Adult Cognition and Lifelong Learning: Contributions and Conflicts in the Development of Architectural Pedagogies

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INTRODUCTION

The growing commitment of universities and their funders to the concept of 'lifelong learning' highlights the need to ensure that teaching and learning practices in architectural education take account of knowledge concerning adult cognition and learning[1] . The idea that adults might think and learn in ways that are distinctively different from children and adolescents has had currency for some time, with cognitive researchers establishing this as a recognised field of knowledge during the 1980's. Brookfield[2] observes that the more recent emphasis by governments on lifelong learning has to some extent discredited the position that adult learning is a discrete and separate domain, although he continues that this should not be allowed to obscure the distinctiveness of learning that typically occurs in adult life. While the idea of lifelong learning inevitably draws connections between schooling, higher education and workplace learning — an idea that can be traced back to John Dewey — certain forms of thinking and learning that may be discernible at earlier stages of life stand out in sharp relief in adulthood. This paper attempts to address the question : how might pedagogical practices in architectural education take account of our knowledge of adult cognition and learning?

CHARACTERISTICS OF ADULT THINKING AND LEARNING

What are the distinctive characteristics of adult thinking and learning? There exists an extensive literature on this question, and different authors offer somewhat different perspectives on this material. Nevertheless, common themes may be identified. Brookfield traces four interconnected strands of empirical research into adult learning: the capacity to think dialectically, to employ 'practical logic', to know how we know what we know, and the capacity for critical reflection.

In dialectical thinking, universalistic and relativistic modes of thought co-exist, with the continuous exploration of the interrelationships between general rules and contextual imperatives. In attempting to resolve contradictions between ideals and actuality, we become attentive to the importance of context and the validity of situational reasoning, while also committing ourselves to personal values and general beliefs. This balancing of the universal and the specific has been identified by some developmental psychologists as a key indicator of 'wisdom'.

'Practical logic' also emphasises contextual reasoning. However, unlike dialectical thinking, which moves back and forth between objective and subjective frames of reference, practical logic focuses on the adult capacity to think contextually in a deep and critical way, by paying attention to the internal features of well-defined situations. The term 'post-formal thought' (or post-formal operations) also refers to this particular feature of mature adult thought, in contradistinction to the concept of 'formal operations' identified by Piaget as the end point of young adult development. A comprehensive account of post-formal thought and its applications has been prepared by Jan Sinnott[3] , including its implications for university education and teaching adults to develop complex post-formal ways of thinking. Sinnott explains that the post-formal thinker recognises that several truth systems may describe a particular reality yet accepts that commitment to a single truth system must be made in order to act. In other words, post-formal thought is both relativistic and non-relativistic, without becoming universalistic.

Key features of 'practical logic' have been referred to by other writers using different terms. These include practical intelligence, practical knowledge, expertise, and embedded logic. The logic involved is invariably one that does not follow formal rules of deductive reasoning, but rather is experiential and inferential.

Brookfield's third strand (the capacity to know how we know what we know), refers to the ability to learn to learn. Fundamental to this is what Karen Kitchener describes as epistemic cognition, or self-conscious awareness of one's learning style, and how it might be adjusted according to the particular learning situation[4]. In an attempt to measure the development of epistemic cognition King and Kitchener have developed a seven stage model of reflective judgement, in which the most advanced stages 'reflect the epistemic assumption that one's understanding of the world is not 'given' but must be actively constructed and that knowledge must be understood in relationship to the context in which it was generated'[5]. It follows that changes in context call for a re-evaluation of that knowledge. Research into epistemic cognition has involved subjects in identifying the inferential chains of reasoning they use, the cues they attend to and why, and the grounds for their decisions. The links to key features of practical logic noted above will be obvious. However, epistemic cognition, to the extent that it involves reflective judgement, also anticipates Brookfield's fourth strand — critical reflection.

