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Richard Hicks*

Gregory Southey†

*Queensland University of Technology, Richard.Hicks@bond.edu.au

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**MEASUREMENT APPROACHES IN
ASSESSING CRITICAL THINKING
FOR PROFESSIONAL PRACTICE
AND MANAGEMENT**

Richard Hicks
*School of Social Science
Queensland University of Technology*

Gregory Southey
*School of Management,
Human Resources and Industrial Relations
Queensland University of Technology*

There has been a growing emphasis placed on competencies and their assessment in the management and professional arenas. The effectiveness of award restructuring, training programs, performance management and career path development can be related at some level to required competencies. However, accurate measurement and appraisal of competencies is not necessarily straightforward. This paper takes one competency, critical thinking, which is generic to most levels of professional practice and management and discusses the problems faced in assessing critical thinking performance for selection purposes. Early research by the authors on the use of the Watson Glaser Critical Thinking Appraisal to assess critical thinking in the Australian setting is cited (Hicks & Southey, 1990a; 1990b; 1992; Hicks, Southey & Tegg, 1992), and brief reference made to other approaches or devices used to assess critical thinking.

Since the now classic outline of a hierarchy of learning skills or of managerial and professional competency categories given by Burgoyne and Stuart (1978) (see Table 1), increasing attention has been given to the taxonomy of these managerial and professional competencies (eg. Baker, 1991; Boyatzis, 1982; Dulewiz, 1989, 1992; Faris, 1992; Howard & Bray, 1989; Mintzberg, 1973, 1989).

This article is based mainly on a paper: "Competencies in management: assessing critical thinking" presented by the authors at the December, 1992 Annual Conference of the Australian and New Zealand Academy of Management, held at the University of Western Sydney, Nepean.

In Australia, legal, political and economic changes have seen special attention given to the area of competencies in the work place. In recent years both award restructuring and the Training Guarantee Act have worked together to focus interest on competencies and related required training. Government interest in the field of competencies has been obvious from the early 1990s (e.g., Beazley, 1992; Gonczi, Hager & Oliver, 1990; Johnston, 1992; Masters & McCurry, 1990; Mayer Committee, 1992). Various professional bodies and tertiary institutions have given extensive attention to competencies; in areas including engineering, architecture business and management, and the social and human service professions such as social work, nursing and psychology (e.g., Ashworth & Saxton, 1990; Board of Organisational Psychology, 1994; Delahaye, 1990; Gonczi et al, 1990; Gow, 1993; Hearn, Charalambous & Smith, 1991; Johnson, 1992; McConkey, 1992; Nurse Registering Authorities, Australia, 1989, 1990; Siddle, 1992; Wilson, 1992). The various approaches impinge on how required competencies are to be perceived. However, one guide to levels and dimensions of the competencies is given by Burgoyne and Stuart (1978) as in Table 1.

Among the various competencies examined and listed in these reports and discussions, the competency of critical or analytical thinking has most often been included. The emphasis given to critical thinking and its correlates including problem solving may be expected given growth in public awareness of the increasing complexity of our society and the need to solve more complex problems. The introduction, for example, of new technology into our society, and the increasing personal freedom and choices we may be given, require competence in discriminating "workable from non-workable solutions" (Gadzella, 1989). Such competencies would seem to be part of what Schon (1983, 1987) means when he talks about "the reflective practitioner". Given the emphasis on the importance of competencies, then it follows that the accurate measurement or assessment of these competencies is also important, whether for recruitment and selection or for career and performance management.

Gratton (1989, pp. 157-8) suggests there are three approaches to identifying competency dimensions, with reference to managerial effectiveness in particular. These three approaches involve a "checklist approach" (typified by Development Dimensions Incorporated which lists 25 competencies significant in management), a conceptual framework approach (e.g., as

explained by Boyatzis, 1982), and an "observation" approach (e.g., as given in Mintzberg, 1973; Kotter, 1982).

Table 1
A Hierarchy of Learning Skills/Managerial Competencies

First Level

1. command of basic facts
2. relevant professional knowledge

Second Level

3. continuing sensitivity to events
4. analytical, problem solving, decision-making/judgement-making skills
5. social skills and abilities
6. emotional resilience
7. proactivity

Third Level

8. creativity
 9. mental agility
 10. balanced learning habits
 11. self-knowledge.
-

The first purpose of this paper is to outline the various frameworks, theories of, or approaches to, critical thinking and the second purpose is to review briefly one overseas measure of critical thinking (the Watson-Glaser Critical Thinking Appraisal - a test in common use).

