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Kolb's experiential learning model: critique from a modelling perspective

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Kolb's experiential learning theory has been widely influential in adult learning. The theory and associated instruments continue to be criticized, but rarely is the graphical model itself examined. This is significant because models can aid scientific understanding and progress, as well as theory development and research. Applying accepted modelling and categorization criteria to Kolb's basic model reveals fundamental graphic syntax errors, a failure to meet modellers' graphic sufficiency and simplification tests, categorization and definitional problems relating to learning activities and typologies, misconstrued bi-polarities and flawed logic. We propose guidelines for recasting the model with a view to overcoming these weaknesses, guiding future research and theory development, and starting to integrate the disparate field of experiential learning.

Keywords: experiential learning theory; Kolb's learning model; models

Introduction

In a seminal review of the experiential learning field, Coffield, Moseley, Hall and Ecclestone (2004) identified 71 learning styles models, 13 of which were regarded as major contributions. Among them is the highly influential model that David Kolb (1984; Kolb and Fry 1975) and his associates, building on Kurt Lewin's work, have refined over decades. Kolb's experiential learning theory (KELT) offers an alternative to traditional didactic and behavioural classroom approaches, providing for personal change and development as part of a learning cycle (Healey and Jenkins 2000; Holman, Pavlica and Thorpe 1997).

Kolb's approach consists of three main components: a theory of experiential learning; a learning cycle graphical model; and the Learning Styles Inventory (LSI), an instrument for testing and applying the theory that has since appeared in several versions (Kolb, Rubin and McIntyre 1971; Kolb 1984). We suggest that many recurring problems with all three components of KELT can be resolved by applying accepted principles of modelling theory.

The KELT literature falls into three main categories. The first, vast, literature reporting on the contribution of experiential learning theory to understanding adult and professional learning falls outside the scope of this paper. Second is a large literature of reliability and validity studies of Kolb's LSI and its refinements. A third, smaller, literature analyses and appraises the theory itself without, however, evaluating the graphical model in modelling terms. This paper addresses this gap.

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Despite the practical appeal of identifying differences in how individuals learn, the field of adult learning styles is fraught with conceptual and empirical problems (Coffield et al. 2004). This paper briefly outlines some of the issues with Kolb's theory and instrument, critically discusses his learning model, and evaluates it against accepted principles of categorization and modelling theory. This reveals fundamental errors in graphical syntax, failure to meet graphic sufficiency and simplification tests, categorization and definitional problems, misconstrued bi-polarities, and flawed logic, all of which may account for the frequent criticisms of KELT and some of the psychometric problems with the LSI. We conclude with recommendations for developing an alternative model to address problems with Kolb's theory and integrate others' theoretical contributions.

Kolb's experiential learning theory

Kolb's theory posits that learning is a cognitive process involving constant adaptation to, and engagement with, one's environment. Individuals create knowledge from experience rather than just from received instruction. Conflicts, disagreements and differences drive the learning process as learners move between modes of action, reflection, feeling and thinking. Different learning styles reflect learning preferences that can change with situation. Learning is a holistic process and results from synergetic interactions with the environment, with people making choices about which parts of the environment to engage with (Kolb and Kolb 2009a). Consistent with Tyler's (1983) possibility theory, individuals create themselves via the choices they make, and these choices in turn influence future actions.

Kolb's work lends itself to interpretation from a variety of perspectives, such as cognitivism, phenomenology and adult learning (Holman et al. 1997). The multi-perspectival and adaptive aspects of KELT highlight differing learning styles and stages within a learning process, rather than a means of allocating particular learning styles to specific students (Garner 2000).

Kolb graphically depicts the process of learning in a cyclical model containing four different learning styles derived from two bi-polar dimensions: concrete–abstract and reflective–active. The learning styles and the experiential learning model form the basis of Kolb's work in management education, with later work such as conversational learning (Kolb, Baker and Jensen 2002) and learning spaces (Kolb and Kolb 2005) building on the initial model. Associated with the theory and model is the LSI, which is fraught with psychometric problems, as discussed next.

Issues with the leadership styles inventory

Criticisms of the LSI are widespread (see Coffield et al. 2004; Webb 2003). Discussions of the validity and reliability of LSI scores are important given the strong influence this work continues to have in academe and practice, and because of the links between learning style constructs used in the LSI and Kolb's learning cycles model. Freedman and Stumpf (1978) and Stumpf and Freedman (1981) argued that the LSI is volatile, producing large, unexplained variances that generate potentially misleading results and limit its validity. Other tests of the instrument (Lamb and Certo 1978; Freedman and Stumpf 1980) reveal that even random survey responses will support the LSI, and caution that claims of support for KELT may be due to instrument bias. Kolb has modified the LSI, for example through the LSI-1985, and the attractiveness of the theoretical constructs and perceived value of the instrument have led others to produce derivatives (see Honey and Mumford's 1992 Learning Styles Questionnaire (LSQ), Felder and Silverman's 1988 Index of Learning Styles (ISL)). However, issues of reliability and validity persist with the LSI (see Duff, Dobie and Guo 2008; Henson and Hwang 2002; Panayiota and Platsidou 2008), as well as with the LSQ and ISL derivatives (Duff and Duffy 2002; Van Zwanenberg, Wilkinson and Anderson 2000). Price (2004) argues that there may be discrepancies between student self-reported study processes – on which the various inventories are based – and student actual study processes. More recent versions of the LSI have addressed some of these concerns (Kayes 2002), but questions continue about the psychometric robustness of the measures and the nature of the underlying learning styles, including the construct validity of the LSI and its scoring method (Coffield et al. 2004). This is a problem for an instrument designed to test such a widely used theory.

Issues with Kolb's theory

Independent of the criticisms of the LSI's reliability and validity, another literature engages with the theoretical foundations of KELT. The theory postulates four learning styles, namely concrete experience, reflective observation, abstract conceptualization and active experimentation. Coffield et al. (2004) challenged KELT on conceptual and empirical grounds. For example, Kolb prevaricates as to whether his model represents four learning styles or four learning stages. The difference is fundamental since learning styles can be related to inherited or acquired personality types, while learning stages refer to sequential steps in a learning cycle. Kolb maintains that his learning-style types are synonymous with Jung's personality types. This is clearly challenged by findings of only occasional, and then weak, connections between Kolb's styles and Jung's types (Garner 2000). Garner further argues that both from the perspectives of an ideal type and an environmental contextualist, KELT is unclear and contradictory, since the nature of what is being measured continually changes between flexible or stable states. If learning styles are traits they are stable, however, if they are states they (need to) become flexible. Garner further suggests that this contradiction may account for the continued findings of lack of reliability and validity with the LSI.