In the broadest sense, critical reflection involves a judgement of the fit between the 'rules of life' previously acquired and the realities of one's adult situation. In order to do this, one needs to experience complex, contradictory and ambiguous realities directly. Adult learning thus becomes the search for meaning in the face of these kinds of realities and the process by which critically reflective capacities are developed in this search. The cycle of action and critical reflection on that action is central to the learning process. Brookfield also observes that 'it is a rhythm of learning which is distinguished by evidence of an increased ability to take alternative perspectives on familiar situations, a developing readiness to challenge assumptions, and a growing tolerance for ambiguity'[6].

Brookfield's synopsis omits several areas of cognitive research that are of interest to those involved in design education, notably the importance of generating new questions or what Arlin[7] refers to as 'problem-finding', and the role of prior experience versus situational information in decision making.

ADULT COGNITION, DESIGNERLY THINKING AND ARCHITECTURAL PEDAGOGIES

It will be evident from this brief review of the essential features of adult cognition that there are significant correspondences with design thinking as we understand it[8]. However, few design education researchers have attempted to investigate these links in any detail. A notable exception is the work of Donald Schon on the central role of critical reflection in design thinking, and his characterisation of design as a reflective conversation with the situation, in which successive steps are generated by reflecting on the outcomes of previous steps[9]. Drawing from Schon's work, Oxman has identified the fundamentally dialectic process of design thinking, focussing on the particular dialectic between conceptual thought and visual reasoning[10]. Oxman's interest is with the possible relationship between cognitive theories of learning and their relationship to design thinking on the one hand and pedagogical approaches in design education on the other.

However, this cognitive approach to design thinking and the development of pedagogical strategies is the exception rather than the rule. Eastman, McCracken and Newsletter suggest that pedagogic strategies for design education typically do not demonstrate a grounding in research conducted over the last two decades in cognitive science and educational psychology[11]. This is surprising in view of the growing need for architectural students to become self-directed or lifelong learners, and for enhancement of the quality of teaching and learning in the face of diminishing resources. However, some recent literature on teaching practices, specifically in the area of design-technology interrelationships, indicate that designerly ways of thinking may be exerting wider pedagogical influence.

If design may be viewed as the model par excellence of adult ways of thinking and learning, what are the implications for architectural pedagogies? Architecture degree programs typically combine at least two very different pedagogies — that of the design studio, and the lecture room. A number of authors have identified problems associated in transferring learning from the latter to the former. How might these difficulties be understood from the perspective of the psychology of cognition and learning? And how (if at all) may they be overcome? A key distinction in approaching this issue is that between information and knowledge.

An early contribution to this debate is Mark Gerlenter's 1988 article in JAE[12] which explores the difficulties that architecture students typically experience in applying 'universal information' (general principles and funda-

mental bodies of knowledge) to problems in the design studio. Gerlenter draws from the cognitive research of Piaget on the mutually interactive relationship between the acquisition of knowledge and its application, and argues that in splitting lectures and studio work, the modern curriculum erroneously assumes that the mind works in two quite distinct and sequential modes. Gerlenter proposes an alternative 'interaction model' of education, in which basic principles and bodies of knowledge considered to be essential to a designer's skill are introduced and developed entirely within the context of design project work. In this way the acquisition and retention of knowledge is seen to go hand in hand with the development of cognitive schemata (Piaget's building blocks in the development of knowledge and understanding). While Gerlenter's examples refer to the relationship between architectural technology and design, his arguments are applicable to all aspects of the curriculum in which principles are advanced that are intended to inform design practices.

A more recent exploration of the dichotomy between science-based theoretical knowledge and design thinking and knowing is presented by Louis Bucciarelli in the in the context of the engineering education curriculum[13]. Buchiarelli proposes that design knowledge couples understanding (in this case an understanding of the fundamentals of the appropriate paradigmatic sciences) with an ability to act. To act means to construct an interpretation appropriate for the immediate occasion, and in this sense knowledge may be distinguished from information on the one hand and skills on the other. Bucciarelli links training with skills, reading with information, and learning with knowledge, and he suggests that the traditional lecture/recitation pedagogy reflects the usually unstated belief that the lecture conveys knowledge-as-information, while the application of this knowledge in doing exercises and projects enables students to develop skills. This approach ignores the contextual nature of knowledge, and thus offers no guarantee that learning has taken place. Bucciarelli's examples focus on the use of abstract or generic exercises set within the context of a lecture course. The prioritising of the content of the exercise over its context in what he refers to as a 'traditional rendering of the problem' was found to inhibit learning when compared with the 'same exercise opened up and embedded in a different context' — one that accords with the world of engineering practice[14].

