Developing a science of teaching through lesson study

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Abstract

Purpose – The purpose of this paper is to explore the potential of lesson study for the development of a science of teaching cast in the form of John Dewey’s “laboratory model” of learning to teach.

Design/methodology/approach – The early sections compare the “laboratory” with the “apprenticeship” and “rationalist” models of learning to teach, which emphasise the primacy of practice and theory respectively. The unity of theory and practice embodied in the “laboratory model” is outlined, linking the development of teachers’ theoretical understanding with the development of their practice. A distinction between pedagogy and teaching is drawn. The later sections examine the potential of lesson study to develop as a teacher-based pedagogical science, particularly when informed by variation theory. The paper concludes by suggesting ways in which different theories of learning can be integrated into learning study, and points to ways in which particular studies can contribute to the systematic construction of pedagogical knowledge.

Findings – There can be no pedagogy without casting teaching as an experimental science, in which pedagogical theories are appropriated, tested and further developed as a source of pedagogical principles. Pedagogy therefore consists of a science of teaching in which teachers actively participate in knowledge construction. Lesson study when informed by an explicit learning theory, such as variation theory, provides a strong basis for the development of a practitioner-based science of teaching.

Originality/value – The paper creates original links across disparate work in the field of teaching and learning.

Keywords Teachers, Learning, Laboratory model, Action research, Pedagogy, Theory and practice, Lesson study, Variation theory, Science of teaching

Paper type Conceptual paper

Introduction

In this paper I shall describe the main features of John Dewey’s[1] “laboratory model” of learning to teach, in comparison with “apprenticeship” and “rationalist” models and then explore its potential for the development of a transnational science of teaching through “lesson study”. In the process I will draw on the ideas of other pedagogical theorists to further develop this model. This will include discussing the “learning studies” developed in Hong Kong schools as a potential strategy for improving the scientific basis of lesson study along the lines initiated by Dewey.

In the Anglo-Saxon countries, policy makers increasingly poured scorn on educational theory, which was in any way relevant to learning to teach in classrooms and schools. The process is largely seen in terms of the novice teacher having an early immersion into practical classroom experience under the guidance of an experienced mentor. This process of induction, in which the novice observes the mentor and then strives to imitate their performance assisted by critical feedback from the latter, depicts an apprenticeship model of learning to teach. It is increasingly viewed as the most efficient and effective way of learning to teach. Spending time not undertaking a great deal of practice work but engaged in the study of educational theory at an institution of higher education prior to such work, the “theory applying” or “rationalist
model” of learning to teach, is widely regarded to be an unworkable model of learning
to teach, inasmuch as novice teachers are unable to match the abstract theories learned
in the academy to the realities of life in classrooms. Even when periods of practice work
in schools under a mentor are interwoven with periods of theory work in higher
education establishments, this is now widely regarded in the policy community as less
effective in helping novice teachers to acquire the practical tools of their profession
than the apprentice model. Hence we have the growing influence of entirely school-
based “teacher training” in the form of the “TeachFirst” programmes in England and
the “Teach for America” programmes in the USA.

The “laboratory model” of learning to teach
What is being ignored is a perspective on practice work in classrooms and schools
that neither fits the “apprenticeship” or “rationalist model” of learning to teach. This
perspective was initially articulated “in western society”, by John Dewey, as the
“laboratory model” of learning to teach, which links the development of the teacher’s
theoretical understanding with the development of their practice through their
personal experiences as learners in classrooms and beyond. The “laboratory model”,
according to Prawat (2000, 2001), reflects an often unacknowledged shift in Dewey’s
thinking about the relationship between action and knowledge. Dewey’s early work
was heavily influenced by the psychologist William James. In it “action” was largely
understood as directed towards the satisfaction of the needs and desires of individuals
and to be largely unthinking, a matter of routine, so long as it “worked”. However, there
are times, it was argued, when an individual will experience a frustration of need,
a discontinuity in the flow of need-related action. Action then gives way to reflection
about the best way of reorganising behaviour to achieve a state of equilibrium. The
knowledge outcomes of such an inquiry are, for both James and the early Dewey,
always subordinate to action (see Prawat, 2001, p. 8).

The shift in Dewey’s thinking, which Prawat documents, involved action as integral
to the construction of knowledge, a process that is significantly influenced, he claims,
by Dewey’s engagement from 1903 onwards with the work of the pragmatist
philosopher of science Charles Peirce (see Prawat, 2000, pp. 21-2). According to Peirce,
it is the “irritation of doubt” that gives rise to inquiry when one expects something to
happen but observes something else, which is a different kind of doubt to hesitancy
about how to act or proceed (see Prawat, 2001, p. 10). For Peirce the fact that we
encounter difficulty walking on ice is at odds with the observed ease with which heavy
objects are propelled across icy surfaces. This puzzling and discordant “complexus of
facts” calls out for some unifying concept. The inquirer will be puzzling over two
disjoint facts – that ice, although difficult to walk on, is ideal for sliding heavy objects.
The notion that these seemingly disparate phenomena can be brought into harmony
with one another when a single concept is brought to bear, friction, is key to
understanding what Peirce is getting at. Friction, as a concept, exerts a unifying effect
“spatially” in bringing the two examples together under the same rubric. It exerts a
unifying effect “temporally” when it is viewed in conjunction with the related notion of
traction. Friction, defined as traction, is helpful when getting an object (i.e. animate or
inanimate) underway; it is an impediment to continued progress once the object has
been set in motion.

Action for Peirce is important, but it is action of a profoundly different sort from
what the early Dewey had in mind. The kind of action that is of greatest interest is that
which is intimately connected to disciplined inquiry (see Prawat, 2001, p. 10). Action
takes place during knowledge construction when index is related to object and, later, during the process of knowledge explication and verification, when the consequences associated with a specific idea are identified and tested across contexts.