De Ciantis and Kirton (1996) argue that the LSI's conflation of three unconnected aspects – style, level and process – as one concept and measure, represents a conceptual flaw that could explain the continued finding of instrument unreliability and dubious validity. Further, they maintain that Kolb's learning styles in fact define a learning process rather than a style (personality trait). It is to be expected that these conceptual weaknesses transfer to the associated model.

Models as theory

Graphics and models can communicate patterns and relationships that might be difficult to communicate with text (Britt 1997; Fry 1981; Vessey 1991; Ware 2000), and they provide an important way of expressing scientific hypotheses (Bezerra, Jalloh and Stevenson 1998). Unfortunately, many writers tend to be far less rigorous with models than they are with text (Bergsteiner and Avery 1999, 2003), possibly reflecting a paucity of training in modelling for social scientists (Smith, Best and Stubbs 2003).

Writers are also rather loose with the term model, and hence it needs to be defined here. Models are analogs or metaphors that are purposefully constructed in physical, mathematical, computer or graphic form, to achieve, as nearly as possible, correspondence between a reality and the model so that causal or associational relations between the two are replicated and replicable to the greatest extent possible (Hesse 1970). To the extent that correspondence is lacking, the theoretical model can be modified to achieve, if not a 'perfect metaphor' (Hesse 1970, 170), then at least better correspondence on 'essential' terms.

Models have long been regarded as an essential aspect of theory building. Theory is made 'intelligible' by models (Campbell 1920), models are an ingredient (Hesse 1970) or constitutive part (Pylyshyn 1980) of theory, and 'modeling activities... constitute a substantial portion of the scientific method' (Nersessian 1995, 147).

There are conventional tests for evaluating models. In this paper we apply simplification, sufficiency and categorization tests; examine adherence to graphic modelling conventions as regards graphic syntax and parsimony; and scrutinize the general logic of Kolb's model. Such tests suggest that Kolb's model is subject to a number of flaws, and hence requires certain modifications.

Critique of Kolb's learning model

From a modelling perspective, Kolb's particular conceptualization is flawed in several respects. Key among these is a highly muddled typology of what constitutes concrete and abstract learning. This confused typology, along with other problems described below, has also beset other learning theorists, and very likely has contributed to a lack of integration in the field. For example, compare Dunn and Dunn's (1989) reflect, visual, aural, kinesic and tactical typology, with Felder and Silverman's (1988) act, reflect, sequential, global, visual, verbal, intuitive and sensing typology. Concepts in the field clearly need defining, rationalizing and integrating, but this is beyond the scope of this paper.

KELT defines learning style as the 'generalized differences in learning orientation based on the degree to which people emphasize the four modes of the learning process' (Kolb 1984, 67). This process is depicted in Kolb's (1984) Experiential Learning Model (Figure 1) and envisages a cyclical four-stage learning process

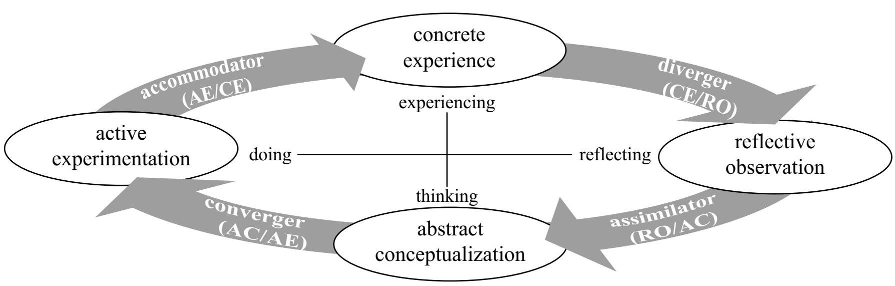

Figure 1. Kolb's experiential learning model. Adapted from: Kolb (1984).

consisting of the following learning modes: concrete experience, reflective observation, abstract conceptualization and active experimentation. Later versions of Kolb's (1984) model also adopt the 'concrete experience – abstract conceptualization' and 'active experimentation–reflective observation' orthogonally arranged bi-polarities, and hence are subject to the same underlying criticisms as the above model. For example, both Mainemelis, Boyatzis and Kolb (2002, 5) and Kolb and Kolb (2005, 194) refer to 'two dialectically related modes of grasping experience – concrete experience (CE) and abstract conceptualization (AC) – and two dialectically related modes of transforming experience – reflective observation (RO) and active experimentation (AE)'.

Graphic syntax of Kolb's model (modelling theory)

Kolb's model is fundamentally at odds with received modelling theory. Graphic models depicting linked activities are variously known as node–link, point–line, entity–relationship, concept–relationship or activity–event diagrams; and activity or flow charts (Freeman 2003; Harel 1995; Ware 2000). In modelling language, Kolb's model takes the form of an activities–point diagram. It is accepted practice that activities that occupy time periods are allegorically represented by links in models, whereas nodes allegorically depict events or points of time. To give a simple example, for a student doing an MBA, the MBA study program involves a lengthy process, whereas enrolling and graduating are events. A line with a starting and a finishing point (indicated by an arrowhead) can represent this (Figure 2).

In fields such as the building industry, activities and events tend to be defined with great precision. In other fields this is more difficult. A certain elasticity in stop and starting times is sometimes unavoidable (e.g., when does a divorce start and finish?); and effects may occur after a lag/delay (Britt 1997).

Each of the four learning modes depicted in Kolb's model refers in turn to specific activities that involve the passage of time (e.g., do a simulation, carry out field work). Contrary to accepted modelling practice, Kolb's model does not show activities as lines, but as points. In other words, the graphic syntax of the model confounds the information the model is attempting to convey. The model should be recast to correctly assign the activities to the time lines, to improve the syntax. Kolb's recast model therefore assumes the form shown in Figure 3.