The learning difficulties reported by Gerlenter and by Bucciarelli in the context of architectural and engineering design education have also been referred to in the literature of cognitive psychology as the problem of 'inert knowledge'. Carl Bereiter and Marlene Scardamalia[15] trace this concept back to Alfred North Whitehead's 1929 treatise, 'The Aims of Education', in which he referred to 'inert ideas' — propositional knowledge that could be expressed but not used by the student. Whitehead viewed curriculum fragmentation and the lack of active application of knowledge as the principal causes, resulting in what he referred to as the passive reception of disconnected ideas. Bereiter and Scardamalia take a cognitive-developmental approach to this issue, noting that the issue is not simply one of how knowledge is presented but what the student is asked to do with that knowledge. They suggest that direct attention to what they refer to as the 'coping strategies' that students bring to knowledge tasks is needed, and they draw on evidence from the area of expository writing in schools, where the 'problem of thinking what to write' looms large. They characterise expository writing as a good example of problem solving in a knowledge-rich domain in which the 'problem' offers little indication of the knowledge that may be relevant to solving it, and in which relevant knowledge is sufficiently diverse that it cannot be accessed efficiently by a top-down search. The cognitive task is described as 'ill-structured', in which the end state is largely defined by the writer. Bereiter and Scardamalia link the difficulties experienced by students in this activity to pedagogical practices similar to those critiqued by Bucciarelli. This might be expected, given the parallels between the problem of expository writing and the problem of designing.

If we return to the issue of architectural pedagogies, one area where the problem of 'inert knowledge' seems most pronounced is in the relationship between 'knowledge' concerning architectural technologies and designing (or what Bucciarelli refers to as 'design knowledge'[16]). Gerlenter's article was in effect about this issue, yet his challenge to abandon lecture courses that are independent of design project work appeared to require a decade of gestation. In 1997 a number of articles reporting on pedagogical initiatives aimed at effectively integrating the architectural technology curriculum with studio-based design teaching appeared in the Journal of Architectural Education. While these articles make little direct reference to developments in the psychology of adult cognition and learning, it is difficult to avoid the conclusion that a contribution of some kind is at work here, since close similarities may be detected between adult thinking and learning strategies and the strategies at work in these initiatives.

DESIGN AND TECHNOLOGY AS THINKING AND LEARNING PROCESSES

A common theme that links these recently reported pedagogical initiatives is the attempt to integrate design as a thinking and learning process with technology as a thinking and learning process. Such integration is seen by some as fundamental to the broader enterprise of architectural learning. In making this point Donald Watson goes on to assert that 'the ultimate measure of a curriculum is how this knowledge and imagination (of both design and technology) are brought together'[17]. Watson outlines several curriculum formats that seek to promote what he refers to as the 'technological imagination', by means of which technological issues are introduced as sources of design insight. Interestingly, these curriculum formats rely heavily on experiential learning, and include a 'technology discovery laboratory' with teaching assistants serving as 'technical knowledge guides'. (The importance of experiential learning, with teachers as guides, is a recurrent theme in the literature on adult learning.)

David Kratzer[18] advances a similar position, and outlines a design studio strategy which places the learner in a context of continual change. The studio begins with the generation of constructions that focus on the development of a tectonic language in the absence of program, site, or other quantitative requirements. Such requirements are then progressively introduced, leading to successive revisions of the initial design proposal. Kratzer explains that the students are always faced with the artefact they have made, requiring transformation of this existing construction, rather than a fresh start each time a new problem is introduced. His intention in so doing is 'to breed in the students an understanding that architectural form results from tectonic responses to the practical conditions at hand'[19]. This closely resembles Brookfield's outline of the capacity to employ 'practical logic' and is consistent with the findings of such cognitive researchers as Labouvie-Vief and Tennant in regard to the relationship between abstract thought and the concrete limitations of real-life situations. In addition, Kratzer's strategy also emphasises the experience of knowledge as context dependent and requiring re-evaluation as that context changes — a further characteristic of mature adult cognition.