APPROACHES TO CRITICAL THINKING

There is a rich variety of perspectives due to the number of disciplines that have contributed to critical thinking:

psychologists emphasise cognitive structure and activities;

- philosophers emphasise the questioning of assumptions, rational analysis, and empirical foundations for thought; and
- educators focus on the objectives of formal education and on techniques for developing critical thinking.

These perspectives are illustrated by writers such as Bloom (1956); Gadzella (1989); Gallo (1989); Sternberg (1986); and Young (1980).

Frameworks for Critical Thinking:

One major approach or framework is that posited by Galotti (1989). Galotti, from a meta-analysis, devised three major *psychological* programmatic approaches to the study of reasoning (a term she uses interchangeably with critical thinking):-

1. **a components or componential approach** which is concerned with analysing reasoning tasks into their component processes. The approach is most closely associated with Robert Sternberg (1986) who described the necessary steps or performance components as encoding of terms, inferring the relationship between terms, mapping the relationship, and applying the relationship to generate the best possible completion. Apart from these performance components, metacomponents (higher order processes used in selecting and monitoring a task) and knowledge acquisition components (selective processes of encoding, combining and comparison), each having the parameters of duration, difficulty and probability of execution are involved;
2. **a rules/heuristic approach** which describes reasoning as - following (implicitly or explicitly) a rule, heuristic or scheme to make inferences; and
3. **a mental models/search approach** which involves constructing one or more representations consistent with given information to reach and test conclusions.

Correlates of Critical Thinking: Abilities, Personality and Values:

Glaser (1941) found a positive correlational relationship between critical thinking and general intelligence tests (Young, 1980). More recently, Kyllonen and Christal (1990) consider reasoning ability to be at the core of what is ordinarily meant by intelligence. Other studies have found a relationship between critical thinking and reading ability (McPeck, 1981) and those with high critical thinking ability have been found to outperform those with low critical thinking ability in reflective judgement skills (Brabeck, 1983).

Galotti (1989) and others argue that the real skill in critical thinking in an informal environment is guarding against the influence of other processes which may threaten to impinge on sound reasoning. In some cases it is entirely appropriate to be influenced by values of the situation (e.g., moral reasoning situations) (Barry & Rudinow, 1990; Weber, 1990). Barry and Rudinow (1990) list certain *personality* factors as blocks to critical thinking, such as egocentricity and resistance to change, wishful thinking and self deception, and reliance on authority.

Wright (1985) sees critical thinking in terms of "the ability to ask the right questions". He also sees as mentally and emotionally exhausting "undisciplined analytical thinking behaviours" - such as fault finding, rationalising, resisting change and procrastinating. Adler (1987) also sees critical thinking in relation to supportive or resistant attitudes (see Table 2).

Definitions of Critical Thinking:

Given that both general mental ability *and* personality factors are related to effective critical thinking, how can we define critical thinking?

Ennis (1987) describes critical thinking as "reasonable reflective thinking that is focused on deciding what to believe or do ... (it) is not the equivalent to higher order thinking skills but is a practical activity that includes most or all of the directly practical higher order thinking skills and includes dispositions which may be taught as a separate subject or infused in other subject

matter courses". He also sees critical thinking as involving clarity and focus, basic judgement, ability to draw inferences and interactive ability, that is, ability to apply knowledge.

Table 2
Adler's 1987 Supportive and Resistant Attitudes in Critical Thinking

Supportive Attitudes or Actions	Complementary Attitudes or Actions
1. Open to opposing viewpoints	Dogmatic, committed
2. Accepts fallibility	Confident
3. Universalizes, impartial abstracts	Personalizes and particularizes contextual sensitivity
4. Humble	Bold
5. Critical	Supportive
6. Literal	Charitable, imaginative, metaphorical
7. Detached (objective)	Engaged
8. Serious	Playful
9. Honest	Persuasive
10. Autonomous	Deferential (to authority)
11. Sceptical	Cooperative and accepting
12. Insistent on clarity and precision	Tolerant of ambiguity and vagueness
13. Practically consistent, i.e. actions conform to principles	Practically inconsistent, hypocritical
14. Seeks criticism; alters behaviour accordingly	Integrity and tenacity in preserving projects and self-conception

Adler, J.E. *On Resistance to Critical Thinking* (1987) in Perkins, D.N., Lockhead, J., Bishop, J. C. (Eds.). *Thinking - 2nd International Conference*. NJ: Lawrence Erlbaum Assoc. Publishers.

Galotti's (1989) definition of critical thinking is: "Mental activity that consists of transforming given information (called a set of premises) in order to reach conclusions". Mental activities that consist of momentary, intuitive responding (any one-step mental process such as flashes of insight, gut reactions, daydreaming, and other forms of free association) are excluded by such a definition. That is, critical thinking must be an identifiable process that involves creative and evaluative functions.