Why is it so important to employ correct graphic syntax? There are three answers to this. First, common language aids communication and scientific progress (Staats 1999). In written language, the pedantic insistence of authors, reviewers, editors and publishers on correct syntax, grammar, style, punctuation, presentation and referencing is so rigorous that (dis)ownership of 'mistakes' is flagged by inserting (sic) after the mistake. Graphic conventions should be applied and adhered to with comparable rigour to aid communication and avoid misinterpretations. Second, scientific tests of a theory based on a flawed model are prone to produce inconclusive

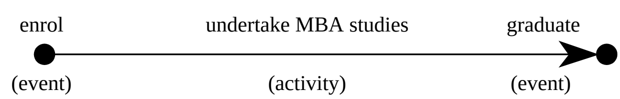

Figure 2. Activity-events diagram of MBA program.

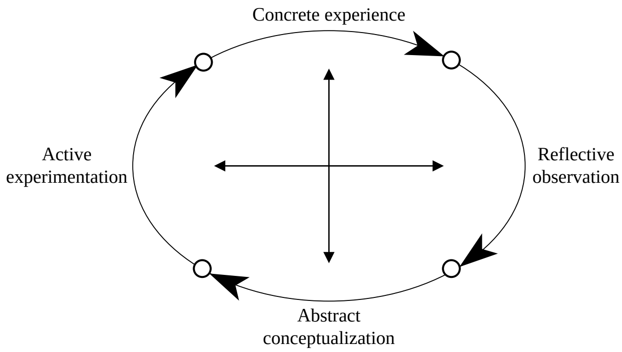

Figure 3. Recast version of Kolb's experiential learning model.

if not confounding results. Third, while simple models may be understood even though the graphic syntax is wrong, fundamental flaws in simple models will hinder, or make impossible, developing more complex models. Thus the ubiquitous critical path programs used in highly complex building projects would cease to have any utility if activities were shown as points and events as lines.

Given that learning is a complex process, adopting an inappropriate graphic syntax will make the development of models that reflect this complexity difficult, if not impossible. On the other hand, avoiding complexity altogether by oversimplifying complex processes does not aid understanding (Britt 1997; Gigerenzer and Selten 2001; Tufte 1983), it merely removes layers of meaning and reduces complexity to a level suited to untrained or simple minds (Trumbo 1997). Therefore, ensuring correct graphic syntax is a fundamental step in scientific modelling. While accurately reflecting complexity, graphics also need to avoid redundancy, as discussed next.

Parsimony and graphic sufficiency of Kolb's model (modelling theory)

Britt's (1997) simplification test for models asks among other things: can model variables be eliminated that are related to the same underlying construct, or that are highly correlated? Arguably the three paired constructs (doing–active experimentation), (reflecting–reflective observation), and (concrete experience–experiencing), each describe a common underlying construct. The terms 'doing', 'experiencing' and 'reflecting' can therefore be removed from the model without any loss of meaning.

The pair (abstract conceptualization–thinking) represents a more problematic case given that three of the four learning modes (reflective observation, abstract conceptualization and active experimentation), are unlikely to be productive in the absence of thinking. That is, thinking is not a helpful discriminator. Kolb acknowledges this himself in so far as a later model, the Nine-Region Learning Style Type Grid (Kolb and Kolb 2005), depicts thinking in six cells of the nine-cell matrix and associates it with reflective observation, abstract conceptualization and active experimentation.

Further simplification can be achieved by removing the horizontal and vertical bi-directional arrows. These lines merely confirm what is already known or assumed – namely that the paired bi-polar dimensions 'active experimentation–reflective observation' and 'concrete experience–abstract conceptualization', stand in an orthogonal, that is non-correlational, relationship to each other. Their removal reflects modellers' credo that models are most effective when they display complexity in content but are parsimonious in the means of expression (see Mintzberg and Van der Heyden 1999; Tufte 1983; Ware 2000).

Removing the two arrows and the redundant terms from the model yields the simplified experiential learning model shown in Figure 4. To further test the explanatory power of Kolb's model, we apply Britt's (1997) sufficiency test for models.

This involves asking four questions, at least one of which is negated for Kolb's model, namely: are there sufficient important variables included in the working model to be able to predict what will happen in the system under consideration? Kolb's model fails the sufficiency test by not allowing for potentially important variables from other models and theories, such as Holman et al's (1997) social aspects of learning or Fleming's (2001) sensory learning dimensions. Kolb's model therefore almost certainly offers only a partial explanation for experiential learning processes.

Models can also be analysed in terms of the degree of differentiation (the number of dimensions of a problem that are taken into account) and integration (the development of complex connections among differentiated characteristics) they provide (Tetlock and Suedfeld 1988, 43). Generally speaking, the more differentiation and integration a model offers, that is, the more it reflects actual complexity, the greater its explanatory and predictive power (Gigerenzer and Selten 2001; Mintzberg and Van der Heyden 1999; Tufte 1983). Finally, definitional problems abound with Kolb's model.

Active/concrete/primary and passive/abstract/secondary learning styles

Essentially, what Kolb's model shows are *styles* of learning that constitute orthogonally arranged *stages* on a *cyclical* model. Many definitional and conceptual problems arise with the model, some of which other scholars have also noted, and confusion has arisen over how these three constructs relate to each other, to different kinds of activities and to learning typologies. Kolb (1984, 23) is quite clear about the concepts of active/concrete/primary and passive/abstract/secondary when discussing the stages of cognitive growth of a child: 'In the first stage (0–2 years), the child is predominantly concrete and active in his learning style... Learning [that is, primary

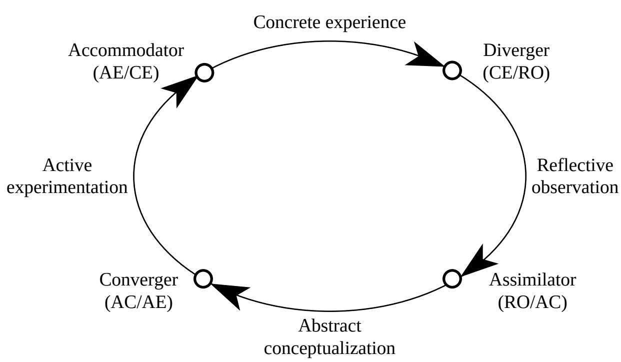

Figure 4. Recast and simplified version of Kolb's model.

learning] is predominantly enactive (*sic*) through feeling, touching, and handling'. As children mature, more abstract and passive learning experiences give rise to secondary learning, Kolb argues. However, the extent of such temporal differences between these two styles of learning is subject to some dispute (see Egan 1997), and this developmental view of learning stages is different from the cyclical learning styles/stages that Kolb employs in his experiential model. For the purposes of this paper, these distinctions are not critical, what is relevant is that there are different learning styles.