Knowledge for Dewey, after his Peircean turn[2], consisted of relations between things and it is the process of experimentation that searches out and tests these relations, which is why Dewey argues that experimentation, as the “means” of knowledge, is totally intertwined with relational outcomes, the so-called “objects” of knowledge. The one is wrapped up in the other (see Prawat, 2001, p. 10).

Following Peirce, Dewey came to view knowledge as socially constructed. The fact that universals can be grasped by individual minds does not imply that all ideas are worth believing. It is the task of scholarly communities to agree on what constitutes a fair test of ideas, to receive reports on the results of such tests and decide whether the ideas should be regarded as valid for the time being. For Peirce, all attempts on the part of a scholarly community to lay the laws of nature bare are to be regarded as tentative, provisional and subject to further challenge. As Prawat (2000, p. 14) points out Dewey (1938/1986) fully appreciated the Peircian insight that the attainment of settled beliefs is a progressive matter. There is no belief he argued that “is so settled as not to be exposed to further inquiry” (p. 16).

Dewey’s “laboratory model” of learning to teach also resonates with conceptions of truth embedded in Confucian thought. Hall and Ames (1987, pp. 77-83) have indeed claimed that the Confucian concept of truth is very similar to that held by pragmatist scholars like Dewey and Mead. From a Confucian perspective truth is not determined independently of action in the circumstances of everyday life. Knowledge is only fully achieved in action and socially constructed by relational selves (see Elliott and Tsai, 2008, p. 572). This perhaps explains why a “laboratory model” of learning how to teach, in the form of a collaborative experimental teaching procedure called Lesson Study, has emerged in Asian countries – Japan, China, Hong Kong, Singapore – where the influence of Confucian thought and culture is strong.

The “apprenticeship” and “laboratory” models compared
John Dewey (1904/1974a) contrasted the difference between the “apprenticeship model” and “laboratory model” of practice work in terms of the different aims each served with respect to the induction of novice teachers. These different aims he argued changed the amount, conditions and method of practice work. On the one hand the immediate and ultimate aim of the apprenticeship approach to practice work is to give novice teachers skill and proficiency in the work of teaching, as well as control of techniques of instruction and classroom management. On the other hand its immediate aim is to make theoretical instruction – knowledge of subject matter and principles of education – real and meaningful. The immediate aim of practice work from the laboratory point of view is not to supply an efficient workman to schools and classrooms but rather “to supply the intellectual method and materials of good workmanship” (p. 314). It aims to give the novice teacher an opportunity to pose intellectual questions about the educational significance of the subject matter they are to teach and of scientific, historical and philosophical studies of education. From this point of view practice work raises questions about the nature of the educational process, which then become the focus of inquiries and culminate in testing hypotheses about “educational significance” in classrooms conceived as “laboratories”. Within this process the dualism between theory and practice is overcome, i.e. embracing lofty pedagogical ideals in abstract while effectively disregarding them in practice, which
Dewey regarded as duplicity and “one of the chief evils of the teaching profession”. The “laboratory model” conceives theory and practice growing together “out of and into the teacher’s personal experience” (p. 320). The teacher not only becomes a technically skilled professional but also develops the capability to generate new conceptions of what constitutes education (p. 338).

Dewey was careful to avoid polarising these different points of view, arguing that “the results are not exclusive” (p. 314). Practice work shaped by the laboratory model can ensure the development of some technical instructional and class management skills as a consequence. Conversely, practice work shaped by the “apprenticeship model” “can incidentally serve to enlighten and enrich instruction in subject matter and the theory of education”. It is a matter of emphasis. In actual practice work one of the aims will be dominant while the other plays a subordinate function.

Dewey argued that the schools themselves will find it difficult to create the conditions under which novice teachers can best acquire and use the intellectual or scientific method to address questions and issues that arise from their personal experience concerning the educational significance of their practice work, whereas there will be time to acquire and perfect technical skills while undertaking the actual work of the profession under normal conditions. He felt that the scientific foundations of pedagogy should be laid in advance of full immersion into the work culture of schools. Nevertheless, an initial training process on a “laboratory model” gave the teacher “the power to keep on growing” while teaching (p. 320), and to continue to view their classroom as a potential laboratory for conducting educational experiments. Hence the need for teacher training schools to organise practice work according to the “laboratory model”.

For Dewey the cost of relying predominantly on an “apprenticeship” model of teacher training is that it limits the power of teachers to keep on growing. Such power consists of being able to accept intellectual responsibility for designing pupils’ learning experiences in the form of lesson plans. There is a world of difference according to Dewey between the novice “who prepares set lessons; who then has those lesson plans criticised; who then has his actual teaching criticised from the standpoint of success in carrying out the prearranged plans” and the experienced teacher who, through a process of reflective self-criticism “has to build up and modify his teaching plans as he goes along from experience gained in contact with pupils” (p. 317). The latter does not become capable of accepting intellectual responsibility for the design of their teaching solely on the basis of the former kind of experience when a student teacher. What that experience does, according to Dewey, is more related to becoming responsible for securing discipline in the classroom. Not that this is a bad thing but it focuses on securing what he calls the outward attention of the pupil to the neglect of the inward attention (pp. 317-8). The latter involves “the giving of the mind without reserve or qualification to the subject at hand. It is the first-hand and mental play of mental powers”. It is in a nutshell the pursuit of understanding as the goal of learning (see Gardner and Boix-Mansilla, 2004). Dewey argued that the supreme mark of the good teacher is the ability “to keep track of this mental play, to recognise the signs of its presence or absence, to know how it is initiated and maintained, how to test it by results attained, and to test results by it” (pp. 318-9). Such a capability also lay at the heart of Stenhouse’s notion of the teacher as a researcher (1975, pp. 142-65).

