The Evolving Link between Learning and Assessment: From 'Transmission Check' to 'Learning Support'

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Abstract: *Learning and assessment are now considered as two sides of the same coin – we simply cannot speak of one without also referring to the other. This paper, which traces the evolution of the link between learning and assessment, explores what led to our shift in understanding of the learning process from the behaviourist to the constructivist model, and the implications that this 'revolution' has had for assessment. Making assessment at the service of learning is subsequently identified as the challenge ahead for the educational community.*

Learning and Assessment in Dynamic Tension

It is a vibrant time for all those involved in education – for we live in an era marked by concurrent, but not coincidental, changes and innovations in theories of learning (which influence in turn conceptions of appropriate instruction) and assessment.[1] Since 'Assessment . . . both reflects and communicates deeply held convictions about how children learn, what children should learn and why',[2] this parallelism can hardly be surprising. The UK-based Assessment Reform Group (ARG) (1999) reports in turn that leading academics are becoming increasingly convinced of the crucial link between assessment (as carried out in the classroom) and learning and teaching. The understanding is that learning goals, teaching activities, learning processes and assessment procedures coexist in a system of interrelationships in which 'all four components are in dynamic tension or balance. That is, adjustment of one component requires sympathetic adjustment of the other three.'[3]

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[1] Cizek, 1997.
[2] Denvir, 1989, p. 277.
[3] Cumming & Maxwell, 1999, p. 179.

A Critique of the Behaviourist Learning Model

Models or theories of learning basically gravitate around either the traditional behaviourist perspective or the more recent constructivist perspective. According to Gipps (1994), psychological theories of learning, which date back to the early part of the 20th century, are underlined by two linked assumptions – decomposability and decontextualization.

Decomposability is based on the notion that learning of complex competencies – just like 'building blocks' – can be broken down into discrete skills learnt separately by developing individual stimulus-response bonds. In what clearly follows the canons of behaviourist theory, learning is seen to be linear and sequential, with complex understandings only occurring by the accumulation of elemental, prerequisite learnings.[4] This learning model, which is characterized by practice, consequently precludes moving to higher levels until the prior level has been mastered, and rests on the idea that repetition is the only way to remedy deficient skills acquisition.[5] But Gipps (1994), apart from pointing out that theories built on the assumption of decomposability never articulate clearly how complex skills can be developed later, argues that the development of problem solving or thinking skills suffers within this learning framework as it tends to focus on separate skills. She moreover criticizes behaviourist learning models for not recognizing the current understanding that practising higher order skills can actually help to develop or strengthen 'basic skills'.

Decontextualization, on the other hand, is based on the premise that 'each component of a complex skill is fixed, and that it will take the same form no matter where it is used'.[6] This builds on the traditional notion of knowledge as an 'integral, self-sufficient substance, theoretically independent of the situations in which it is learned and used'.[7] But situated cognition theorists now challenge this separating of what is learned from how it is learned and used, and argue instead that the activity in which knowledge is developed and deployed is an integral part of what is learned – situations might indeed be said to co-produce knowledge through activity.[8] This implies that skills, knowledge and facts cannot be learned in isolation and then used in any context.[9]

Black (1998) contends that an atomized approach to learning – which decomposability and decontextualization imply – emphasizes learning by rote, of small pieces of information without the understanding that interrelates them, and of

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[4] Shepard, 1991

[5] Shepard, 1991.

[6] Resnick & Resnick, 1992, p. 43; cited in Gipps, 1994.

[7] Brown *et al.*, 1989, p. 32.

[8] Brown *et al.*, 1989.

[9] Gipps, 1994.

fixed rules and procedures. These rules and procedures will consequently be grasped only as tactics, without the strategic overview needed to give them significance and to guide their application. This form of learning is not helpful to students who will be expected to be flexible, adaptive and able to change in response to the rapidly developing and complex technological society.[10] Although there are some things that are probably most efficiently learned by rote (e.g., number bonds, spellings, and multiplication tables), the exponential increase in the amount of factual information in recent years and for the foreseeable future, coupled with the rapid changes in the nature of employment, indicate that there should be far greater emphasis on learning that can be transformed and applied to new circumstances than on learning facts and procedures applicable only in situations closely similar to those in which they were learned.[11]