Thus for Kolb, learning can be expressed in terms of the following bi-polar duality: an active and concrete learning situation gives rise to primary learning, and a passive and abstract learning situation gives rise to secondary learning. This concrete/active/primary and abstract/passive/secondary duality is not intended to imply that the terms within each category are interchangeable, but that they are strongly linked.

Much of learning theory is, however, characterized by a basic lack of clarity and rigour in defining what constitutes concrete/abstract, active/passive or primary/secondary learning experiences. First, there is inadequate recognition that each of these learning dualities captures the two extremes of a range of possible learning experiences. Second, authors have failed to differentiate between activities (e.g., field work) and the learner's role in relation to these activities (e.g., doing the field work or reading about someone else's fieldwork). We deal with these two problems in turn, starting with the concept of dualities as ranges and then examining how learning activities and experiences are categorized.

'Dualities' denote ranges

Svinicki and Dixon (1987) have expressed the active/passive duality in terms of the student as either actor or receiver (Figure 5), with specific activities increasing in

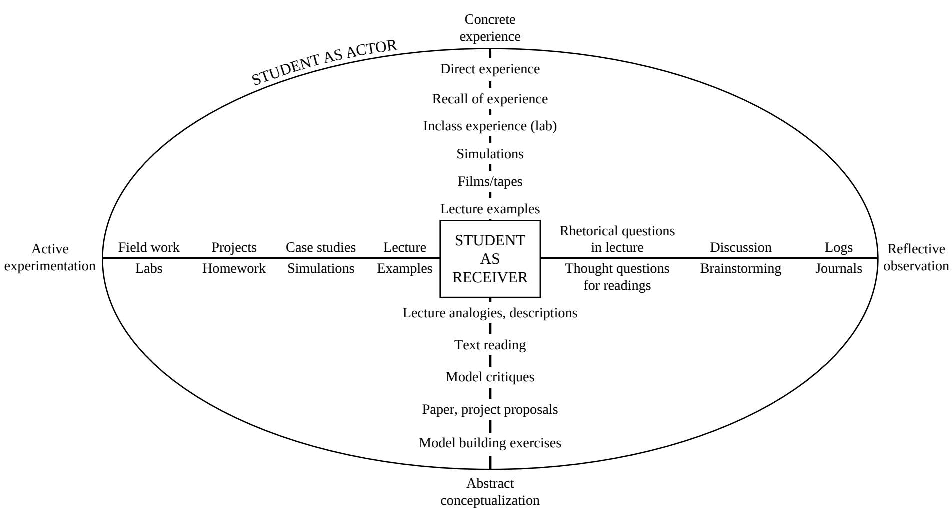

Figure 5. Nature of student involvement in various teaching methods. Adapted from: Svinicki and Dixon (1987).

activeness as one moves from the centre of the oval (student as receiver) to its perimeter (student as actor). Svinicki and Dixon therefore suggest that to view learning in terms of a simple duality or polarity is an oversimplification. Kolb and Kolb (2009a) reproduce this figure, praising it as a response to the key challenge of matching student readiness for experiential learning with the teaching methods used.

Categorizing learning activities and typologies

One of the 'activities' depicted on Svinicki's oval is 'labs'. Forgetting for the moment that labs is not an activity, but a place where activities are carried out, the question arises whether the activity labs always engages the students as *actor*, as the oval suggests? We suggest that this is a misclassification and an oversimplification since one can read about an experiment, attend a lecture on it, watch it, or actually do it. Where to locate labs on Svinicki and Dixon's oval therefore depends entirely on what form of exposure the student has to the lab work. If she is reading about it, she is simply receiving; if she is doing it, she is the actor. Similar issues arise with other teaching methods.

These examples show that learning experiences ought not to be categorized on the basis of broad activity typologies (e.g., lab work), but on the basis of specific learning typologies (e.g., reading, listening, watching, doing). The problem with Figure 5 is that activity typologies and learning typologies have been randomly mixed on the same graphic. This cannot make sense. Developing instruments on the basis of such typologies will perforce produce confusing results at best, or meaningless results at worst.

Similar degrees of de-construction can be applied to many other activities listed in Figure 5. Figure 6 captures this argument in a generic sense for the student as actor and receiver. Note that there is a degree of overlap between Svinicki and Dixon's oval and Figure 6, with the concrete/active end of Figure 6's generic scale of learning typologies representative of the student as actor and the abstract/passive end of the scale representative of the student as receiver.

The question arises: at what point does a learning experience become more abstract than it is concrete and vice versa? Using Kolb's (1984) and Jarvis' (2004) primary/secondary differentiation as a guideline, it would appear that the distinguishing features are that primary learning essentially occurs through active/concrete doing, whereas secondary learning occurs when a passive receiver interprets abstract information communicated by another through spoken words, written text, graphic images or gestures. At this stage we seem to have come full circle. We started with the bi-polar dimensions concrete/abstract, active/passive and primary/secondary, then argued that at least concrete/abstract and active/passive are continua, but concluded that primary and secondary learning tend to be a more clearly differentiated bi-polarity.

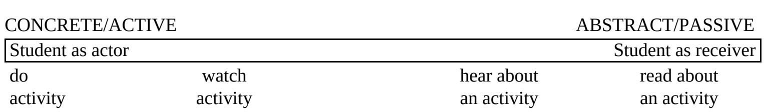

Figure 6. Generic scale of learning typologies.