Patricia Kucker[20] also advocates a studio teaching strategy in which technological issues are central to early explorations of architectural form and space and in which building technology and materials are presented as conceptual, malleable, and a generative aspect of the design process. But perhaps the most uncompromising of these pedagogical initiatives aimed at circumventing the problem of 'inert knowledge' is that outlined by Edward Allen, whose work is informed by Gerlenter's arguments. In addition to architectural design studios as we know them Allen proposes a second parallel studio that focuses on the technical dimensions of design project work being undertaken in the primary studio[21]. This second studio serves as a demand-creating vehicle for informal technical lectures that introduce material of direct relevance to the current design problems being addressed in one or more primary studios. What is uncompromising about Allen's position is that it proposes to abandon independent lecture courses in technologies and to subsume this pedagogy into the pedagogy of the design studio. But Allen also identifies the labour-intensive nature of all studio-based teaching, and goes on to suggest a hybrid pedagogy as an alternative to the second studio, in which the traditional pattern of a 'logical' sequence of lectures accompanied by numerical problem sets is replaced by a sequence of creative design exercises that generate a need for lectures. (A similar point is made by Schierle[22], when he argues for basic concepts and principles introduced in the context of real problems, recalling the work of Buciarelli.)

CONFLICTS AND CONTRIBUTIONS: AN AUSTRALASIAN PERSPECTIVE

Any move from traditional lecture-based pedagogies to pedagogies that focus on the learning achieved by each student and the demonstration of that learning in design project work would appear to be in direct conflict with the requirement in many schools of architecture for staff to work with larger groups of students. In Australasia, government and institutional pressures have seen architecture programmes either reduce staff numbers or increase student numbers, in order to achieve staff-student ratios that are closer to institutional norms. Yet architecture perhaps more than any other discipline is dependent upon the small group interactive teaching and learning practices that characterise the design studio. An analysis of teaching economy, measured in terms of the total number of staff hours per student for courses at the University of Auckland School of Architecture, revealed that for courses of equivalent credit size, a lecture-based course delivered to a class of 100 students was more than twice as economical of teacher time than a studio-based design course with student groups of fifteen. A further factor is the space required for all students to have their own studio workspace. Space charging regimes in some Australian universities have prompted several schools to relinquish studio workspaces, in favour of smaller areas in the form of crit rooms. This has the effect of

requiring students to establish design workspaces elsewhere, typically remote from the school premises.

When these realities are juxtaposed with the growing need for architectural graduates to very quickly become productive employees in architectural practice, with the ability to be self-directed and effective on-the-job learners, the shortcomings of lecture-based pedagogies and the problem of 'inert knowledge' become more acute. Somewhat ironically, the tendency for the profession's accrediting agencies to add to, rather than to take away from existing curricula, serves to exacerbate the problem.

The challenge for schools of architecture will be to enhance student learning and student learning independence while expending fewer staff resources in the process. Pedagogical experiments that achieve the former without also achieving the later are likely to be of little value to most schools. It could also be suggested that the most interesting educational developments to emerge in the near future will be those that protect the design studio as a learning environment, while also enhancing its effectiveness in preparing students to be independent learners. While this paper does not attempt to predict what these developments will be, it is possible to identify areas that are likely to be focal. A few are suggested below.

If there is to be more attention to learning, then it may be inevitable that there be less attention to teaching. In their review of lifelong learning through undergraduate education, Candy, Crebert and O'Leary record that it is widely acknowledged that undergraduate curricula expand in proportion to the expansion of knowledge[23]. This has the effect of prioritising information transfer rather than knowledge acquisition, and in reducing opportunities for individual student choice of study and hence self-direction. Graham Gibbs cites research demonstrating that a curriculum that leaves the student with a full timetable of prescribed courses is associated with a surface rather than a deep approach to learning tasks, with disastrous consequences for learning outcomes[24].