The greater body of thought accepts critical thinking as a distinctive (albeit large) group of process skills, abilities and dispositions. The Watson Glaser Critical Thinking Appraisal (CTA) for example, uses this relatively comprehensive approach to the measurement of critical thinking. Watson and Glaser (1980) see critical thinking as a "composite of attitudes, knowledge and skills" in relation to inquiry, the nature of evidence and application to the situation. The Watson-Glaser approach to critical thinking gives attention to just five major logical areas based in part on Dressel and Mayhew's (1954) definition (see Table 3), and incorporates selected items of an emotive nature which might distract the thought processes of those "who think less critically".

Table 3
Dressel & Mayhew (1954): Critical Thinking

-
- the ability to define a problem
 - the ability to select relevant information
 - the ability to recognise assumptions
 - the ability to formulate hypotheses
 - the ability to draw valid conclusions and judge the validity of inferences
-

* In Watson, G & Glaser, E. (1980) *Manual for the Watson-Glaser Critical Thinking Appraisal*. Psychology Corporation.

THE ACCURATE MEASUREMENT OF CRITICAL THINKING

Accurate measurement of critical thinking must depend upon:

- reasonably comprehensive coverage of the areas of significance in critical thinking (content and level);
- the presence of the conditions which enable observation/assessment of critical thinking to occur (measuring the processes versus outcomes); and

- inclusion of "emotive" items which ensure that the real life distractions to effective critical thinking are present.

This is no easy task and there have been a number of recommendations about how to approach the complex challenge. Some suggestions run well beyond the use of simple "analytical or critical thinking tests" and recommend the full scale Assessment Centre (or Development Centre) approach as giving the best overall measure of a person's individual and social skills, including thinking. Assessment Centres involve a variety of individual tests or tasks and group assignments, usually conducted over one-two days (Hicks, 1992; Murdoch, 1992).

However, senior management personnel are usually concerned to assess competencies or potentialities over a shorter time span than the period involved for comprehensive assessment. Preferences would be given to combinations of well constructed tests or "assessment devices", questionnaires and behaviourally based interview programs. Hence the attention given to single rather than multiple tests and questionnaires.

Given that "critical thinking ability" needs therefore to be assessed in a shorter time span, what should be the primary guides in choosing or preparing a measurement technique?

FOUR ASPECTS TO CONSIDER IN EVALUATING A CRITICAL THINKING MEASURE.

There seem to be at least four major aspects which should be taken into account in evaluating whether a designated approach to the assessment of critical thinking (in particular) achieves its goal, that it is a valid approach. These aspects are:

1. Relationship to general mental ability:

The measure(s) chosen should have demonstrated high correlations with general mental

ability, reasoning capacities, comprehension and judgment (e.g., Brabeck, 1983; Ennis, 1987; Galotti, 1989).

2. Relationship to creativity:

Preferably, the measure(s) chosen should incorporate both convergent thinking processes (as in the previous point) and also divergent thinking processes. Galotti (1989) and Gallo (1989), for example, suggest that both formal (logical) and informal (open, creative) thinking ought to be tested as part of critical thinking. Siegal and Carey (1989) cite "everyday reasoning" as being "pragmatic, reflective and generative in the context of purposeful action"; this emphasis ought to be considered in item development and assessment. This would mean less formal reasoning (one convergent answer) and more openness to different answers requiring perhaps, more attention to the processes used to arrive at an answer (Faccione, 1989).

3. Relationship to personality factors and values:

The measure(s) should allow for "critical thinking in context" to occur. That is, values, personality and social factors which might override logical, critical reasoning in practice need somehow to be taken into account (e.g., Adler, 1987; Barry & Rudinow, 1990; Gallo, 1989; Watson & Glaser, 1980; Weber, 1990; Wright, 1985).

4. Relationship to field of work:

Finally consideration should be given as to whether items should be "domain specific"; for example, if preparing to assess business applicants whether the items should be business oriented, or if applicants are for science positions, whether the items should be scientifically oriented, and so on (e.g., Ennis, 1987). However, most writers take a broader view of the kinds of item needed, that is, that they may be "domain-general".

How Does The Watson-Glaser Critical Thinking Appraisal Compare Against These Four Aspects?

The Watson-Glaser Manual describes the CTA as follows (1980, p. 2):

"The exercises include problems, statements, arguments, and interpretations of data similar to those that are encountered on a daily basis at work, in the classroom, and in newspaper and magazine articles.

The *Critical Thinking Appraisal* calls for responses to two different kinds of item content. Items having "neutral" content deal with the weather, scientific facts or experiments, and other subject matter about which people generally do not have strong feelings or prejudices. Items having "controversial" content, although approximately parallel in logical structure to neutral items, refer to political, economic, and social issues that frequently provoke very strong feelings. As has often been shown, strong attitudes, opinions, and biases affect the ability of some people to think critically".