The basis of discipline and control should rest on the teacher’s mastery of the subject matter from the standpoint of its educational value and use, Dewey contended,
but the novice teacher cannot focus on both at the same time. The mastery of classroom management techniques should follow on from the mastery of educational principles in relation to their application to the subject matter “which is at once the material of instruction and the basis of discipline and control” (p. 318). Hence the acquisition of technique in relation to fostering and maintaining the inward attention of pupils constitutes the true mode of apprenticeship, as opposed to that which focuses on the acquisition of technique in relation to securing the outward attention of the pupil as the supreme goal. This distinction is very important in my view. There is an important difference between techniques exclusively aimed at the “management of behaviour” in classrooms and the “management of learning”.

Subject matter knowledge and teaching method
It is often assumed that the scholarly acquisition of subject matter knowledge is an independent process from learning how to teach it. In Democracy and Education Dewey, however, argues that method is embedded in the organisation of subject matter content (1916/1966, pp. 164-70). The latter he claims tends to be organised for the purpose of learning. The pedagogical implications of this are made even clearer by Dewey over a decade earlier in an attempt to demonstrate that content is not simply theory “remote from the practical problems of teaching” (1904/1974a, p. 327). The bodies of knowledge that make up subject matters are not isolated scraps of information put together at random. There is method in subject matter itself because it is material that has been “selected and arranged with reference to controlling intellectual principles” (p. 328). Such principles will consist of the key ideas and concepts that shape and discipline different modes of thinking to bring the “raw material of human experience to a point where it at once satisfies and stimulates the needs of active thought”. Hence, the organisation of subject matter exemplifies the kind of higher order mental activity which characterises the growth of the human mind and hence the educational process.

In the light of the above Dewey warned against a particular kind of practice work for lesson planning, in which subject matter is snatched as a basis for constructing isolated and independent lesson plans for a particular grade of pupils. What is needed is a view of the entire curriculum as a process of continuous growth, which reflects the growth of the mind itself. This in turn, argued Dewey, demands “consecutive and longitudinal consideration of the curriculum – rather than a cross-sectional view of it” where the same subject matter is seen to develop throughout the movement of the school from day to day and year to year (pp. 332-3). Such a view of the curriculum is a necessary basis for avoiding a piece meal approach to lesson planning in which subject matter is isolated from its educational use to develop the mental powers of the child (see also Dewey 1966, pp. 180-84).

Pedagogy as the science of teaching
Dewey’s “laboratory model” of learning to teach, views teaching as a practical science. Novice teachers are inducted into the use of the scientific method, which he regarded as the form of all inquiry, and not simply that, which is related to a particular kind of subject matter. Dewey regarded scientific method to consist not so much of a body of specialised techniques as a set of mental attitudes and habits of mind, such as curiosity, objectivity, honesty, open-mindedness and a commitment to freedom of thought and discussion (Dewey, 1910/1974b, pp. 182-92). Scientific or intellectual method is viewed as a social process of inquiry that exemplifies the democratic virtues.
Dewey’s characterisation of the difference between the “laboratory model” and the “apprenticeship model” of induction into the practice work provides a basis for making a clear distinction between pedagogy and mere teaching. Brian Simon, the English educational historian asked back in 1981 “Why no pedagogy in England?” compared with continental Europe (see also Simon, 1994, pp. 150-1). By pedagogy, he was referring to a science of teaching. He partly blamed the dominant educational institutions – ancient universities and the leading elite ‘public schools’ – which attributed little importance to educational theory as a basis for teaching.

Simon (1981) identified two conditions for the development of such a science. The first was the recognition of a human capacity for learning without limits (p. 38-9). Although this recognition underpinned Dewey’s conception of education it was not always present in psychological theories of mental activity, as he pointed out with respect to the influential psychometric theory of mental measurement during the mid twentieth century. Here individual cognitive development was viewed as “driven by an engine of a given horse-power which is fixed, unchangeable and measurable, in each particular case”, and thereby setting limits to learning. The second condition is that the process of learning is common across the human species, and that learning capability is similar across it. Again this is consistent with Dewey’s conception of the process of education. Hence it becomes possible to imagine, Simon argued, the possibility of determining a body of “general principles of teaching” that are relevant for “most individual pupils” (p. 39).

Simon claimed that leading educational psychologists today accept both conditions, and are thereby concerned to link the development of learning theory with pedagogy. He cites Bruner’s claim that “any subject can be taught to anybody at any age in some form that is both interesting and honest” as pointing to the need to link developmental psychology with pedagogy. Such a view was articulated early in the twentieth century by Dewey (1916/1966) when he expounded the relationship or interplay between the teacher’s mastery of subject disciplines as a source of standards in teaching and the pupil’s own lived experience that is “organised in connection with direct practical centres of interest” (p. 183).

Simon (1981) believed that the work of Vygotsky and Luria in Russia on the “zone of proximal development” and the role of language as a medium of communication between the teacher and the learner – a pedagogical theory emphasising teaching as the means of accelerating learning (see Alexander, 2008, p. 80) beyond the process of natural growth and development – were particularly relevant to the development of a science of teaching (p. 40). Yet I would ask “where are teachers engaged in learning studies aimed at testing pedagogical theories through their practice work in schools?”