A simple but powerful way of characterizing these two approaches to learning – the former leading to understanding and the latter to rote memorization – is to distinguish between 'deep learning' and 'surface learning'. Deep approaches involve an active search for meaning, underlying principles, structures that link different concepts or ideas together, and widely applicable techniques; surface approaches, in contrast, rely primarily on attempts to memorize course material, treating the material as if different facts and topics are unrelated.[12] A surface or shallow approach to learning – especially if used indiscriminately or habitually[13] – is clearly inappropriate because 'Isolated facts, if learnt, quickly disappear from the memory because they have no meaning and do not fit into the learner's conceptual map. Knowledge learnt in this way is of no use because it cannot be applied, generalized, or retrieved.'[14]

Assessment within the Behaviourist Learning Model

Shepard (1991) identifies the 'test-teach-test' cycle as one of the fundamental principles that underlie a behaviourist approach to educational practice. This insistence on testing builds on 'The assumption made in the traditional, behaviourist testing/ learning model . . . that one can specify and measure all important learning objectives, and furthermore that mastery on the test items implies mastery of the intended skills and concepts.'[15] Testing within this tradition typically engages the learner in finding someone else's correct answer rather than in personal interpretation and thinking.[16]

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[10] Denvir, 1989.

[11] Harlen & James, 1997.

[12] Marton & Säljö, 1976.

[13] Cf. Harlen & James, 1997.

[14] Gipps, 1994, p. 21.

[15] Gipps, 1994, p. 20.

[16] Gipps, 1994; also Black, 1998.

According to von Glasersfeld (1995), the behaviourist school succeeded in eliminating the distinction between training for performance and teaching that aims at the generation of understanding with unfortunate consequences for education:

> [The behaviourist learning theory] has tended to focus attention on students' *performance* rather than on the *reasons* that prompt them to respond or act in a particular way. Reinforcement fosters the repetition of what gets reinforced, regardless of the acting subject's *understanding* of the problem that was posed, and of the inherent logic that distinguishes solutions from inadequate responses. Thus, training may modify behavioural response, but it leaves the responding subject's comprehension to fortunate accidents. (p. 4) (emphasis in original)

Within the dominant behaviourist teaching/learning/testing model, teachers focus on discrete skills and on decontextualized test items, offering over-practice in the hope of achieving mastery.[17] But albeit an 'explanation and practice' approach may seem to cover ground more quickly, progress is often illusory (and hence long-term learning elusive) as imitative methods usually develop dependency and a fragile fluency that is lost when practice ceases.[18] This approach evidently contradicts the assumption that an important aim of education is to bring about learning with understanding.[19] In particular, teaching within this traditional model is accomplished by telling and learning by repetition, and the learner is viewed as a passive container waiting to be filled with knowledge, but possibly not receiving the knowledge because of a 'block'.[20]

Given that the underlying assumption in this transmission approach to teaching and learning is that knowledge can be transferred from teacher to student, teachers' main concern is thus to get knowledge into their students' heads.[21] It follows that the purpose of assessment within this transmission framework is to determine the effectiveness with which a body of knowledge has been communicated by the teacher to the student.[22] And the feedback it provides is in terms of what has not been learned.[23] This explains the considerable emphasis in the past on analysis of 'error patterns' that emerge from watching students' performance.[24]

More recently, however, the desire to encourage deep learning strategies has favoured instead an assessment system that places 'emphasis on understanding, transfer of learning to untaught problems or situations, a   nd other thinking skills,

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[17] Gipps, 1994.
[18] Swan, 2001.
[19] Cf. Harlen & James, 1997.
[20] Cf. Denvir, 1989.
[21] Von Glasersfeld, 1989.
[22] Brown, 1989.
[23] Harlen & James, 1997.
[24] Cf. Bright & Joyner, 1998.

evaluating the development of these skills through tasks that clearly must involve more than recognition or recall'.[25] This shift in assessment parallels the new conceptions of learning that, as Glaser and Silver[26] explain, became necessary following the failure of behaviourist theories to describe adequately complex processes of thought, reasoning and problem solving.