Less teaching, however, does not necessarily result in more learning. Candy et al suggest that structuring the curriculum to promote learning becomes necessary, and they identify a number of ways in which this has been successfully achieved in the Australasian context[25]. These include:

- courses that explicitly promote critical thinking and reflective practice
- an integrated curriculum, in which subjects are linked horizontally across sub-disciplinary areas and vertically over successive years of study within a specific discipline focus
- a well-structured knowledge base, rather than a patchwork of courses
- freedom of choice and flexibility in structure
- curriculum structures that promote incremental development of both content knowledge and learning autonomy
- courses that promote information literacy skills and learning-to-learn skills

Assuming that curriculum structure is learning rather than teaching focussed, how might this learning take place, and how might it be assessed, while at the same time achieving staffing economies? Again, while there are no simple answers developments in the field of adult cognition and learning have led to techniques which are already being employed in undergraduate education and which may need to gain wider acceptance. As part of their Australia-wide survey Candy, Crebert and O'Leary list four approaches identified by students, graduates and staff that were considered to promote learning outcomes that translated into lifelong learning skills: self-directed and peer-assisted learning; experiential and real-world learning; resource-based and problem-based learning; reflective practice and critical self awareness. Connections with key features of adult cognition outlined earlier in this paper will be apparent. Brief comments on each of these in relation to architectural education follow.

In regard to self-directed learning, the objective should be for a gradual relinquishing of control by the teacher, while techniques such as the use of learning contracts can ensure that individual learning activity is well structured and productive. Candy et al note that in the case of professional degree programs in particular, self-directed learning approaches invert the dilemma that accompanies traditional teaching approaches: rather than worrying over what can be left out of the curriculum, staff are faced with the problem of what has to go in to ensure professional competency[26].

As student capacities for self-directed learning grow, and as students come to know how they know what they know (to use Brookfield's phrase), opportunities for peer learning and peer mentoring also increase. Peer learning is one of the foundation stones on which the case for studios as the heart of architectural

education rests, but the formalising of these opportunities might well increase this kind of learning. Peer mentoring and peer-tutoring for credit programs have been introduced in a number of Australasian universities, including at two Auckland universities reported by Jones, Jones and Kerr[27], while a 1993 Australasian conference on this issue resulted in some thirty presentations from those who had organised peer tutoring schemes in one form or another (Jones[28]). However, none of these initiatives were located in schools of architecture. Peer mentoring, both as an informal and a formal process, provides one way of developing self-directed and lifelong learning skills, and enhancing the effectiveness of studio-based learning.

Experiential and real-world learning and problem-based learning are readily accommodated in the design studio, and compared to other disciplines architecture is well placed in this respect. From a learning perspective, Candy et al observe that problem-based learning intentionally takes account of such aspects as the degree of learner control, recognition of students' prior knowledge, the transdisciplinary nature of real world problem-solving, and the active and informed involvement of the learners in framing the problem and evaluating the outcomes of their learning.

Reflective practice and critical-self awareness are also at the heart of studio-based teaching and learning. Candy et al observe that reflective practice is essentially about lifelong learning, and they identify a variety of techniques that aim to enhance reflective practice learning.

CONCLUSION

A review of knowledge regarding adult cognition and practices considered to promote lifelong learning indicates that the pedagogy of the design studio significantly advantages architectural education in relation to many other disciplines. However, a number of impediments to the wider use of this pedagogy can also be identified. These are primarily sociological and institutional in nature. Both theoretical and practical developments in the fields of adult learning and lifelong education suggest ways in which the quality of architectural education may be enhanced without corresponding increases in staffing resources. Traditionally, the design studio has been a site for experimentation, although the potential for expressly pedagogical experimentation remains high. Such experimentation should not preclude the creative adaptation of teaching and learning experiments in other disciplines.

NOTES

[1] A comprehensive report on the issues of lifelong learning and undergraduate education in an Australasian context may be found in Philip Candy, Gay Crebert and Jane O'Leary, *Developing Lifelong Learners through Undergraduate Education* (National Board of Employment, Education and Training, Australian Government Publishing Service, 1994).

[2] Stephen Brookfield, ''Adult Cognition as a dimension of lifelong learning'', in John Field and Mal Leicester (eds), *Lifelong Learning: Education Across the Lifespan* (London: Routledge Falmer, 2000): 89 — 101.