Kolb and Kolb (2009b, 301) recently commented on the abstract/concrete duality: 'From the learner's perspective solitary reflection can be an intensely emotional concrete experience and the action of programming a computer can be a highly abstract experience'. This statement appears to contain two implicit assertions: one, as the intensity of an experience increases, it becomes more concrete; and two, abstract outcomes presuppose abstract activities. Neither assertion stands up to scrutiny. On the first assertion: while the tears that a movie-goer sheds during an emotional scene in a film are real, from the *observer*'s point of view, the experience remains passive, abstract and secondary, irrespective of the emotional intensity it arouses in the movie-goer. In other words, observer engagement is not the same as participation. On the second assertion: while the outcome of the activity (the computer program) may involve some highly abstract concepts, the activity itself (the act of writing the program) was active, concrete and primary. These analyses are predicated on two basic propositions. First, one needs to distinguish:

(a) broad types of activities (e.g., experiments, computer programming, lecturing); from
(b) specific learning typologies (doing, watching, hearing, reading) (see the generic learning typology scale proposed in Figure 6);
(c) outcomes of activities (e.g., a thought, computer language);
(d) attributes of activities (e.g., solitary, intense); and
(e) the state of the person (e.g., emotional).

A second issue concerns which of these are critical for the concrete/active/primary – abstract/passive/secondary continua? We suggest that it is the learning typologies. That is, broad activity types, outcomes of activities, attributes of activities and states of persons are not relevant criteria for determining how concrete/abstract, active/passive or primary/secondary an activity was. This does not imply that they do not contribute to a learning experience, merely that they measure different things, such as the intensity of the learning experience. If it turns out that the intensity of a learning experience is a variable of interest, then it should be recognized as such, however, it should not be allowed to confound other variables.

Abstract and concrete learning typologies

Given the widespread acceptance of fundamentally flawed categorization schemas as discussed above, further discussion seems called for on categorizing specific learning typologies as abstract or concrete. We embark on this with some examples. Undoubtedly, watching someone give a lecture is a concrete experience by experiencing the presence of the lecturer. However, learning about the material being studied is entirely abstract. This concrete/abstract differentiation also holds true if the lecturing situation is described in terms of active and passive learning. A person learning about intercultural issues from a lecturer is learning passively; when this learning occurs in the context of a role-play, the learning is active.

A lecturing situation provides an especially interesting case because two parties are involved, where one has a designated role as teacher, but both have a role as learner. The lecturer is engaged in a concrete/active activity that gives rise to primary learning on her part. At least one would hope that her skills as lecturer improve through practice, evaluation and reflection. The student for his part is engaged in an abstract/passive activity that gives rise to secondary learning. One might say, while the medium, that is, the lecturer, is concrete, the message as far as the student is concerned is abstract. This lack of clear differentiation between the role/behaviour of the teacher and the role/behaviour of the learner has led to confusion in the literature, with writers such as Le Cornu (2005) asserting that primary experience necessarily accompanies secondary experience. The question is: primary and secondary for whom?

Therefore, we suggest that learning from written and spoken words is always an abstract activity in relation to the material being studied – except where the spoken or written words themselves are the object of learning as in learning a language or studying poetry, for example. In other words, we suggest that a useful and rigorous typology for determining where to place an activity on the concrete/active/primary – abstract/passive/secondary continuum is the scale of learning typologies proposed in Figure 6.

Accepting this, Kolb's model poses a further sufficiency problem given the omission of the notion of 'abstract/passive experience'. This suggests that either Kolb's cycle needs to be modified to include this learning style, or that there may, in fact, be two alternative experiential learning cycles one of which may be called the concrete/active/primary cycle and the other the abstract/passive/secondary cycle. Perhaps Kolb's line of enquiry would have been more productive had he expressed his theory in terms of two such learning cycles. We suspect that the second line of enquiry may be more fruitful. We hasten to add, however, that such an endeavour need not imply a complete break with Kolb's focus on experiential learning, as distinct from action, cognition and reflection learning (Kayes 2002), but extends his concept to experiential forms of learning not encompassed by his single-loop model.

The issue of where to assign learning activities on the Generic Scale of Learning Typologies (Figure 6) becomes more complicated in the case of simulations since real activities are necessarily more concrete than simulated ones, although they may approach parity in terms of how active and primary they are. Obviously losing real money in a venture is more concrete/active than losing notional money in a simulation. In both cases it is also possible to hear or read about someone having lost real money versus someone losing notional money. In other words, both the real venture and the game can be the subject of a concrete/active/primary learning experience and an abstract/passive/secondary learning experience. Of the four possible scenarios, the most real obviously is for someone to lose real money, and the least real is for someone to read about someone else losing play money in a game. This constellation of scenarios can be depicted as shown in Figure 7. To what extent there is a shift to the right on the simulated scale relative to the real scale is a subject for future empirical research.

	CONCRETE/ACTIVE/PRIMARY (student as actor)						ABSTRACT/PASSIVE/SECONDARY (student as receiver)
Real situation	do	watch		hear	read		
Simulated situation		do	watch			hear	read

Figure 7. Perceived "reality" of an experience from a learner's perspective, using the concrete/active versus abstract/passive duality.

A further example: one could engage in, observe, watch, or read about an intercultural exchange; or one could simulate, watch, hear about, or read about a simulated intercultural exchange. Because of a shift to the right on the scale for the simulated activity, this, in fact, results in six possible levels of learning concreteness-activeness or abstraction-passivity. To further complicate matters, this dual scale offers room for discussion/research about which of 'watch a real situation' or 'do a simulated activity' is more concrete/active for the learner. The essential conflict is that both are primary experiences, however, while participating in a simulation is more active, watching a real activity is more concrete.

Deconstructing Kolb's (1984) and Svinicki and Dixon's (1987) activities

In addition to the conundrum of whether an activity, or rather a learning experience, is concrete/active/primary or abstract/passive/secondary, a further problem arises, namely how these activities and learning experiences relate to Kolb's learning styles/modes. Based on Kolb (1984), Svinicki and Dixon (1987) proposed a schema that related various 'activities' and learning experiences to Kolb's learning styles (Table 1). (For convenience sake we continue to refer to all items on the table as activities). Kolb appears to have endorsed this taxonomy by citing it in later works (see Kolb and Kolb 2009a) and describing the paper as influential.