From a Deweyan perspective there can be no pedagogy without casting teaching as an experimental science, as a form of action research, in which pedagogical theories are appropriated, tested and further developed as a source of pedagogical principles in the course of practice work in classrooms and schools. This perspective was clearly reflected in Stenhouse’s concept of the “teacher as researcher” (1975, Chapter 10) engaged in the development of an educational science through testing ideas cast in curricular form in classrooms conceived as laboratories. Where can we find this happening in the world to-day? It seems to me that teacher preparation has in general not provided solid foundations for the development of a science of teaching in educational institutions as Dewey hoped. Such preparation has either transmitted
learning and pedagogical theory in relative isolation from practice work in schools, or has, as I believe to be increasingly the case across the globe, been shaped by an “apprenticeship model” that rapidly socialises student teachers into the work-place culture of schools. If this is the case then we have to consider ways in which work-place cultures can be opened to the critical scrutiny of the teachers whose practices they shape, and thereby transformed to create space for the development of a science of teaching.

Testing and developing pedagogical theory through lesson study
Lesson study of the kind that originated in Japan is providing a context for systematically developing and testing a pedagogical theory. Japanese lesson study is rapidly globalising as a powerful intervention into the prevailing cultures of teaching and learning in schools (see Matoba et al., 2006). At the heart of it is the collaborative development of a lesson conceived not so much in terms of a single unit of time but rather as a unit of study, which may extend over a considerable period of time. A group of three to eight teachers engaged in teaching the same topic or theme to different classes may start by jointly producing a design for teaching it, perhaps guided by an outside curriculum or pedagogical specialist. The teachers then observe each others’ teaching in turn and pool their observations as a basis for discussion in a series of meetings. The “original design for teaching” is continuously changed at these meetings in the light of the teachers’ research and discussion. Decisions are made collectively on the basis of any shared understandings arrived at during a meeting about how the teaching of the lesson might be improved. These “improvements” are then tested by the teacher who teaches the lesson next.

Lesson study as an intervention into the work-place culture in classrooms and schools is specifically designed as a means of improving teaching by enabling teachers to build and share knowledge of teaching and learning (see Lewis et al., 2009, p. 142). It therefore opens up a space for an explicit pedagogy in schools, conceived as a science of teaching. Given the demands it makes on time and staff resources some educators, as Lewis points out (2009, p. 148), have been sceptical about the extent to which lesson study could be sustained outside of the collaborative organisational culture to be found in Japan, and I would add in some other Asian-Confucian countries. However, Lewis provides evidence of how surprisingly sustainable lesson study groups have proved to be in North America (p. 148). She argues that many groups have shown considerable ingenuity in building support within schools for the development of collaborative spaces such as shared planning time and opportunities to share relevant subject matter knowledge with each other. I would suggest that the fact that much lesson study outside Japan has focused on Mathematics, where measured attainment is an important performance indicator for schools and a basis for international comparisons with Asian countries, may explain the ingenuity displayed by teachers to support the growth of collaborative space inside schools. However, Lewis claims that lesson study is now spreading in North America to other subject areas, and it will be interesting to see how sustainable it becomes beyond the Mathematics curriculum.

Although it might be argued that lesson study has helped to construct shared knowledge about how to teach, particularly in Japan, “the pedagogical theories” that underpin such knowledge building are often implicit and unclear. In Japan they may explicitly underpin national curriculum goals and guidelines, but in North America, as Lewis points out (p. 150), the relationship between lesson study and the pursuit of
explicit pedagogical goals is often unclear. In which case there will be little explicit pedagogical theory about how such aims might be realised in the teaching and learning process. We need I suggest to look at the extent to which the lesson study process in different countries challenges teachers to make explicit and open to critical scrutiny the dominant folk pedagogy that shapes their practice. To what extent is such study simply premised on, and contained by, the model of mind that shapes practice within the teacher group. Hence, as a method it may improve teaching without changing the theory of mind and its cultivation, which underpins it. We need to know how lesson study might be recast to engage teachers in rethinking the model of mind, which drives the development of their pedagogical knowledge. This requires the introduction into the lesson study process of a quite explicit pedagogical theory that will challenge teachers implicit folk pedagogies and in doing so require them to pedagogically theorise about their practice. In the process they will test the practical validity of different models of the learner’s mind as a basis for their teaching.

There is one notable respect in which lesson study has been recast in the form of an explicit pedagogical theory. I am referring to the learning study method developed in schools in Hong Kong by Lo Mun Ling and her associates at the Hong Kong Institute of Education. In Hong Kong Japanese lesson study was fused with a phenomenographic theory of learning developed initially in Sweden and then in Hong Kong by Ference Marton and his co-workers (see Marton and Booth, 1997; Marton and Morris, 2002; Marton and Runesson, 2003; Marton and Tsui, 2004; Marton and Pang, 2004, Lo et al., 2006). This theory is known as variation theory, where learning is regarded as a function of discernment, which presupposes an experienced variation. In Sweden, and at first in Hong Kong, the theory was tested in a variety of curriculum areas through “design experiments”, where teachers collaborated with researchers to test the pedagogical validity of the theory but the primary responsibility for data gathering and analysis, largely pre- and post-test data, lay with the latter.

In the Hong Kong curriculum reform context teachers have been given responsibility for developing school-based curricula within a national framework of key learning areas and tasks, aims and goals and values. The Hong Kong government had encouraged and supported teachers’ action research as a basis for such development. In this context Lo Mun Ling grasped the potential of variation theory as a theoretical framework of concepts that might enable teachers to address the “learning gap” in lesson and curriculum planning. She linked the theory to Japanese lesson study procedures, thereby integrating it into a collectivist form of teachers’ action research.

The transformation in Hong Kong of lesson study into a form of “learning study” structured by variation theory has challenged a currently widespread western assumption that action research is about the development of practice rather than the testing and development of theory. The action research context has, as I shall show later, resulted in the further development of the theory as it was tested by teachers in use.