[3] Jan Sinnott, *The Development of Logic in Adulthood: Post Formal Thought and its Applications* (New York: Plenum Press, 1998): 24.

[4] K. S. Kitchner, ''The Reflective Judgement Model: Characteristics, Evidence and Measurement'', in R. Mines and K. S. Kitchener (eds), *Adult Cognitive Development: Methods and Models* (New York: Praeger, 1986): 76 — 91.

[5] P. M. King and K. S. Kitchener, *Developing Reflective Intellectual Growth and Critical Thinking in Adolescents and Adults* (San Franscisco: Jossey Bass, 1994): 17.

[6] Brookfield (2000): 98.

[7] P. Arlin, ''Wisdom: the art of problem finding'', in R. Stemberg (ed), *Wisdom: its Nature, Origins and Development* (Cambridge: Cambridge University Press, 1990): 230 — 243.

[8] For a fuller discussion of the parallels between characteristics of adult cognition and designerly thinking, refer to J. Hunt, ''From Pedagogy to Andragogy: Implications for Learning and Teaching in Architectural Design and Architectural Science'', *Modern Practice of Architectural Science: From Pedagogy to Andragogy*: Proceedings of the 36th conference of the Australian and New Zealand Architectural Science Association (November, 2002): 193-200.

[9] Donald Schon, *The Reflective Practitioner: How Professionals Think in Action* (London: Temple Smith, 1983): chapter 3.

[10] Rivka Oxman, ''Educating the designerly thinker'', *Design Studies 20* (1999): 105-122.

[11] Charles Eastman, Michael McCracken, Wendy Newstetter (eds), *Design knowing and Learning: Cognition in Design Education* (Amsterdam: Elsevier 2001): 2.

[12] Mark Gerlenter, ''Reconciling Lectures and Studios'', *Journal of Architectural Education* 41/2 (Winter 1988): 46-52.

[13] Louis Bucciarelli, ''Design Knowing and Learning: a Socially Mediated Activity'', in Charles Eastman, Michael McCracken and Wendy Newsletter (eds), *Design Knowing and Learning: Cognition in Design Education* (Amsterdam: Elsevier, 2001): 297 — 314.

[14] Bucciarelli: 309.

[15] Carl Bereiter and Marlene Scardamalia, ''Cognitive Coping Strategies and the Problem of Inert Knowledge'', in S.F.Chipman, J.W.Segal and R.Glaser (eds), *Thinking and Learning Skills: research and open questions* V2, (Hillside, N.J.: Erlbaum, 1985): 65-80.

[16] The idea of 'design knowledge' needs to be distinguished from knowledge about design as a cognitive process.

[17] Donald Watson, ''Architecture Technology, and Environment'', *Journal of Architectural Education* 51/2 (November, 1997): 119.

[18] David Kratzer, ''The Practical as Instrument for Technological Imagination'', *Journal of Architectural Education* 51/1 (September, 1997): 33.

[19] Kratzer: 35.

[20] Patricia Kucker, ''Recognizing a (Fertile) Gap'', *Journal of Architectural Education* 51/2 (November, 1997): 110.

[21] Edward Allen, ''The Second Studio: a Model for Technical Teaching'', *Journal of Architectural Education* 51/2 (November, 1997): 92.

[22] G. Goetz Schierle, ''The Pedagogy of Architectural Technology'', *Journal of Architectural Education* 51/2 (November 1997): 82.

[23] Candy, Crebert and O'Leary: 97.

[24] Graham Gibbs, ''Better Teaching or Better Learning?'', *HERDSA News* 5/2 (July 1983): 3-11.

[25] Candy, Crebert and O'Leary: 128.

[26] Candy, Crebert and O'Leary: 130.

[27] John Jones, Ann Jones and Phil Kerr, ''Peer Tutoring for Academic Credit'', *HERDSA News 16/3* (November 1994): 3-5.

[28] John Jones (ed), *Peer Tutoring: Learning by Teaching*. Proceedings of the conference held at the University of Auckland, 1993.