As alluded to above, categorizing *broad activities* as concrete/active/primary or abstract/passive/secondary is an exercise in confusion, if not futility, given that we are interested in the multiple *learning experiences* or *typologies* associated with certain activities. To justify this comment requires a closer look at Table 1. Categorization theorists hold that members of a category should meet one or more of the following criteria: be organized into hierarchies of relative complexity, be subunits of a basic unit, form part of a structure or taxonomy, share common salient attributes, have category resemblance, or provide functional comparability (Britt 1997; Feigl 1988; Rosch 1978). Kolb's model fails, in whole or in part, on each of these dimensions. Focusing on the four modes of the model in Figure 4 and the

Table 1. Activities associated with Kolb's learning modes.

Concrete experience	Reflective observation	Abstract conceptualization	Active experimentation
Lecture examples	-----------------------------	*Lecture*	*Lecture examples*
Laboratories	-----------------------------	-----------------------------	*Laboratories*
Readings	-----------------------------	*Text readings*	-----------------------
Fieldwork	-----------------------------	-----------------------------	*Fieldwork*
-----------------------------	-----------------------------	*Projects*	*Projects*
Simulations	Thought questions	Model building	Case studies
Observations	Brainstorming	Model critiques	Homework
Films	Discussions	Papers	
Problem sets	Logs	Analogies	
	Personal journals		

Source: Adapted from Kolb (1984) and Svinicki and Dixon (1987), but reorganized to highlight in italics activities that are said to be able to fall under two or more learning styles.

associated activities shown in Table 1, reveals numerous definitional and categorization problems, as explained next.

Misclassifying activities as locations, outcomes and linguistic devices

Table 1 purports to list activities, however, on the table we find a mixture of activities (e.g., brainstorming, field work, model building), activity-locations (e.g., laboratories), activity-outcomes (e.g., films, logs, papers), learning typologies (e.g., observing, reading), and linguistic devices (e.g., analogy). In the case of activity-outcomes such as logs, there is uncertainty whether this refers to *making* them, or *reading* them. This is important because writing logs is a primary activity based on first-hand experience, whereas reading logs written by another is a secondary activity.

Activities spanning more than one learning mode

Examining Table 1 and Figure 5 from the perspective of KELT shows 'lecture examples' to fall within both 'concrete experience' and 'active experimentation', whereas 'lecture' (Table 1) and 'lecture analogies' (Figure 5) are given as examples of 'abstract conceptualization'. Similarly, each of the activities laboratories, readings/text readings, fieldwork and projects falls into two different learning modes. The fact that some activities have been linked to several learning modes can, of course, be explained in terms of the different learning experiences that such activities offer. In other words, it makes no sense to assign a particular activity to a particular learning mode when such activity offers a range of possible learning experiences.

Activities arbitrarily (mis)allocated to one learning mode

Some activities are aligned with particular learning styles, when arguably they could apply to two or more. For example, 'homework' is associated with 'active experimentation', when it could just as likely involve 'readings', writing a 'personal journal' or 'model building', which are respectively associated with 'concrete experience', 'reflective observation' and 'abstract conceptualization'. Similarly, analogies can be deployed under all four learning styles. This is partially and indirectly recognized on Table 1 by showing 'simulation', which is a kind of analogy, under 'concrete experience'.

Learning modes and activities treated as synonymous

Table 1 introduces an anomaly in suggesting that observations that describe one of Kolb's learning styles ('reflective observation') also exemplify the concrete-experience learning style. This renders the distinction between the learning styles 'reflective observation' and 'concrete experience', which includes observations, blurred, if not meaningless.

Activities seemingly arbitrarily (mis)allocated to a particular learning mode

'Brainstorming' is classified as an example of the learning style 'reflective observation'. However, brainstorming *a priori* has to do with random and uncritical ideas generation and not, if it is to work, premature reflection (Osborn 1957). Ought brainstorming therefore not more properly be listed under abstract conceptualization? 'Discussions' are classified as 'reflective observation'. Surely this depends on whether one is actively engaged in a discussion, or simply a passive observer. Both 'model building' and 'model critique' are stated to be examples of 'abstract conceptualization'. Arguably model building, particularly of physical models, could be classified as a 'concrete experience' whereas 'model critiques', especially in the case of others' models, could fit 'reflective observation'.

We suggest that these ambiguities, inconsistencies, vagaries and misclassifications have their source in and are evidenced by: a lack of clarity as to what constitutes concrete and abstract learning experiences; a lack of differentiation between learning activities and learning typologies associated with these activities; poor rigour in terminology; and the attempt to accommodate concrete/active/primary and abstract/passive/secondary learning in the same learning circle.

Logic of Kolb's model

At a logical level, the bi-polar dimensions 'active experimentation–reflective observation' and 'concrete experience–abstract conceptualization' pose fallacies in discourse. Taking the 'active experimentation–reflective observation' duality first, the construct 'active experimentation' is, strictly speaking, tautological. After all, there can be no such thing as inactive experimentation, that is, experimentation is necessarily active. Replacing the term experimentation with behaviour removes the tautology since active behaviour, such as playing a football game, is a logically-valid construct. Further, the polar opposite of the term 'active', in so far as it is paired with behaviour, is not 'reflective behaviour' (which involves active thinking!), but passive behaviour (e.g., watching a football game). However, a more cogent polar opposite of the combined constellation 'active experimentation', or perhaps *experimenting behaviour*, may be *routine behaviour*. Furthermore, while the duality 'active experimentation–reflective observation' refers to activities that are substantially kinesic in one case and largely cerebral in the other, activity is involved at both ends of the dimension. This is contrary to the implied bi-polarity 'active–passive'.

Additionally, the polar opposite of 'reflective observation' is not 'active experimentation', but passive (i.e., unreflective) or impulsive observation, depending on whether one is focusing on the intensity of thinking–activity or its speed. For example, in observing a man with a briefcase running one could passively observe that he is running, or one could reflectively observe that he is running because he is late for an appointment. Kolb's model, in effect, combines the polar opposites of the two quite distinct phenomena, behaviour and observation/interpretation of behaviour, on one continuum. In other words, the bi-polarity or duality active experimentation–reflective observation is an invalid combination of the two bi-polarities/dualities:

- experimentation–routine behaviour.
- passive observation–reflective observation.