A Constructivist Perspective on Learning

Recent work in cognitive and constructivist psychology comes as an alternative to the behaviourist, linear hierarchy model of learning.[27] The underlying assumption is that different students possess different 'kinds of minds', and that they consequently learn, remember and understand in different ways.[28] This recognition of heterogeneity is built on the notion that each learner presents a unique profile of abilities, accomplishments, characteristics and needs.[29] Contemporary cognitive psychology, which has built on the very old idea that things are easier to learn if they make sense,[30] supports the notion that:

. . . understanding involves creating links in the mind and that 'making sense' of something depends on these links. Isolated pieces of information do not have links to existing mental frameworks and so are not easily retained in the mind. The identification and creation of links to existing frameworks depends on the active participation of the learner and on the familiarity of the context of the material to be learned. Understanding, in this view, is the process of construction and reconstruction of knowledge by the learner. What is known and understood will, of course, change with new experience and as new ideas and skills are presented to help make sense of it.[31]

In this new understanding of learning as a cognitive and constructive process, knowledge is not an external map that is transposed directly into the student's head, but results from the organic process of reorganizing and restructuring undertaken by the student as he or she learns.[32] The students are now believed to learn best by actively making sense of new knowledge – making meaning from it and mapping it into their existing knowledge map/schema.[33] Constructivist learning theories acknowledge that students are active in their learning – a notion that belies their traditional role as passive receivers of knowledge. The student is now seen as agent,

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[25] Crooks, 1988, p. 468.

[26] Glaser & Silver, 1994; cited in Cizek, 1997.

[27] Gipps, 1994, 1996.

[28] Gardner, 1991; cited in Gipps, 1996.

[29] LaCelle-Peterson, 2000.

[30] Shepard, 1991.

[31] Harlen & James, 1997, p. 368.

[32] Gipps, 1994.

[33] Gipps, 1994.

the active constructor of meaning and knowledge who shares responsibility for learning with his or her teacher.[34] But whereas learning in some versions of cognitive theory is almost completely a function of the learner's interpretations of events,[35] knowledge from a social constructivist perspective is a product of dialogue and negotiation between teachers and students.[36] The latter understanding is that 'we learn from being part of and interacting within a social environment, and that individual construction of knowledge is derivative of its social construction'.[37]

Assessment within the Constructivist Learning Model
The constructivist awareness that knowledge is something cohesive and holistic that scaffolds subsequent learning carries important implications for assessment:

. . . we can no longer use a model of assessment which atomizes knowledge. We need to assess level of understanding and complexity of understanding rather than recognition or recall of facts.[38]

Thus, for instance, constructivist theories demand that tests show what students know and can do, as well as facilitate good learning – what Glaser (1990) calls 'placing tests in the service of learning'. 'Tests ought not to ask for demonstration of small, discrete skills practised in isolation. They should be more ambitious instruments aimed at detecting what mental representations students hold of important ideas and what facility students have in bringing these understandings to bear in solving their problems.'[39]

In a constructivist environment, the students are expected to engage in dialogue with each other and with teachers, and to validate their own understandings rather than merely accept transmitted views.[40] This implies that students should be willing to consider each other's solutions and to be prepared to accept better solutions without an *a priori* acceptance of the teacher's view.[41] Improvement in learning is seen to depend on students coming to hold a concept of quality roughly similar to that held by the teacher, and on their ability to draw on a range of strategies to close the gap between their actual performance and the standard they are aiming for.[42] The emphasis is now on students as conscious decision-makers whose learning is

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[34] Murphy, 1996.
[35] Steadman & Svinicki, 1998.
[36] Murphy, 1996.
[37] Jaworski, 2002, p. 73.
[38] Gipps, 1994, p. 22.
[39] Shepard, 1991, p. 9.
[40] Murphy, 1996.
[41] Seegers & Gravemeijer, 1997.
[42] Sadler, 1989.

based on personal commitment and deep consideration. The concept of agency by students – which rests on the premise that it is the student who constructs meaning out of the opportunities that the school offers – links educational progress to the need for students to gain an explicit understanding of what they know and how they come to know it.[43] Towards this end, students need to develop what von Glasersfeld (1989) calls 'operative knowledge' that, contrary to the traditional knowledge used for associative retrieval of a particular answer, is knowledge of what to do to produce an answer.

