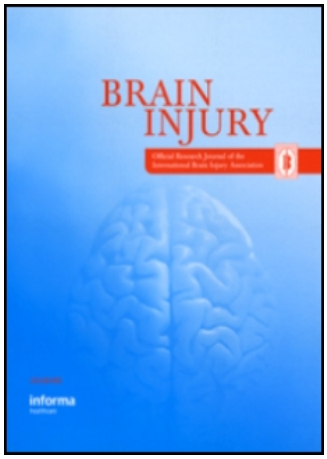

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Evaluation of cognitive rehabilitation as a treatment paradigm

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Evaluation of cognitive rehabilitation as a treatment paradigm

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Abstract
Purpose: The construct of 'cognitive rehabilitation' has not been defined in a consensual manner and the variations in usage have produced misunderstanding and controversy. At one extreme, it refers to a paradigm of complex, sophisticated, integrated interventions and at the other to a poorly conceptualized and largely ineffectual service modality. A number of articles criticizing cognitive rehabilitation make little effort to differentiate between these usages, thus subjecting very different clinical procedures to the same complaints.
Methods: This article abstracts five major criticisms from this literature to examine the best-developed, 'holistic' versions.
Conclusion: A treatment selection standard is proposed, specifying the conditions under which a holistic model or the 'contextualized' training alternative is likely to be more viable.

Keywords: *Cognitive rehabilitation, traumatic brain injury, neurorehabilitation, generalization, holistic rehabilitation*

Introduction

Cognitive rehabilitation (CR) for traumatic brain injury (TBI) was introduced in Israel 33 years ago in an effort to restore disabilities that responded to no other clinical procedure [1]. Mental health psychotherapy, special education, physical rehabilitation and other established treatments failed to address the enduring cognitive and behavioural sequelae responsible for the disablement [2, 3]. CR is rooted in procedures to minimize cognitive impairments and improve functional behaviours in CVA, designed by Diller, Ben-Yishay and their associates at New York University [2, 4, 5]. After adapting these techniques to TBI, they joined forces with a group of Israeli neuropsychologists including Yigal Gross to create the National Head Injury Programme of Israel, the most complex, ambitious neurorehabilitation programme ever attempted [6, 7].

Surprise and excitement greeted their demonstration that the cognitive impairment from TBI could be ameliorated. NYU invited Ben-Yishay to open their TBI programme in 1978. Robert Wood Johnson Rehabilitation Institute turned over their fledgling programme to Gross in 1980 and these facilities became recognized as state-of-the-art centres [1, 3, 8]. Eminent neurorehabilitation specialists, including Anna-Lise Christiansen [9], George Prigatano [10], Barbara Wilson [11], James Malec [12], Keith Cicerone [13] and Wayne Gordon [14], learned about the 'holistic' model from these pioneers and built and documented their own, similarly designed programmes. In turn, the commercial success of these programmes sparked a 'land rush' movement into CR by the hospital industry.

'Despite the wide acceptance of CR among TBI professionals (of that era), it has aroused a great deal of skepticism and controversy', ([15], p. 9, see also [16]) mainly from scholars of the next generation who do not practice it. They argue that CR's efficacy is unproven [17–19] and even that the basic paradigm is misguided [17, 20]. Such criticisms

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have raised doubts about the justification for this expensive therapy in the minds of cost-conscious payors [16, 21], which has damaged the development of the field [12] and limited access to services [3, 19].

The criticisms must be taken seriously, as all therapy models are expected to submit to scrutiny by the professional community; however, external critics may encounter difficulty in characterizing such an unfamiliar model accurately. Public criticism of the efficacy of an established therapy model should be based on a careful definition of that model. This article, written by two practitioners of both the holistic and non-holistic approaches, first defines and describes the paradigm and then discusses five major concerns which have been raised about it.

Initially, the term CR referred to the meticulously crafted holistic programmes, but the label was soon applied to any treatment of a cognitive faculty. Physical rehabilitation therapists administered drills obtained from workbooks or computer programs and advertised and billed this service as CR. Some of these procedures were already known to be ineffectual, notably the exercise of focal attention and declarative memory, as if the mind could be retrained like a 'mental muscle' [2, 12, 22]. One article written in criticism of CR began by distinguishing the pioneering holistic programmes from these later 'indefensible practices implemented by inadequately trained practitioners (through which) the service has been trivialized' ([20], p. 192), yet the body of the critique went on to tar both the original and the derivative approaches with the same brush.

The present authors hold that the substantive question of efficacy should be focused on the best exemplars of a method rather than its degenerate variants. Toward this end, CR is defined here as a systematic, theory-based programme of integrated didactic, experiential, procedural and psychosocial training activities, conducted to restore cognitively compromised adaptation, including decrements in interpersonal and vocational participation, self-awareness and self-determination [23]. A focus on the psychosocial/emotional aspects of recovery is central, as defective insight and the consequent dearth of adjustive motivation are major rehabilitative obstacles in TBI [2, 24–26]. This expanded breadth of scope is more than just a practical expedient; it also represents a new theoretical understanding that the brain's network organization invariably activates wanting, feeling and thinking together [27, 28]. Following this construal, this study employs the term cognition to refer not just to computational and ideational faculties but to all of the mediational processes interposed between stimulus and response [29].