Similarly, the polar opposite of 'concrete experience' (e.g., losing money) is not 'abstract conceptualization' (e.g., how someone may have lost money) but 'abstract experience' (e.g., reading about someone losing money). Kolb's perspective is based on the assumption that within his notion of experiential learning, experience must necessarily be concrete. We have argued above that an equally cogent case can be made for abstract experience. Finally, there is the notion of 'abstract conceptualization'. This appears to lack a polar opposite, possibly because it is, in fact, a tautology. Concepts are necessarily abstract. When concepts are tested, they become experimentation, and when they are implemented, they become reality – and hence cease being abstract. The notion of concrete conceptualization therefore does not exist, leaving 'abstract conceptualization' in search of a polar opposite.

The fact that 'routine behaviour', 'passive observation' and 'abstract experience' are missing from Kolb's model suggests that he does not recognize them as learning modes. But this is false, since all three can result in learning. Could it be that the self-imposed constraints of Kolb's model result in the negation of recognized learning styles, thus further undermining the efficacy of the model?

Conclusions and future developments

Despite a vast literature on Kolb's influential work in experiential learning, his graphical model has rarely been examined, even though it underpins his theory. In terms of accepted modelling theory, Kolb's model contains many flaws. It fails to meet the tests of graphic sufficiency and simplification, does not differentiate plausibly and consistently between concrete/active/primary and abstract/passive/secondary learning processes, fails to differentiate appropriately between learning activities and learning typologies, the bi-polar dimensions are flawed, certain viable learning constructs are not recognized, and others' learning constructs are not taken into account. These sufficiency, simplification, logic, categorization and definitional problems render the model less holistic than it claims to be, and make related theory and the LSI liable to criticism. Basing theory, model and measuring instrument on flawed conceptualizations, hinders research and practice in any field.

That said, we believe that Kolb's model is worth developing further. We have argued, however, that there is a need for a more holistic model based on good science, sound logic and established modelling principles. We have, in this paper, provided a sound basis for an improved model by:

- identifying and eliminating redundant and tautological concepts;
- proposing a rigorous categorization schema and scale of learning typologies (Figures 6 and 7);
- identifying flawed bi-polarities; and
- identifying recognized learning styles absent from Kolb's model.

A complete redesign of the model guided by the above categorisation schema and logic, mindful of appropriate graphic syntax, and possibly taking the form of two learning cycles (one for active/concrete/primary learning, the other for passive/abstract/secondary learning) is proposed to further contribute to the development of experiential learning theory, practice and measuring instruments.

References

Bergsteiner, H., and G.C. Avery. 1999. Graphical models in management: Some guidelines. Proceedings of the 5th International Meeting of the Decision Sciences Institute, Athens, Greece. Vol. I: 177–80.

Bergsteiner, H., and G.C. Avery. 2003. Making graphic management models smarter. *International Business & Economics Research Journal* 2, no. 12: 47–58.

Bezerra, R.F., S. Jalloh, and J. Stevenson. 1998. Formulating hypotheses graphically in social research. *Quality and Quantity* 32, no. 4: 327–53.

Britt, D.W. 1997. *A conceptual introduction to modeling: Qualitative and quantitative perspectives.* Mahwah, NJ: Lawrence Erlbaum.

Campbell, N.R. 1920. *Physics, the elements.* Cited in Hesse, 1970, op. cit., original unavailable.

Coffield, F., D. Moseley, E. Hall, and K. Ecclestone. 2004. *Learning styles and pedagogy in post-16 learning: A systematic and critical review.* London: Learning and Skills Research Centre.

De Ciantis, S., and M. Kirton. 1996. A psychometric reexamination of Kolb's experiential learning cycle construct: A separation of level, style and process. *Educational and Psychological Measurement* 56, no. 5: 809–20.

Duff, A., A. Dobie, and X. Guo. 2008. The influence of business case studies and learning styles in an accounting course: A comment. *Accounting Education: An International Journal* 17, no. 2: 129–44.

Duff, A., and T. Duffy. 2002. Psychometric properties of Honey and Mumford's Learning Styles Questionnaire (LSQ). *Personality and Individual Differences* 33, no. 1: 147–63.

Dunn, R., and K. Dunn. 1989. *Learning style inventory.* Lawrence, KS: Price Systems.

Egan, K. 1997. *The educated mind: How cognitive tools shape our understanding*. Chicago: University of Chicago Press.

Feigl, H. 1988. The scientific outlook: Naturalism and humanism. In *Introductory readings in the philosophy of science*, ed. E.D. Klemke, R. Hollinger, and A.D. Kline, 427–37. Buffalo, NY: Prometheus Books.

Felder, R.M., and L.K. Silverman. 1988. Learning styles and teaching styles in engineering education. *Engineering Education* 78, no. 7: 674–81.

Fleming, N.D. 2001. *Teaching and learning styles: VARK strategies.* Christchurch: N.D. Fleming.

Freedman, R., and S. Stumpf. 1978. What can one learn from the learning style inventory? *Academy of Management Review* 21: 33–9.

Freedman, R., and S. Stumpf. 1980. Learning style theory: Less than meets the eye. *Academy of Management Review* 5: 445–7.

Freeman, L.C. 2003. Visualizing social networks. *Journal of Social Structure.* http://zeeb.library.cmu.edu:7850/JoSS/article.html.

Fry, E. 1981. Graphical literacy. *Journal of Reading* 24, no. 5: 383–90.

Garner, I. 2000. Problems and inconsistencies with Kolb's learning styles. *Educational Psychology* 20, no. 3: 342–8.

Gigerenzer, G., and R. Selten. 2001. Rethinking rationality. In *Bounded rationality: The adaptive toolbox*, ed. G. Gigerenzer and R. Selten, 1–12. Cambridge, MA: MIT Press.

Harel, D. 1995. On visual formalisms. In *Diagrammatic reasoning: Cognitive and computational perspectives*, ed. J. Glasgow, N.H. Narayan, and B. Chandrasekaran, 235–71. Cambridge, MA: AAAI Press.