These roads to deep learning involve thinking about the meaning of what is being learned – a metacognitive process (which is basically the second-order practice of 'thinking about thinking') that helps the learner to plan, monitor, orchestrate and control his or her own learning through a variety of self-awareness processes.[44] But as metacognitive understandings do not just happen, the teacher has to help his or her students acquire the necessary skills and experiences. When teachers progressively turn over metacognitive functions to their students, students start to appreciate what it means to learn and gain awareness of their own learning strategies and efficiency – this is when learning can turn into an intentional process rather than incidental.[45] But if the teaching and development of higher-order skills such as application of knowledge, investigation, analyzing, reasoning and interpretation are to be encouraged, assessment needs to reflect such qualities.[46] In particular, assessment facilitates metacognition when students are active in their own assessment, and when assessment is seen by students as a moment of learning in the light of an understanding of what it means to get better.[47]

Once knowledge and competence are recognized as products of the individual's conceptual organization of the individual's experience, the teacher's role will no longer be to dispense 'truth' but rather to help and guide the students in the conceptual organization of their experiences.[48] This involves providing students with authentic activities that are meaningful and purposeful from their perspective, and that allow them to apply and develop their understandings in explicit relation to others.[49] Above all, the teacher needs to orchestrate a discussion around issues that are significant in view of the envisioned learning trajectories.[50] A discussion-based teaching approach built on the sharing and renegotiation of ideas in an atmosphere of mutual trust may

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[43] Murphy, 1996.

[44] Gipps, 1994.

[45] Gipps, 1994.

[46] Gipps, 1994.

[47] Cf. Black & Wiliam, 1998.

[48] Von Glasersfeld, 1989.

[49] Murphy, 1996.

[50] Seegers & Gravemeijer, 1997.

appear slow initially, but learning becomes meaningful, connected and stable over time.[51] In this scenario,

> The teacher . . . becomes an enabler, a facilitator, one who has to be alive to the shifts and turns in pupils' thinking and to its cultural supports, and to encourage the pupil to build on his or her relevances.[52]

This new role was given prominence by the Russian cognitive psychologist Vygotsky in his 1962 seminal publication *Thought and Language* in which he argues that learning proceeds by an interaction between the teacher and the learner.[53] His theory of cognitive development rests on the key concept of 'internalization':

> Vygotsky argues that all higher psychological processes are originally social processes, shared between people, particularly between children and adults. The child first experiences active problem-solving activities in the presence of others but gradually comes to perform these functions independently. The process of internalization is gradual; first the adult or knowledgeable peer controls and guides the child's activity, but gradually the adult and the child come to share the problem-solving functions, with the child taking initiative and the adult correcting and guiding when she falters. Finally, the adult cedes control to the child and functions primarily as a supportive or sympathetic audience.[54]

It is within the context of this gradual internalization of cognitive activities that Vygotsky (1978) introduced his concept of the Zone of Proximal Development (ZPD). The ZPD refers to the 'gap' between what the learner can do on his or her own and what he or she can do with the help of others. The process of support and guidance offered by the teacher to help the student to perform at a higher level is known as 'scaffolding' – the teacher offers support that is gradually removed as the student becomes competent at that level.[55] The scaffolding metaphor signals that even though the teacher provides the scaffold for the building, the building itself can only be constructed by the learner.[56] In this supportive role, the teacher has to discern the potential of the student to advance in learning, so that the activities presented, instead of being either too trivial or too demanding, fall within Vygotsky's ZPD area of appropriate and productive challenges.[57]

The use of scaffolding understandably requires the teacher to be aware of individual students' personal needs.[58] One function of assessment would then be to help identify this zone accurately and to explore progress within it. This implies

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[51] Swan, 2001.
[52] Woods, 1990, p. 30.
[53] Black, 1999.
[54] Brown & Ferrara, 1985, pp. 281–82.
[55] Gipps, 1994.
[56] Black, 1999.
[57] Black, 1999.
[58] Murphy, 1996.

moving assessment beyond the traditional static model of what is known towards a more interactive model that looks at learning potential in Vygotskyian terms.[59] This is not potential in a 'static' sense (i.e., it is determined and cannot be changed), but potential that is elastic and highly responsive to adult support and teaching. As such, assessment not only indicates what the student knows and can do, but also what he or she nearly can do.[60]

The Challenge Ahead

Current work in cognitive science for the assessment of student learning (as opposed to performance) suggests that we need to focus on the models that students construct for themselves and their understandings. 'The challenge, then, is to find out enough about student understanding to design performances that will reflect these different understandings and then to design assessment techniques that can accurately reflect these different understandings.'[61] This calls for skilfully directed assessments that reveal important aspects of learning and lay down the foundations for further growth and accomplishment.

