested: "Let's try and make it possible for people from a whole host of different backgrounds to enter into this, rather than strictly from the biological science model, which was still dominating the medical schools at this stage of the game".[4] In addition, Flexner never mentioned anything about interdisciplinary or cross-disciplinary teaching. In fact, much of his work is devoted to explaining the role of separate disciplines in medical education.

Given the apparent contradictions in the interpretation of the *Flexner Report* by the Founding Fathers, one can legitimately ask if this should be listed amongst the intellectual influences of PBL at McMaster. We have included it here, because whether misinterpreted or not, Flexner is the most explicitly stated sources of inspiration of the Founders of the original McMaster PBL model, and to some extent, the Founders' reading of the Report influenced their conceptions of education, particularly with regards to reducing the importance of lectures, the social orientation of the programme, and the integration of clinical problems in the first years of study. Should a modern educator wish to understand the intellectual roots of PBL, it is recommended that they read the pedagogical section of the *Flexner Report* and try to see it as Evans did in the 1960s. That said, as we shall see in the discussion section, such an influence should not be overstated, as the Founders were not driven by theory, but found in some (at times misinterpreted) theory a convenient match for their own ideas.

## 3. Bill Spaulding and the Didactica Magna

The inclusion of the *Flexner Report* in the sources of intellectual inspiration of PBL, although unexpected to many (including the author when the research first started), is not, upon reflection, altogether surprising given its importance in the history of medical education. What is surprising however, is that the second source of pedagogical inspiration that could be identified was the *Didactica Magna* (the Great Didactic), a manuscript dating from 1657, written by the Moravian scholar Johannes Comenius.[13] The peculiarity of this reference is that it seemed exclusive to Bill Spaulding, who opened his founding memorandum of 1968 with the following quote: "Let the main objectives be as follows; to seek and find a method of instruction by which teachers may teach less, but learners may learn more.' - The Great Didactic of Comenius, a famous educator (1592-1670)".[11] None of the other founders mentioned Comenius, leading us to surmise that this was probably an idiosyncratic preference of Spaulding. Nonetheless, it should be emphasized that Spaulding was the main architect of the first PBL programme. While the other founding fathers contributed ideas, Spaulding is the one who designed the nuts and bolts of the programme and gave the Chairmen of the programme their marching orders, and therefore any intellectual influence of his, idiosyncratic as it may be, could potentially have coloured how PBL came out in practice at McMaster. It is therefore worth exploring the ideas of the Great Didactic to see if and in what way they influenced Spaulding's conception of PBL.

Comenius was a reformer at heart whose belief in the necessity for educational change lay, firstly, in his own dire educational experiences as a child and adolescent, and secondly, in his spiritual conviction, as a man of the Protestant Church, that "the seeds of knowledge, virtue and of piety exist in all men".[13] The Great Didactic was by far his largest and most renowned work. The naturalist slant of the Great Didactic echoes the dominance of natural philosophy in his time. Throughout the book, Comenius expended considerable effort comparing the work of the teacher and the role of schools to what could be observed in the natural world; using the metaphors of birds' nest-building, the gardener tending to his plants, and the methods of a carpenter

in house-building to illustrate his propositions. Although this may seem quirky to the modern reader, the main takeaway from this is that Comenius thought schooling had become an artificial exercise that alienated children from their natural potential. To fix this, school should be changed to reflect the natural learning proclivities of humans. Such a proposal would have appealed to Spaulding, given his account of his own stifling experience as a medical student and his desire to bring fun back into the curriculum.

The chief principles of Comenius' educational proposition were as follows: firstly, that teaching and learning should be fun, based on the interest of the pupil and not on coercion. Comenius advocated culling the number of hours spent on class benches and increasing the time spent on private study:

The ease and pleasantness of study will therefore be increased:

(i) If the class instruction be curtailed as much as possible, namely to four hours, and if the same length of time be left for private study.
(ii) If the pupils be forced to memorise as little as possible, that is to say, only the most important things; of the rest they need only grasp the general meaning.[13]

Secondly, Comenius strongly supported the integration and contextualization of knowledge in the learning process. To do this, he advocated that students should themselves endeavour to teach their peers:

> Questioning takes place when a pupil interrogates his teachers, his companions, or his books about some subject that he does not understand. Retention follows when the information is committed to memory, or is written down for greater security […]. Teaching takes place when knowledge that has been acquired is communicated to fellow-pupils or other companions.[13]

Despite his humanist propositions, Comenius envisaged a rather martial style of teaching based on authority, punishment, reward and standardization, which seems quite incongruent with his other two principles – and only makes sense if one takes into account the strong religious dogma underlying his writing. A modern educator like Spaulding would surely have shrugged this off as the natural disposition of a seventeenth century man of the church. What Spaulding is likely to have retained from Comenius, if the quotes he selected in his own memorandum are anything to go by, is that interest is key to learning, and top-down classroom instruction detrimental to it. And thus McMaster's core focus on small group work and self-study could be interpreted in the light of Comenius' call for reforming the classroom to be more "easy and pleasant" – quite in line with Evans' previous admission that he and Spaulding had engineered the first PBL curriculum as a revolt against their experience of boredom and frustration in their own medical education.

## 4. The humanist *vs* behaviourist controversy

With the passing of time, there is a tendency to retroactively ascribe clarity of mind, farsighted vision and perfect comprehension of extant ideas to pioneers and inventors. In fact, the story of novel methods often involves stumbling around in the intellectual dark and fumbling with half-understood concepts. So it was with PBL and two particular sets of ideas that, to any education scholar, should have immediately appeared to be epistemologically incompatible. These two opposing ideas were the behaviourist teaching approach of Robert Mager and the humanist learning approach of Carl Rogers. The practice-oriented doctors of McMaster spent considerable time and energy trying to fit these ideas together between 1965 and 1972 (unsuccessfully, as we shall see).

To understand this controversy and how it played out, we need to begin with the Programmed Instruction Movement from the 1950s and 60s; an educational movement rooted in the work of the Burrhus Skinner. In "Teaching Machine", a manifesto for a new age of programmed education, Skinner proposed that audio-visual instruction aids such as the television and the tape-recorders would supplant lectures, textbooks and demonstrations, not as learning aids but as actual replacements for teachers.[14] The essence of his short treatise follows the precepts of classical behaviourism: reward mechanisms that provide positive reinforcements for desired responses to stimuli and negative reinforcements for undesired responses to stimuli. In order for the conditioning to work, Skinner prescribed small steps that should be taken in sequences of increasing complexity - and his machine ensured that no step could be taken until the previous one has been completed. This was done by a succession of "frames" that the learner had to complete in logical order. Skinner faced, among others, the criticism that his methods did not allow students to think through a problem because they merely produced automated responses. He addressed this by considering "thinking" to be just another programmable form of behaviour: "a

more sensible programme is to analyse the behavior called 'thinking' and produce it according to specifications".[14]

Robert Mager, upon discovering the work of Skinner in the early 50s, became the champion of educational behaviourism and thrust in the hands of numerous educators a small booklet entitled *Preparing Instructional Objectives*.[15] In it, he provided precise instructions for teachers to construct learning objectives with a focus on teaching, rather than learning, and on the objectives as determined by the instructor rather than the student. The aim of education, for Mager, was to condition students to display desired behaviours (as determined by the teacher):

> An objective is meaningful to the extent it communicates an instructional intent to its reader and does so to the degree that it describes or defines the terminal behavior expected of the learner. (…) Terminal behavior refers to the behavior you would like your learner to be able to demonstrate at the time your influence over him ends.[15]

Mager claimed to reject partaking in education philosophy, but it could be argued that his position made some fundamental philosophical claims about the human mind – namely that fuzzy concepts such as free will, creativity, inspiration or imagination are not useful in explaining learning. This thinking is laden with consequences for learning: if free will and imagination are irrelevant in explaining learning, then learning must be explained in mechanistic terms, and learner performance can only be evaluated in the observation of the physical output of his or her body (either spoken, written or physically performed). In essence, education is a mere form of performance training. Mager summarized it thusly: "Since no one can see into another's mind to determine what he knows, you can only determine the state of a learner's intellect or skill by observing some aspect of his behaviour performance".[15]