Against available research evidence and the authors' observations, the Watson-Glaser CTA may be considered to rate as follows against the four criteria we have suggested:

- well, with respect to comparison with general mental ability (De Lemos, 1990; Watson & Glaser, 1980);
- not so well or in a limited manner, with respect to divergent or creative thinking. Another measure would be needed if divergent thinking capacity were to be assessed taking this evaluation principle fully into account. However, there is inclusion of everyday occurrences in many of the items.
- sound, with respect to personality factors. A determined effort was made in the development of the CTA as indicated above to include items susceptible to emotional response. However, some authors argue that critical thinking ability seen primarily as

logical thinking and critical thinking seen as *involving personality factors* affecting one's thinking, ought to be assessed by separate specific measures (that is, by intellectual tests and by personality questionnaires cf. Gallo, 1989); and

- in the "domain-general" approach to item inclusion, with respect to the domain-specific versus domain-general continuum; though there appear to be a few more business and management items than general science or technical items.

Table 4 defines the five subscales in the CTA. A high level of competency in critical thinking, as measured by the CTA, may be operationally defined as the ability to perform correctly the universe of tasks represented by its five subscales. These are described by Watson and Glaser (1980, p. 2) in Table 4.

Some of the items in the CTA have clear US content and have worried some candidates in Australia; and these items performed marginally less well than others in an item analysis which was based on an Australian tertiary student sample (Hicks & Southey, 1990a; 1990b; 1992). Ensuring item content is understood by candidates and that the items do not distract from the valid measurement of the competency or ability under review is a requirement for the fair development, use and interpretation of tests results. This may be one reason to consider whether to develop an Australianised version of the Watson-Glaser or to remove or replace the weaker items. Other reasons for an Australianised version to be considered could include the need to ensure gender neutrality and to ensure appropriate ethnic or cross-cultural emphases (Southey, Hicks & Tegg, 1992; Tegg, 1992). While the Psychology Corporation (Australia) has considered these matters, market reasons and costs preclude a completely new version being developed.

In 1994, however, the US Psychology Corporation issued a shorter version of the Watson Glaser Critical Thinking Appraisal - a Form S. Form S includes 40 items from the longer 80 item Form A version. A number of the items which earlier concerned the authors no longer appear in this short version. The authors predict that Form S will be preferred by many test users on grounds of savings in time alone. On the evidence given in the Manual (Watson-

Glaser Form S: Manual, 1994), Form S should help meet the continuing demand for tests which can assess reasonably accurately and quickly generalised "critical thinking competency".

Table 4
Five Subscales of the Watson Glaser Critical Thinking Appraisal

Test 1:	Inference. Discriminating among degrees of truth or falsity of inferences drawn from given data.
Test 2:	Recognition of Assumptions. Recognizing unstated assumptions or presuppositions in given statements or assertions.
Test 3:	Deduction. Determining whether certain conclusions necessarily follow from information in given statements or premises.
Test 4:	Interpretation. Weighing evidence and deciding if generalizations or conclusions based on the given data are warranted.
Test 5:	Evaluation of Arguments. Distinguishing between arguments that are strong and relevant and those that are weak or irrelevant to a particular question at issue.

FINAL COMMENTS

Measuring competencies accurately is not an easy process, but attempts must be made to do so. We have taken just one competency we consider significant: critical thinking. We have outlined the different views which exist about what critical thinking is, and by implication therefore, how it should be assessed. Since critical thinking itself appears to be complex, complex and multiple assessment procedures might be expected and needed if all aspects of critical thinking are to be covered. The sub-areas of the Watson-Glaser touch on five important aspects of thinking: drawing inferences, recognising assumptions, making deductions, interpreting data accurately and evaluating arguments.

However, other aspects of critical thinking, such as divergent thinking, attitudinal and personality factors impinging widely on decisional and social competencies, and the ability to

conceptualise and act within a particular professional domain, may still need to be assessed in other ways. The use of targeted "domain area problems" (questions) and attention to questioning which elicits flexibility (creativity) and also sheds light on the social skills desired will need to be addressed through the "best practice" available for human resources measurement today (as in specialised forms of interviewing or through aspects of assessment centre approaches).

We believe the same attention is needed in the development of appropriate assessment strategies and techniques for all of the management and professional competencies. In general, the competencies movement gives attention to specific measurable outputs. However, some of the higher level competencies are not as readily measurable in such simple output terms. These higher level competencies may require special attention to the component skills that make up the competency. We believe critical thinking is one of these complex competencies.

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