Lo and Pong (2006, p. 10-1) summarise the phenomenographic research findings which underpin the theory:

1. Pupils’ experience the same phenomenon in qualitively different ways.
2. Variation will tend to be limited to certain patterns.
Pupils bring their own beliefs and ideas into the formal learning situation and these may conflict with what the teacher tries to teach. Students understand the same curriculum material or teaching act differently.

Variation in discernment of the same phenomenon will result in variable learning outcomes – as a norm rather than an exception.

Although pupils experience different understandings of the same object they often assume that others understand it in the same way as they do. Hence it is only too easy for teachers to assume that their pupils will come to understand something in the way they intended.

Given the different ways individual students experience the same phenomenon, Lo and Pong, argue that teachers need help to develop a pedagogy that caters to individual differences. The central task of such a pedagogy “[...] would be, first to find out what these different ways of understanding are and, second, to consider how teaching should be structured to enable students to see what is taught in the intended way” (p. 11). A pedagogy that caters to difference will accept the following reasons for students’ incomplete understandings of the subject matter:

1. their intuitive ways of understanding;
2. they fail to focus on all the critical features of what is to be learnt;
3. they have not been exposed to suitable learning experiences in the lesson that would have enabled them to learn.

In doing so, Lo and Pong claim, it will challenge the common view that what prevents students from fully understanding subject matter is their lack of ability or the failure of their teachers to arrange the classroom as a learning environment in ways that motivate students.

Variation theory builds from phenomenographic research findings a conceptual framework aimed at helping teachers to structure learning experiences in ways that cater for individual ways of seeing. As such it is best described as a pedagogical theory rather than simply a learning theory. The key terms, which constitute the conceptual framework of variation theory, are outlined by Lo and Pong as follows (pp. 14-20):

1. The object of learning – intended, enacted and lived: the objects of learning are the ends towards which learning activities are directed and how they are understood by learners. Such ends have a general and specific aspect. The former refers to the capabilities to be nurtured in the learners while the latter refers to the subject matter upon which the capability is being developed or exercised. Lo and Pong have argued that the use of the term need not be confined to understanding a concept or theory but may also be associated with the development of a skill, attitude or value (pp. 14-15).

In choosing an “object of learning” “one cannot simply make reference to a set of topics and their places within the content or structure of an academic discipline, such as mathematics” (Lo and Pong, p. 15). One must also make reference to the rationale for learning a particular subject matter in terms of how it functions to open up possibilities for the learner in relation to their lives and their world. For example, during a lesson on “evaporation and condensation” a pupil asked her teacher why there was condensation on the leaves of a tree in the evening? But both the air and the trees were cold at night.
The concept of “the object of learning” clarifies the relationship between the curriculum and the tasks of school-based curriculum development. The former depicts the subject matter to be learned and the learning goals related to it, but it does not describe how this subject matter is to be pedagogically handled. That is the task of designing detailed programmes of study. From the standpoint of variation theory this is a task for teachers, since they need to establish which critical aspects of the subject matter need to be discerned by learners in the light of their particular difficulties in developing a particular capability. The problem with some national curricula is the tendency for the government to centrally prescribe detailed programmes of study and thereby prevent teachers from being responsive to their students’ learning needs (as was the case in the UK).

“Objects of learning” can be differentiated according to context. They may be “intended”, “enacted” or “lived”. Students do not always learn what is intended. The teacher may enact an “object of learning” in a lesson that does not express the “intended object of learning” before the lesson, and a student may encounter an “object of learning” as a lived experience that was not intended or enacted by the teacher.

(2) Critical aspects: these are critical features of the subject matter that students need to discern in order to acquire the intended capability. By way of example Lo and Pong cite the study of astronomical phenomena in the general studies primary curriculum in Hong Kong (p. 17). The students are expected to learn topics like the four seasons, lunar eclipses, tides, rotation and revolution of the Moon and Earth. Lo and Pong argue that without “carefully analysing what the object of learning should be, what the critical aspects are, and how these are related, teachers often feel that they are confronted with, and have to conform to, a curriculum which fails to support learning for understanding”. This is because it appears to present “too many disconnected facts in too short a time”. To help students learn such topics teachers must be able to understand why students may experience difficulties in discerning their critical features. They are likely to approach these topics intuitively from a geocentric perspective “because they can only see the movements of the moon and the sun, but not that of the earth as they are standing on it”. Pedagogically students are required to change their geographical perspective to a heliocentric one. Lo and Pong show how concepts like “gravitational force and how it operates between these celestial bodies resulting in rotation and revolution” are critical aspects of the subject matter that need to be discerned if students are to develop the capability to explain and deduce the astronomical phenomena which feature in the Hong Kong general studies curriculum.

(3) The structure of awareness: any phenomenon has different aspects. It can be seen in different ways depending on which aspects are discerned as critical, and this will depend on one’s purposes in relation to it. Learning is the discernment of critical aspects of the subject matter that have not previously been discerned or noticed (see Lo and Pong, p. 18).

(4) Discernment and variation: people notice things when they stand out. “Things tend to stand out when they change or vary against a stable background or when something stays unchanged against a changing background”, e.g. birds in forest are discerned from the same background when they move. Lo and Pong (p. 19) state that “[…] we must discern all the critical aspects of a phenomenon simultaneously in order to gain a complete understanding of a phenomenon”, e.g. the detective weighing up all the evidence may suddenly discern all the critical aspects at the same time so
that their relationship becomes clear. To fully understand a phenomenon one needs to discern how each critical aspect is related to the others and to the whole (p. 20).