Every action has its opposite reaction and so the 50s and 60s also produced a countermovement to behaviourism led by Carl Rogers and Abraham Maslow, which garnered the name "Humanist Psychology".[16] Grounded in the belief that humans were unique and naturally inclined to goodness irrespective or class, creed or culture, Rogers and Maslow proposed a theory of education based on achieving a deeply personal and individual form of "self-actualization".[17] They did not believe in generalizable psychological claims such as those made by the behaviourists, but instead proposed that each individual experience was incommensurable with any other and should be given a voice through "real" emotional dialogue rather than general scientific theories – a proposition consistent with a phenomenological methodological approach.[18]

Translating this into learning principles, humanist educators proposed that each student was a unique individual with the potential to become the best version of themselves if they could only be set free from traditional teacher authority, fixed curricula and summative examinations. In essence, just as experience existed in a phenomenal field, so "facts" and "knowledge" were only as good as the students' capacity to internalize and give meaning to them. Therefore, real learning was redefined by the humanist movement, under the leadership of Rogers, and later Malcolm Knowles, as a personal journey of "self-directed learning" upon which the student should embark for life in order to self-actualize.[19]

The idea of self-directed learning was enshrined by Evans in his important memorandum of 1966 on the principles of PBL. In it, he wrote that he wished for students to develop "the ability to become a self-directed learner, recognizing personal education needs, selecting appropriate learning resources and evaluating progress".[10] In the years that followed, Mustard called it "self-education",[12] Spaulding talked about "individualized lifelong learning"[12] and "self-organized activity devoted to comprehension",[11] Walsh referred to "self-education" and "T-Groups" (short for "Therapy Groups", a form of emotional dialogue advocated by Rogers as a replacement for the conventional classroom).[20] Around the time the Founding Fathers left in the mid-70s, a book written by Knowles but heavily influenced by Rogers, entitled *Self-Directed Learning*, made the rounds of the education committee as the de facto reference on the subject, after which "self-directed learning" became the standard phrase in use at McMaster and in PBL generally.[21]

It may therefore come as a surprise that the humanistic orientation evidenced by the plethora of references to self-directed learning (and other synonyms) co-existed in the Education Committee (after its expansion in 1968) with a commitment to Mager and his instructional objectives. Correspondence between two prominent figures from the EC from 1971, Dave Sackett and George Sweeney, indicates that Magerian learning objectives were very much a common reference at McMaster:

> Dear George, enclosed, as promised the other night, are educational objectives (Magerian!), resources, and problems suggested for Phase II - Ischaemia. I

> hope that this will provide a framework for pulling the stuff together and assisting the tutors.[22]

The omnipresence of Mager was confirmed by Jim Kraemer, a key figure in the EC after 1968, who raised the subject in his interview:

> I remember sitting through sessions and committees. I sat on. God knows how many. 25 various sub-committees and curriculum committees. And they developed absolutely encyclopaedic listings of knowledge that students should have. They developed objectives, they were all forced into getting. was it Robert Mager or whatever his name, who talked about learning objectives. was the magazine. a book that people used as the Bible.[23]

The fact that he refers to Mager's work as a "Bible" can leave no doubt as to its importance in his mind. However, just as this reminiscence implies that abiding by Magerian objectives was a tedious process, so archival evidence also indicates that Mager was not so readily accepted or applied by everybody. Already in 1968, EC members were questioning the applicability of behaviourist objectives to a model of medical education driven by humanist goals:

> Dr. Mueller suggested that the ideal product of a medical education would demonstrate a) interest, b) industry c) creativity d) responsibility e) personal stability f) ability to transform basic information into clinical relevance g) social attitudes and knowledge of the art. He emphasized that the Council exams normally stress the last of these and medical education tends to reflect a similar pattern. Dr. Mueller suggested that the difficulty in applying Mager to this end product is in apportioning values to these particular objectives that are flexible enough to apply to various stages in a medical career, in particular the M.D. degree. Once these values were apportioned, Magerian objectives could be determined and failure to demonstrate the appropriate behaviour would result in failure to obtain the McMaster M.D.[24]

Despite the difficulty, it would seem that Dr. Mueller doggedly attempted to apportion quantitative values to these "ideal products" of medical education such that they could be measured against Magerian objectives. However, he was ultimately overruled by one of the five McMaster founders, Jim Anderson, who judged the application of Magerian learning objectives to be a failure:

> *Evaluation sessions in small groups with a tutor follow each unit.* A) Our aims for each unit are not as easily formulated as I thought they would be. My head is bloody and bowed (Chairman of Medicine, please note) but a lot of the things we have done well have not been capable of being expressed in Magerian terms and so have been very difficult to evaluate.[25]

Under the influence of Anderson, Mager was dropped and summative assessment was abandoned, thereby aligning McMaster squarely with the Humanist position. This alignment was not revisited until the early 1990s, when it became clear that such a policy was not conducive to good results on the national medical exam.[26] But by that point the general understanding of assessment in medical education had moved beyond the behaviourist – humanist binary.

How do we account for the struggle between these ideas of freedom to learn and conditioned behaviour at McMaster when it should have been obvious that they were incompatible? A tentative explanation goes as follows: in the 60s, Mager and the behaviourists were accepted as standard practice in North America by teachers from all fields and at all levels who had no knowledge of this approach's epistemological foundations. Some evidence for the popularity of Mager's method can be found in the passing of the Stull Act in California in 1972, which required teachers to use his methods of devising instructional objectives.[27] Most of the people who were involved at the beginning of McMaster's programme were pragmatic educators with no clear overview of the ongoing intellectual disputes in education psychology. They probably didn't know that Mager was a behaviourist, if they even knew what behaviourist education theory entailed, and therefore likely did not know that it stood at the polar opposite of the principle of self-directed learning. Conversely, the founders seem to have latched onto the concept of self-directed learning more as a broad ideal of what a student should be than an actual methodology to be applied in the classroom. As Rogers had been anything but specific about how to achieve self-direction in his writings, and the founders were not prone to musing on philosophical texts to distil their meaning, the EC and unit coordinators were left to fend for themselves in finding the concrete means by which to enact the self-direction ideal. The tension came from the clash between the founders' ill-defined ideal loosely based on humanistic principles and the search for a concrete methodology for achieving that ideal, which seemingly landed on Mager's work, more likely due to its general

popularity rather than its relevance to the McMaster objectives.

The tension is quite apparent from the contortions reported in the archives to make the round of Mager's objectives fit in the square hole of the self-directed learning philosophy of PBL. In the absence of strong guidance from the founders, who were not education theorists, behaviourism pervaded throughout the echelons of the McMaster programme management, co-existing in a strange arranged marriage with the distinctively Rogerian approach held the founders. The oddness of this arrangement only became apparent once behaviourism was abandoned in education psychology in the 1970s, and the McMaster programme was reformed to align with the Rogerian approach. By that point, any reference to Mager disappeared, as did the long lists of learning objectives initially found in the unit manuals. Instead, longer PBL problems emerged with far more open possibilities for interpretation by the students, culminating in the 1980s with problems that could be three or four pages long. In addition, summative assessment, such as tests and exams, was discontinued and only formative assessment by the group tutor remained. This was all changed in 1991 when McMaster reformed its curriculum to align with the constructivist scientific research on PBL.[28]

## 5. Discussion

The purpose of this paper was to provide a historical description of the intellectual context in which PBL developed at McMaster University. The outcome of this search has been to show that the sources of inspiration one most expected to find were absent – no mention was made of Socrates or Dewey – and the sources that were found have not usually been associated with PBL. That is not to say that other sources did not tacitly play a role in the development of PBL at McMaster by virtue of being "in the air" at the time. Dewey is a case in point here; one could write an entire essay on the similarities between Dewey's work and the Founders' ideas on education, but this would be a speculative exercise rather than one bound in historical evidence for Dewey's influence on the founders. The purpose of this paper was to identify *explicitly* stated sources of inspiration only. In the light of the findings, we come to two conclusions: one concerns the specific mindset of the founders of PBL, and the other medical education reform in the mid-twentieth century in general.