At classroom level, the best assessment practices appear to be based on the reform vision that Gipps captured so well in her book *Beyond Testing* in 1994. This newly emerging assessment culture – which calls for an alternative way of comprehending assessment away from the traditional psychometric model – is now generally known, at least in the UK, as 'assessment for learning'. Contrary to 'assessment of learning' for the purposes of grading and reporting that has its own well-established procedures,[62] 'assessment for learning' is 'the process of seeking and interpreting evidence for use by learners and their teachers to decide where the learners are in their learning, where they need to go and how best to get there'.[63]

The underlying implication of assessment for learning is thus the need to move away from an assessment culture with a clear intent on measuring, grading and reporting that has little to do with the use of assessment for the promotion of learning.[64] For only then can assessment actually aim to help rather than sentence the individual.[65] This new focus on the human potential for self-realization and creativity has in turn significant potential for social reform,[66] as assessment is:

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[59] Gipps, 1994.

[60] Gipps, 1994.

[61] Wilson, 1992, p. 125; cited in Gipps, 1994.

[62] ARG, 1999.

[63] ARG, 2002.

[64] Cf. ARG, 1999.

[65] Cf. Gipps & Murphy, 1994.

[66] Broadfoot & Black, 2004.

... a powerful tool: it can shape curriculum, teaching and learning; it can affect how pupils come to see themselves both as learners and in a more general sense as competent or not; through labelling and sorting pupils (certification and selection) it affects how pupils are seen by others; it controls access to further education and high status careers.[67]

The understanding that 'good education, by definition, encompasses good assessment'[68] has paved the way for assessment to gradually gain centrality in educational discourse. The important message now confronting the educational community is that the single most powerful tool for both raising standards and empowering lifelong learners is assessment that is explicitly designed to promote learning.[69]

It would however be a mistake to think that assessment reforms on their own would automatically guarantee improvements in teaching and learning. For even though assessment issues have grown over the past few years from relative insignificance into one of the most prominent features of many governments' educational strategy,[70] assessment is essentially a context-bound activity. The understanding that teachers' decisions and practices are governed to a large extent by the way they experience and interpret the various contexts in which they operate[71] suggests that assessment reforms can only bear fruit once this wider embedding context has also been addressed and aligned. This implies that albeit improvement in assessment may be necessary, it is by no means a sufficient condition.[72]

Bibliography

Assessment Reform Group, *Assessment for learning: beyond the black box* [Pamphlet], Cambridge, 1999.

Assessment Reform Group (ARG) (2002). *Assessment for learning: 10 principles* [Leaflet/poster].

BLACK, P., *Testing: friend or foe? The theory and practice of assessment and testing*, London, 1998.

BLACK, P. , Assessment, learning theories and testing systems', in P. Murphy (ed.), *Learners, learning and assessment*, London, 1999, (pp. 118–34).

BLACK, P., & WILIAM, D., 'Assessment and classroom learning', *Assessment in Education: Principles, Policy and Practice*, 5(1), 1998, pp. 7–74.

BRIGHT, G. W., & JOYNER, J.M., 'Understanding and improving classroom assessment: summary of issues raised', in G.W. Bright & J.M. Joyner (eds), *Classroom assessment in mathematics: views from a National Science Foundation working conference*, Lanham, 1998, pp. 27–57.

BROADFOOT, P.M., *Education, assessment and society: a sociological analysis*, Buckingham, 1996.

BROWN, M., 'Graded assessment projects: similarities and differences, in P. Murphy & B. Moon (eds), *Developments in learning and assessment*, London, 1989, pp. 300–11.

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[67] Gipps, 1994, p. 144.

[68] Murphy & Torrance, 1988, p. 7.

[69] ARG, 1999.

[70] Broadfoot, 1996.

[71] Cf. Buhagiar, 2004.

[72] Torrance, 1995.

BROWN, A.L., & FERRARA, R., 'Diagnosing zones of proximal development', in J.V. Wertsch (ed.), *Culture, communication, and cognition: Vygotskian perspectives,* Cambridge, 1985, pp. 273–305.

BROWN, J.S., COLLINS, A., & DUGUID, P., 'Situated cognition and the culture of learning', *Educational Researcher, 18*(1), 1989, pp. 32–42.