Healey, M., and A. Jenkins. 2000. Learning cycles and learning styles: The application of Kolb's Experiential Learning Model in higher education. *Journal of Geography* 99: 185–95.

Henson, R.K., and D.Y. Hwang. 2002. Variability and prediction of measurement error in Kolb's Learning Style Inventory scores: A reliability generalization study. *Educational and Psychological Measurement* 62, no. 4: 712–27.

Hesse, M.B. 1970. *Models and analogies in science*. Indiana: University of Notre Dame Press.

Holman, D., K. Pavlica, and R. Thorpe. 1997. Rethinking Kolb's theory of experiential learning in management education: The contribution of social constructionism and activity theory. *Management Learning* 28, no. 2: 135–48.

Honey, P., and A. Mumford. 1992. *The manual of learning styles.* Maidenhead: Peter Honey.

Jarvis, P. 2004. *Adult education and lifelong learning: Theory and practice.* London: RoutledgeFalmer.

Kayes, C.D. 2002. Experiential learning and its critics: Preserving the role of experience in management learning and education. *Academy of Management Learning and Education* 1, no. 2: 137–49.

Kolb, A.Y., and D.A. Kolb. 2005. Learning studies and learning spaces: Enhancing experiential learning in higher education. *Academy of Management Learning and Education* 4, no. 2: 193–212.

Kolb, A.Y., and D.A. Kolb. 2009a. Experiential learning theory: A dynamic, holistic approach to management learning, education, and development. In *The SAGE handbook of management learning, education and development*, ed. S.J. Armstrong and C.V. Fukami. London: Sage.

Kolb, A.Y., and D.A. Kolb. 2009b. The learning way: Meta-cognitive aspects of experiential learning. *Simulation and Gaming* 40, no. 3: 297–327.

Kolb, D. 1984. *Experiential learning: Experience as the source of learning and development*. New Jersey: Prentice-Hall.

Kolb, D., A. Baker, and P. Jensen. 2002. Conversation as experiential learning. In *Conversational learning: An experiential approach to knowledge creation*, ed. A. Baker, P. Jensen, and D. Kolb, 51–66. Westport, CN: Quorum Books.

Kolb, D.A., and R. Fry. 1975. Toward an applied theory of experiential learning. In *Theories of group process*, ed. C. Cooper. London: John Wiley.

Kolb, D., I.M. Rubin, and J. McIntyre. 1971. *Organizational psychology: An experiential approach*. Englewood Cliffs, NJ: Prentice Hall.

Lamb, S., and S. Certo. 1978. The learning styles inventory (LSI) and instrument bias. *Academy of Management Proceedings* 1: 28–32.

Le Cornu, A. 2005. Building on Jarvis: Towards a holistic model of the processes of experiential learning. *Studies in the Education of Adults* 37, no. 2: 166–81.

Mainemelis, C., R.E. Boyatzis, and D.A. Kolb. 2002. Learning styles and adaptive flexibility: Testing experiential learning theory. *Management Learning* 33, no. 1: 5–33.

Mintzberg, H., and L. Van der Heyden. 1999. Organigraphs: Drawing how companies really work. *Harvard Business Review* 77, no. 5: 87–94.

Nersessian, N.J. 1995. Capturing the dynamics of conceptual change in science. In *Diagrammatic reasoning: Cognitive and computational perspectives*, ed. J. Glasgow, N.H. Narayan, and B. Chandrasekaran, 137–81. Cambridge, MA: AAAI Press.

Osborn, A.F. 1957. *Applied imagination*. New York: Scribner.

Panayiota, M., and M. Platsidou. 2008. Kolb's learning style inventory (1985): Validity issues and relations with metacognitive knowledge about problem-solving strategies. *Learning and Individual Differences* 18, no. 1: 114–9.

Price, L. 2004. Individual differences in learning: Cognitive control, cognitive style, and learning style. *Educational Psychology* 24, no. 5: 681–98.

Pylyshyn, Z.W. 1980. Computation and cognition: Issues in the foundations of cognitive science. *Behavioral and Brain Sciences* 3: 111–33.

Rosch, E. 1978. Principles of categorization. In *Cognition and categorization*, ed. E. Rosch and B.B. Lloyd, 27–48. Mahwah, NJ: Lawrence Erlbaum Associates.

Smith, L.D., L.A. Best, and D.A. Stubbs. 2003. Bolstering science and practice through graphism. *American Psychologist* 58, no. 10: 818–9.

Staats, A.W. 1999. Unifying psychology requires new infrastructure, theory, method, and a research agenda. *Review of General Psychology* 3, no. 1: 3–13.

Stumpf, S., and R. Freedman. 1981. The learning style inventory: Still less than meets the eye. *Academy of Management Review* 6, no. 2: 297–9.

Svinicki, M.D., and N.M. Dixon. 1987. The Kolb model modified for classroom activities. *College Teaching* 35, no. 4: 141–6.

Tetlock, P.E., and P. Suedfeld. 1988. Integrative complexity coding of verbal behavior. In *Analysing everyday explanations: A casebook of methods*, ed. C. Antaki, 43–59. London: Sage.

Trumbo, J. 1997. The process of critique in visual communication. *Journalism and Mass Communication Educator* 52, no. 2: 15–23.

Tufte, E.R. 1983. *The visual display of quantitative information*. Cheshire, CT: Graphics Press.

Tyler, L. 1983. *Thinking creatively: A new approach to psychology and individual lives.* San Francisco: Jossey-Bass.

Van Zwanenberg, N., L.J. Wilkinson, and A. Anderson. 2000. Felder and Silverman's Index of Learning Styles and Honey and Mumford's Learning Styles Questionnaire: How do they compare and do they predict academic performance?. *Educational Psychology* 20, no. 3: 365–80.

Vessey, I. 1991. Cognitive fit: A theory-based analysis of the graphs versus tables literature. *Decision Sciences* 22, no. 2: 219–40.

Ware, C. 2000. *Information visualization: Perception for design*. San Francisco, CA: Morgan Kaufmann.

Webb, M.W. 2003. A definitive critique of experiential learning theory. Unpublished diss., Weatherhead School of Management, Case Western Reserve University. http://cc.ysu.edu/~mnwebb/critique.htm.