First, although this research has exposed Flexner, Comenius and Rogers as sources of inspiration for Evans, Spaulding, Mustard, Anderson and Walsh, the impact of these influences should not be overstated. We had to do quite a lot of digging to unearth these sources, indicating that although they had some influence on the Founders' thinking, the latter were not driven by theoretical concerns. At best, they found in Flexner, Comenius and Rogers perspectives that aligned with their own more pragmatic concerns based in their experience as honed medical educators. The intercession of Mager into this debate is evidence enough that the founders had no real grasp of where any of these ideas really stood on an epistemological and ontological spectrum of education philosophy. In a different paper, the author showed that the Founders gave much more weight to concrete, practical sources of inspirations from other North American educational programmes like the Harvard Case Method and the Western Reserve University Organ Systems model, in combination with a good dose of trial and error.[29] This means that while it is interesting for present-day education scholars to reflect on PBL in the light of Dewey, Popper, Bruner, Kierkegaard or other thinkers whose work has been associated with PBL over the years, these musings are *post hoc* interpretations that do not reflect the origins and purpose of the first PBL programme.

Second, the major shift in medical education represented by McMaster's innovation should be regarded in the context of medical education reform and higher education reform more generally in the mid-twentieth century. PBL was born, in the words of one of the EC pioneers, in the time of the hippies and Woodstock.[30] The PBL reform rode on the back of the tectonic shift in mindset that was occurring the world over in universities and colleges. Experiments in project-based and problem-oriented education were abounding, entire scholarly movements were born around that time to criticize the status quo of professorial authority and stifling lecture halls. That PBL survived and thrived and many of these other experiments did not is probably the reason that its origins have generated much interest and speculation. But in the light of our findings, we can hardly ascribe PBL's success to a solid intellectual foundation for the method at McMaster. In fact, we have submitted elsewhere that had PBL's rather shaky theoretical foundations not been shored up with scientific learning principles by the cognitive psychologists of Maastricht University in the 1970s, it would likely also have been relegated to the dustbin of education history.[31] The difficulty of McMaster's original programme having such weak theoretical foundations is that it allowed later educators to read whatever they wanted into it. Today we witness splits, cracks and disputes on the

interpretation of PBL; disagreements on what PBL is for, criticism of the implementation of PBL in so-called "hybrids", disputes over the use of the term "PBL" to describe project-organized education and so forth. On each side of these arguments, educators refer to thinkers and theories that support their point. It is precisely the weakness of the theoretical foundations of the original PBL model that has allowed this to happen. We cannot rewrite history, so we have to accept the McMaster experiment for what it was: an interesting innovation created by doctors who had no idea how popular it would become and never sought for it to be adopted across the world in every discipline imaginable. It is important now to look critically at what has made PBL successful over the years – that is, in our opinion, the scientific research that has come to support its effect on learning. This has allowed educators to refine the practice of PBL in medical education through the development of specific application protocols that fit the research findings in terms of optimized learning outcomes. This has yielded practices like the seven-step method, assessment tools like the progress test, and complementary developments such as the skills lab.

## 6. Conclusion

It is hoped that this paper has shed some light on the intellectual context in which the original PBL model was developed. Though the insights into Flexner, Comenius and the Humanist *vs* Behaviourist debate are interesting to provide some clarity on the sources the founders were drawing from, the key takeaway from this paper is that the intellectual context of McMaster was largely one of pragmatism – led by people whose key drive was their own experience of medical education, and who, instead of being theory-driven, took bits and pieces from eclectic and sometimes epistemologically incompatible theories to support their emergent practice. That said, it should be noted that like all historical research endeavours, this research was limited by the availability of documents and witnesses, and provides the historian's interpretation rather than an elusive "objective" account of the past. Future historians of PBL may offer alternate interpretations of this story.