BUHAGIAR, M.A., 'How appropriate is this task for my class?' Exploring teachers' classroom decision-making processes as they waver between 'practical' and 'ideal' positions, *Mediterranean Journal of Educational Studies, 9*(2), 2004, pp. 83–108.

CIZEK, G.J., 'Learning, achievement, and assessment: constructs at a crossroads', in G.D. Phye (ed.), *Handbook of classroom assessment: learning, adjustment, and achievement*, San Diego, CA, 1997, pp. 1–32.

CROOKS, T.J., 'The impact of classroom evaluation practices on students', *Review of Educational Research, 58*(4), 1988, pp. 438–81.

CUMMING, J.J. & MAXWELL, G.S., 'Contextualising authentic assessment', *Assessment in Education: Principles, Policy and Practice, 6*(2), 1999, 177–94.

DENVIR, B., 'Assessment purposes and learning in mathematics education', in P. Murphy & B. Moon (eds), *Developments in learning and assessment*, London, 1989, pp. 277–89.

GIPPS, C.V., *Beyond testing: towards a theory of educational assessment*, London, 1994.

GIPPS, C., 'Introduction', in P.F. Murphy & C.V. Gipps (eds), *Equity in the classroom: towards effective pedagogy for girls and boys*, London, 1996, pp. 1–6.

GIPPS, C. & MURPHY, P., *A fair test? Assessment, achievement and equity*, Buckingham, 1994.

GLASER, R., 'Toward new models for assessment', *International Journal of Educational Research, 14*(5), 1990, pp. 475–83.

HARLEN, W. & JAMES, M., 'Assessment and learning: differences and relationships between formative and summative assessment', *Assessment in Education: Principles, Policy and Practice, 4*(3), 1997, pp. 365–79.

JAWORSKI, B., 'Social constructivism in mathematics learning and teaching', in L. Haggarty (ed.), *Teaching mathematics in secondary schools: a reader*, London, 2000, pp. 67–82.

LaCELLE-PETERSON, M., 'How assessment policies and practices obscure the education of language minority students', in A. Filer (ed.), *Assessment: social practice and social product*, London, 2000, pp. 27–42.

MARTON, F. & SÄLJÖ, R., 'On qualitative differences in learning: 1. Outcome and process', *British Journal of Educational Psychology, 46*, 1976, pp. 4–11.

MURPHY, P., Defining pedagogy. In P.F. Murphy & C.V. Gipps (eds), *Equity in the classroom: towards effective pedagogy for girls and boys*, London, 1996, pp. 9–22.

MURPHY, R. & TORRANCE, H., *The changing face of educational assessment*, Milton Keynes 1988.

SADLER, D.R., 'Formative assessment and the design of instructional systems', *Instructional Science, 18*, 1989, pp. 119–44.

SEEGERS, G. & GRAVEMEIJER, K., 'Implementation and effect of realistic curricula', in M. Beishuizen, K. P. E. Gravemeijer & E. C. D. M. van Lieshout (eds), *The role of contexts and models in the development of mathematical strategies and procedures*, Utrecht, 1997, pp. 255–72.

SHEPARD, L.A., 'Psychometricians' beliefs about learning', *Educational Researcher, 20*(6), 1991, pp. 2–16.

STEADMAN, M. & SVINICKI, M., 'CATs: a student's gateway to better learning', in T. Angelo (ed.), *Classroom Assessment and Research: an update on uses, approaches, and research findings*, San Francisco, CA, 1998, pp. 13–20.

SWAN, M., 'Dealing with misconceptions in mathematics', in P. Gates (ed.), *Issues in mathematics teaching*, London, 2001, pp. 147–65.

TORRANCE, H. 'The role of assessment in educational reform', in H. Torrance (ed.), *Evaluating authentic assessment: problems and possibilities in new approaches to assessment*, Buckingham, 1995, pp. 144–56.

VON GLASERSFELD, E., 'Learning as a constructive activity', in P. Murphy & B. Moon (eds), *Developments in learning and assessment*, London, 1989, pp. 5–18.

VON GLASERSFELD, E., 'A constructivist approach to teaching', in L.P. Steffe & J. Gale (eds), *Constructivism in education*, Hillsdale, NJ 1995, pp. 3–15.

VYGOTSKY, L.S., *Mind in society: the development of higher psychological processes*, Cambridge, MA, 1978, pp. 3–15.

WOODS, P., *Teacher skills and strategies*, London, 1990.