Learning studies in Hong Kong has built variation theory into Japanese lesson studies through three major projects. The process began on a major scale in 2000, when the Curriculum Development Institute in Hong Kong commissioned research into how to cater for individual differences in students attending mainstream schools. The CDI had just embarked on widespread curriculum reforms following the changeover from British rule. Lo Mun Ling with Ference Marton (2006) serving as the main consultant directed this research. It explicitly set out to test the value of using the framework of concepts associated with variation theory as a guide to pedagogical/curriculum design. The project worked with a total of 18 groups of teachers supported by 12 academic staff over a three-year period. In the process the framework itself was refined, and then further tested through the QEF funded PIPS project (2001-2004) and the Education and Manpower Bureau funded “Variation for the Improvement of Teaching and Learning” project (VITAL 2003-2007). PIPS engaged 40 volunteer primary schools and VITAL 120 primary and secondary schools in learning studies.

Three types of variation were discriminated in assessing the impact of the first project on the teachers involved. These came to be known as V1, V2 and V3:

1. V1 refers to variation in students’ understanding of the subject matter.
2. V2 refers to variation in teachers’ ways of handling the object of learning (topic) in planning a research lesson, e.g. in their discernment of its critical features.
3. V3 refers to variation as a guiding principle of pedagogical design, i.e. the use teachers make of patterns of variation in enabling students to discern critical features of the object of learning[3].

Hence, the integration of the theory into a teacher’s based action research process called lesson study has resulted in it being further developed and refined as a pedagogical theory. Its use as a guiding principal for designing teaching by teachers made them aware of variations in their own subject matter knowledge and the importance of sharing their own understandings of the object of learning with each other in the design process.

From the perspective of variation theory teachers are responsible for designing learning experiences that can bring about the discernment needed (Lo and Pong, p. 21). Lo and Pong argue that it addresses a gap in lesson preparation that needs to be filled. There is too much emphasis on teaching methods in educational reform that are disconnected from an explicit pedagogical theory of children’s minds as learners. Variation theory enables the teacher to interact with the minds of all children to secure their inward engagement with the subject matter (p. 25) by:

1. carefully selecting worthwhile objects of learning;
2. identifying variation in pupils understanding of the intended objects of learning and corresponding critical aspects that pupils that pupils fail to discern (V1);
3. plan learning experiences to help pupils focus on these critical aspects by making use of appropriate patterns of variation (V3).
The use of variation theory to inform lesson study in Hong Kong schools: an evaluation

What follows draws on an independent evaluation of the VITAL project, which this author carried out in Hong Kong over a three-year period (2003-2007) assisted by Christina Yu (see Elliott and Yu, 2008). It built on a previous evaluation of learning study in Hong Kong primary schools, which this author carried out in 2001-2004. The VITAL project was sponsored by the Hong Kong government and engaged 120 secondary and primary schools in carrying out at least one full learning study each. The evaluation involved in-depth interviews with school development officers, and principals, teachers and pupils in a sample of 13 schools plus surveys of principals’ and teachers’ perspectives on learning study across all the schools involved.

The use of variation theory to inform lesson study may appear overly restrictive. In addition to peer observation and post-lesson conferencing the use of variation theory also requires the gathering of data about pupil perceptions of the “object of learning” and the design, administration and analysis of pre- and post-tests. Hence a learning study appears to be a much more complex process of teacher research than a lesson study. As such it is even more dependent upon the commitment of school leaders and their ability to marshal scarce resources, in terms of time and manpower, for this kind of practitioner research. Given such conditions many in Hong Kong questioned whether it can be integrated into the working practices of teachers on a sustainable basis, even when it is well supported by a local teacher education institute providing in-school consultancy and training days for school leaders and participating teachers.

In their evaluation of the VITAL project in Hong Kong, Elliott and Yu (pp. 73-81, 90-3) asked teachers whether the costs of involvement in a single learning study, in terms of the consumption of scarce time and resources, outweighed the benefits. The majority felt that on balance benefits outweighed costs. However, a significant minority did not and one explanation offered by the evaluation was the extent to which principals and school leaders were able to help teachers connect their engagement in learning study with other changes taking place in the school as a whole as part of system-wide curriculum reforms.

Although many principals in the VITAL project became committed to learning study and were able to create conditions for a group of teachers to participate in a single study, they were more sceptical about sustaining this level of involvement as an integral component of the professional development of all their staff over time (p. 88). However, having experienced the benefits of a single study for the pupils and teachers involved they became interested in developing more condensed and therefore sustainable kinds of learning study, perhaps by restricting the number of teachers involved to pairs or triads, reducing the amount of time spent on video-recording and pre- and post-testing as opposed to pupil interviewing (pp. 94-103).

Even if the implementation of the procedural package that constituted the full-blown learning study in Hong Kong could not be sustained as part of a continuing process of professional development, one can still ask questions about the long-term impact of such a resource intensive and procedurally inflexible single learning study on the pedagogical practices of the teachers involved, and compare it with the impact of less resource intensive and more flexible kinds of teacher research. The evaluation of the VITAL project concluded that there was evidence of long-term impact on teachers’ pedagogical practice from participation in a single full-blown learning study. Rather than serve as a replacement for the latter condensed studies might function as "booster
injections” to sustain theory-informed experimental teaching on a continuing basis (see pp. 90-112).

I will now focus on an issue that emerged in Hong Kong during the discussions and debates about learning study, and in doing so draw on data and findings in the evaluation report. It relates to the exclusive use of variation theory as a basis for research-based lesson planning.

To what extent does the aim of systematically testing an educational theory constrain or empower practitioners to develop their practice through research?

The main capabilities associated with variation theory in the VITAL Project (see Elliott and Yu, p. 180) are:

- understanding variations in the ways students understand the intended object of learning (V1);
- understanding variations in the way teachers understand and handle the particular object of learning (V2); and
- using V1 and V2 to plan learning experiences, which make use of patterns of variation that, are judged appropriate for enhancing a critical discernment of the object of learning (V3).