## References


1. Spaulding WB. *Revitalizing Medical Education, McMaster Medical School the Early Years 1965–1974*. Hamilton, ON: B. C. Decker Inc; 1991.
2. Servant-Miklos VFC. Fifty years on: a Retrospective on the World's First Problem-based Learning Programme at McMaster University Medical School. *Health Prof Educ* 2018http://dx.doi.org/ 10.1016/j.hpe.2018.04.002.
3. (a) Savin-Baden M, Howell-Major C. *Foundations of Problem Based Learning*. Maidenhead, UK: Open University Press; 2004;
   (b) 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.
4. McAuley J. *McMaster Oral History - Dr. J.R. Evans - 28th September 1979. Founding Fathers Interviews - HHS/FHS Archives*. Hamilton, ON: McMaster University; 1979.
5. Vaughan P. *Valedictory Address, McMaster University MD Class '82, May 14, 1982. Education Programme Committee - 1981–1982 - HHS/FHS Archives, Box 233.3;6*. Hamilton, ON: McMaster University; 1982.
6. Flexner A. *Medical Education. A Comparative Study*. New York: The MacMillan Company; 1925.
7. 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 - HHS / FHS Archives, Box 232.5;5*. Hamilton, ON: McMaster University; 1969.
8. Flexner A. *Medical Education in the United States and Canada: a Report to the Carnegie Foundation for the Advancement of Teaching (No. 4)*. New York, NY: Carnegie Foundation for the Advancement of Teaching; 1910.
9. Ludmerer KM. Commentary: understanding the Flexner report. *Acad Med* 2010;85(2):193–196.
10. Evans JR. *General Objectives. Objectives of the Faculty School of Medicine – HHS/FHS Archives, Box 145.8;1*. Hamilton, ON: McMaster University; 1966.
11. 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.
12. Mustard JF. *Objectives of the Faculty of Medicine – Letter to D.L. Sackett - 11th November 1968 - Box 145.8,1. HHS/FHS Archives*. Hamilton, ON: McMaster University; 1968.
13. Keatinge MW. *The Great Didactic of John Amos Comenius: translated into English and edited with biographical, historical and critical introductions*. New York, NY: Russell & Russell; 1967.
14. Skinner BF. Teaching machines. *Science* 1958;128(3330): 969–977.
15. Mager RF. *Preparing Instructional Objectives*. Palo Alto, CA: Fearon Publishers; 1962.
16. Hergenhahn R. *An introduction to the history of psychology*, 4th ed., Belmont, CA: Wadsworth Pub. Co.; 2001.
17. Maslow AH. A theory of human motivation. *Psychol Rev* 1943;50(4):370–396.
18. Rogers CR. *Client-centered Therapy: its Current Practice, Implications and Theory*. London, UK: Constable; 1951.
19. Rogers CR. *Freedom to learn*. Columbus, OH: C. E. Merrill Pub. Co; 1969.
20. Walsh W. *Attitudes in Medicine - A Draft Submission. Educational Programme Committee - 1968 - HHS/ FHS Archives, Box 232.4;4*. Hamilton, ON: McMaster University; 1968.
21. Knowles MS. *Self-directed learning: a guide for learners and teachers*. Chicago, IL: Association Press; 1975.

22. Sackett DL. *Re: Phase II - Ischaemia - To: Dr. G.D. Sweeney. Phase II Ischaemia (1969- 1970) - HHS/ FHS Archives, Box 242.1;7*. Hamilton, ON: McMaster University; 1971.
23. Kraemer J. McMaster Education Coordinator between 1968 and 1973 in interview with the author, by telephone, February 12; 2013.
24. Kraemer J. *Education Committee Meeting - October 11, 1968. Educational Programme Committee - 1968 - HHS/ FHS Archives, Box 232.4;7*. Hamilton, ON: McMaster University; 1968.
25. Anderson JE. *Re: Progress Report - To: Faculty involved in Phase I. Educational Programme Committee - 1969 - HHS / FHS Archives, Box 232.5;4*. Hamilton, ON: McMaster University; 1969.
26. Neville AJ, Norman GR. PBL in the undergraduate MD program at McMaster University: three iterations in three decades. *Acad Med* 2007;82(4):370–374.
27. Taylor R. Life in the Pinball Machine: looking back with Bob Mager. *Perform Improv* 2005;44(9):5.
28. Norman GR, Neville A, Blake JM, Mueller CB. Assessment steers learning down the right road: impact of progress testing on licensing examination performance. *Med Teach* 2010;32: 496–499.
29. Servant-Miklos VFC. The Harvard connection: how the case method spawned problem-based learning at McMaster University. *Health Prof Educ* 2018http://dx.doi.org/ 10.1016/j.hpe.2018.07.004.
30. Mueller CB. *McMaster University Medical School: The Little School that Could – and Did*, 5. McMaster University Medical Journal; 29–33.
31. Servant-Miklos VFC. Problem solving skills versus knowledge acquisition: the historical dispute that split problem-based learning into two camps. *Adv Health Sci Educ* 2018: 1–17 http://dx.doi.org/10.1007/s10459-018-9835-0.

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