In interview members of the core academic support staff were asked to clarify their understanding of the range of applications of variation theory involved in the VITAL project lesson studies and the extent to which they captured the capabilities teachers need to develop to improve the quality of teaching and learning in their classrooms. In general the core academic staff believed that the project provided all the teachers involved with opportunities to develop the full range of capabilities. However, some academic consultants outside the core group perceived limitations in the usefulness of variation theory as a pedagogical tool in some curriculum areas, such as languages (p. 184).

In responding to the questionnaire survey, 45 per cent of the 232 teacher respondents claimed that they were using variation theory in their daily teaching practice (pp. 183-6). The total number of responses also indicated that teachers’ understanding of variation theory was somewhat divergent. However, the “examples of use” cited were judged by the evaluator and his assistant to indicate a reasonable level of understanding (see pp.186-91). In using variation theory as a pedagogical tool, teachers:

- experienced lesson planning as a form of coordinated action;
- observed and discussed each others’ practice; and
- elicited students’ perspectives on lessons.

In one school teachers felt that aspects of variation theory mirrored things teachers were tacitly aware of and served as a reminder to ensure that they were embedded in their practice. Hence, they became incorporated into the teachers’ technical repertoire as “tricks of the trade”. It was certainly regarded by some teachers as a pedagogical tool that enabled them to reflect about the significance of what is varied and what is held constant in the pedagogical situation for the quality of learning. Viewed from the standpoint of variation theory teaching was cast in the form of an experimental science.

There is little doubt that the VITAL project learning studies, informed by variation theory, provided a context and space in which teachers were able to reflect on their classroom practice (see pp. 200-4). They gave teachers an opportunity to reflect about their teaching from the learners’ point of view. In addition to using student data from
pre and post-lesson tests and interviews, a great deal of information stemmed from informal dialogues and discussions with students during the course of a lesson. This appears to have permanently changed the way teachers viewed and related to students and vice versa, and made them more self-reflexive in their interactions with them. Teachers involved in the VITAL project now increasingly plan their lessons from the students’ perspective.

The VITAL project, according to the questionnaire survey of principals’ views made a significant difference, with respect to effecting changes in the professional culture and in the capabilities of teachers (see pp. 41-3). The vast majority of the respondents (90 per cent, 53/60) felt that the project had made a lot of difference. The main difference cited was the development of a collaborative professional culture – cooperative lesson planning, peer observation and deep discussion of classroom experiences, with respect to the latter some principals clearly associated the quality of the discussions between teachers with them acquiring a language – the terminology of variation theory – for talking about and analysing teaching and learning together. Other differences cited, which can also be linked to the use of variation theory, included an enhanced capability on the part of teachers at diagnosing students’ misconceptions of the subject matter and the gaps between the teacher’s intended object of learning and students’ conceptions of it. Also reference was made to teachers no longer imposing limits on some students’ learning potential.

The transference of capabilities acquired through the learning study to other lessons was cited as an indicator of impact, but there were some disagreements about the extent to which transference had occurred.

There was considerable overlap between principals’ and teachers’ perceptions of the impact of the VITAL project in schools (see pp. 43-7). Both tended to emphasise impact on the professional development of frontline teachers. However, in responding to the questionnaire teachers tended to cite the specific capabilities they had acquired in greater detail (see p. 43). These included improvements in subject matter knowledge, in interviewing, research and teamwork skills, in identifying students’ learning needs and potential, in “assessment for learning” capabilities. Also, when asked whether the schools had followed up their involvement in the project with further learning studies over half of the teacher respondents said they had. In total these VITAL follow-up studies embraced all the main areas of the new curriculum.

In one interview it was suggested that teachers whose subject knowledge is weak might be frightened of this being exposed if they participated in the VITAL project. In order for the learning study to strengthen teachers’ subject knowledge teachers must experience it as a safe learning environment. The evidence gathered in the course of the evaluation suggests that the vast majority of participating teachers experienced it in these terms. One of the benefits claimed for lesson study is that it links the development of subject knowledge with the development of pedagogical knowledge (see pp. 192-4). The latter consists of knowledge about the problems students have with learning certain topics and how pedagogically they can be helped to over-come them.

The growth in teachers’ subject and pedagogical knowledge through the VITAL project was clearly evidenced in teachers’ testimony that they now knew how to choose a topic, to plan a lesson around it, and to teach it (see pp. 175-9). In spite of the extensive use of pre- and post-tests and the general emphasis on the importance of assessment for learning, teachers’ questionnaire responses showed that only 41 per cent claimed that their assessment practice had been influenced by the learning study (pp. 193-9). With respect to these teachers, their involvement in a learning study appears to have
impacted on both their conceptual and practical understanding of assessment. In addition
to pre- and post-tests more teachers were using information gathered in conversation
with students and via close observation of their performance on learning tasks.

Students’ accounts of their learning in the context of a learning study were also
indicative of their teachers framing their learning experiences according to a variation
theory perspective. The students interviewed, across the 13 schools sampled, were
asked about their experience of the learning process in the VITAL learning study and
how it differed from their normal learning experiences at school (pp. 116-22). Most
clearly enjoyed a learning process that they experienced as more active and self-
directed than the one they were accustomed to. This partly explains their ability to
recall a learning study lesson long after it had finished (in some cases two years
previously). They were also able to recall a lesson long after the event because the more
active/interactive process, which they experienced in relation to the subject matter,
generated learning in greater depth, and which was retained in the long-term memory
rather than simply being stored in the short-term memory for the mere purpose of
passing public examinations.

Learning study students claimed that they were more able to apply their learning to
everyday life (pp. 128-33). In particular the learning study appears to have created a
stronger linkage between mathematical learning and its usefulness in everyday life
(pp. 155-6). In one group interview the issue arose about whether this was because the
topic was chosen for the learning study in terms of its relevance to daily life or whether
any mathematical topic could be taught in a form that enabled students to discern its
practical significance.

The impact of a learning study on students’ learning was perceived by some
teachers to be a consequence of teachers having the time to focus together and in detail
on teaching a small amount of content (see p. 159). On the basis of student testimony
the VITAL project learning studies appear to have transformed pedagogy – at least
temporarily – in ways that are consistent with the pedagogical aims of the Hong Kong
Curriculum Reforms (pp. 159-69).

Towards a unified science of teaching through lesson study
My evaluation of learning studies in Hong Kong supports the view that teachers action
research in classrooms will be enhanced by the use of an explicit pedagogical theory,
which not only provides a framework for constructing pedagogical knowledge that
can be tested through action research but also further developed? It also supports the
view that in the process teachers’ folk pedagogies (see Bruner, 2007, pp. 10-7), based on
tacit and largely unexamined theories about the minds of learners and how they learn,
appear to have been challenged and subjected to critique.

Bruner claims that four dominant models of learners’ minds can be discerned by a
culturally orientated educational psychology.

First, there is the model of children as imitative learners that provides a basis for
learning practical skills via apprenticeships that lead “the novice into the skilled ways
of the expert”. Second, there is the model of learning through didactic exposure to
propositional knowledge of facts, principles and rules of action to be remembered and
then applied. Its appeal argues Bruner, is that “it purports to offer a clear specification
of just what it is that has to be learned and, equally questionable, that it suggests
standards for assessing its achievement”. Third, there is the model of children as
thinkers learning through inter-subjective interchange with their teacher and peers.
Teaching on this view must recognise the children’s perspectives in the learning
process, and concerned with understanding their existing thinking about the subject matter and how they have arrived at it. Fourth, there is the model of children as knowledgeable: the management of “objective” knowledge. This model pedagogically implies helping children to draw on what is known canonically as a resource for doing their own personal and creative thinking. The four theoretical models of teaching and learning embedded in the folk pedagogies outlined by Bruner can be ordered along two dimensions, he argues (p. 17-8). There is the internalist-externalist dimension. The older externalist pedagogical theories emphasise what adults can do from outside the mind of the child to foster learning. The younger internalist theories focus on the intentional states of the child in the learning process; what s (he) thinks she can do and is doing to bring learning about. The second dimension is the intersubjective-objectivist dimension. It describes the degree of “common understanding” required between the pedagogical theorist and those to whom his/her theories relate. Objectivist theories do not presume that their subjects should see themselves in the same terms as the theorist does. Modern pedagogical thinking, according to Bruner, is moving increasingly towards the inter-subjective end of the continuum. It views the role of the pedagogical theorist and the teacher alike to be one of helping the pupil to be more meta-cognitive in the sense of becoming “as aware of how she goes about her learning and thinking as she is about the subject matter she is studying” (p. 18). Equipping the student with a good theory of mind is part of helping her to reflect about her mental functioning as a learner and how it can be improved (p. 18).

If one views variation theory in the light of the dominant folk pedagogies cited by Bruner one can see that it incorporates elements of each with a strong emphasis on children as thinkers. It also tends towards the internalist and inter-subjective poles of the dimensions along which Bruner orders the folk pedagogies without neglecting externalist and objectivist aspects of pedagogy. As such the development of variation theory may be viewed as progress towards a unified mapping of what Bruner depicts as a broader continent of pedagogical theory. Personally, I would also like to see the acceleration and metacognitive theories of Vgotsky and Bruner synthesised with the theory of variation as a broad framework for the production of pedagogical knowledge at different stages of education, which can be tested and further developed through lesson study on a global basis.

There is another aspect of the use of learning studies to develop a science of teaching that deserves urgent attention, and this has been acknowledged by Lo and her co-workers. In Hong Kong there are a substantial number of case reports and case data sets that can be assembled as a basis for making cross-case comparisons in relation to a range of specific objects of learning in different learning areas.

In order to effect long-term sustainable improvements in pedagogical practice theory-based lesson studies need to become the building blocks for systematically organised sets of pedagogical knowledge.

Theory-based lesson study in Hong Kong has created the conditions, which Stenhouse (1975) outlined as necessary for the systematic and cumulative production of pedagogical knowledge in actionable form by teachers. It has injected into the world of teaching capabilities associated with taking a self-critical stance, a willingness to submit work to the scrutiny of others and the use of a common vocabulary of concepts and a syntax of theory in which to capture and share insights into teaching and learning (Stenhouse, p. 157). The development of such capabilities lies at the heart of Dewy’s “laboratory model” of learning to teach.
Notes

1. John Dewey (1859-1952) was an American philosopher, psychologist and educationalist who held professorships at the University of Chicago and Columbia University in New York. Over a long life he produced an enormous volume of work in the fields of philosophy and education. With William James and Charles Peirce he is widely regarded as one of the founding fathers of "philosophical pragmatism". In the field of education his classic text is *Democracy and Education* 1916.

2. Prawat (2001, p. 17) identifies the completion of a manifest shift in Dewey’s thinking at around 1915, while acknowledging a growing engagement with Peirce’s work from 1903. However, I would argue that this shift was very apparent in some of Dewey’s pedagogical writing as early as 1904. Compare, for example, the similarity in Dewey’s thinking about the unity of subject matter and method in Chapter 13 of *Democracy and Education* (1916) and in Section BII of “Relation of Theory to Practice in Education” originally published in 1904 (see references).

3. Two excellent examples of teachers’ uses of variation theory as a guiding principle of pedagogical design can be found in Lo and Marton’s (2012) article.

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Further reading


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