Forms of cognitive rehabilitation

The first cognitive rehabilitation programmes were called holistic [1] to highlight their combination of systematic treatment of cognitive/behavioural deficiencies, psychotherapy and milieu therapy [6]. The milieu therapy component, initially modelled on therapeutic communities for drug and alcohol addiction [30], is a unique feature not found in programmes for physical rehabilitation. The rationale for its use is that trainees need to be optimally engaged, motivated and taught self-discipline and this is best accomplished through (1) a programme philosophy that places the responsibility for recovery on the patient, (2) strong group cohesion and identification and (3) the use of confrontative (as well as supportive) peer feedback as a primary vehicle for establishing insight [7, 39]. In some ways, this model is even more effective than its original application in substance abuse, in that the trainees are brought face-to-face with their deficits many times every day and required to make commitments to anticipate and recognize the deficits and use the recommended processing strategies. Those who refuse face immediate consequences, embarrassing themselves by rejecting the input of up to a dozen peers and then being proven to be wrong time after time. Saving face is not only the path of least resistance, but also an accomplishment modelled by the successes of cooperative peers and richly rewarded by community recognition. Some Model One programmes also bring back successful graduates to explain how the strategies are helping them on the job and in relationships. Moreover, it is the trainees who teach the newcomers, lead the therapy groups and star in ceremonial presentations, proving that survivors can and should become therapy experts.

These Model One programmes are lengthy, complex and cumbersome to organize, requiring development of new role skills and attitudes by all members of the treatment team. Treatment is usually conducted for 5–8 hours on 4–5 days per week across a fixed duration of weeks, with the total contact hours varying from 400–1200. Although a small number of full-featured holistic programmes have been developed in the US [7, 8, 10, 23, 31–35], this model never approached defining the standard of care.

Model Two combines intensive cognitive treatment with psychotherapy or counselling, but staged in a conventional clinic environment [9, 11, 14, 36, 37]. As Model Two programmes are sometimes called

'holistic' as well [38], the descriptor 'modified holistic model' is appropriate. The two models differ mainly in their approach to inducing insight and otherwise motivating participation. In Model Two programmes, these intervention methods are more varied and may include the staging of cognitive therapies in groups with peer feedback, videotaping of exercises and key performances and/or discussion of deficits in psychotherapy and family therapy.

Model One and Model Two programmes display many theoretical and technical similarities. Both approach vocational, social, behavioural and practical disabilities as expressions of underlying cognitive impairments. Most assume that the cognitive deficits require intensive intervention. Hence the treatment plans tend to be relatively complex, staging therapies for the defective cognitive processes in several content areas [36, 39], including simulations and/or *in vivo* training of job, social, daily living and community skills required for post-discharge adaptation [19]. Many of these programmes also attempt to create a transdisciplinary 'united front' in which multiple therapists jointly address key deficits as soon as they become fully amenable to training (the 'zone of proximal development' [40, 41]) by the use of a shared behavioural intervention protocol [42]. Therapy rationales are almost always derived from theories of normal neurocognitive function, neuropathology and neurorehabiliation [3, 7, 11, 23, 25] rather than empirical rules of thumb or the logic of alien practices such as physical rehabilitation or special education. Although treatment plans are typically individualized, certain strategems have proven so broadly effective that they have become staples in CR programmes: notebooks and other information-recording devices to compensate for impaired declarative (content) memory, daytimers, alarms or pagers to support impaired prospective memory and time management and problem-solving algorithms or routines [9, 12, 32]. Some programmes elevate executive or problem-solving processes, with their special application for re-instituting self-management, to the centre of focus [14, 25, 43].

Generalization training is systematically staged across several phases of the programme. First, strategies are introduced didactically, anchored in clearly defined central concepts. Then they are applied to a varied set of training tasks, which are progressed to higher levels of difficulty and complexity as they are mastered [26, 39]. They are next 'bridged' to other therapy sessions and activities and assigned for use in the real world as homework, often with the collaborative assistance of family members [7, 14, 24]. Finally, home structure is recommended to support continued, expanded strategy use after discharge [43].

Because Model Two programmes employ more conventional therapist roles and functions, they are less cumbersome to start and manage. The programmes provide fewer psychosocial induction and solidarity rituals and admit and discharge patients individually rather than in groups, so the duration of treatment can be more flexible. For both reasons, they are more numerous and have proven more durable.

Model Three refers to cognitive treatment offered as a modality within traditional multidisciplinary rehabilitation [20, 36, 44]. In some facilities, cognitive training is designated as a discrete therapy which can be ordered by the physician. In others, the responsibility is assigned to a discipline, most often speech-language pathology or occupational therapy, and cognition is addressed in a treatment plan at the discretion of that therapist. This model does not stipulate the integration of cognitive treatment with any other intervention. Consequently, the therapy tends to consist largely or entirely of decontextualized exercises, which may be drawn from school textbooks, workbooks or computer programs. The use of applicable theories to select and plan the treatment is left up to the therapist. Because this model can be readily offered at any rehabilitation hospital or clinic (or even as a stand-alone treatment), with no requirement to change staffing or programme structure and a modest or negligible training requirement, it is the most common as well as the least specialized variant of cognitive rehabilitation.

Does cognitive rehabilitation work at all?

Many Model One and Model Two programmes are managed by scientist-practitioners, who have accumulated large sets of outcome data. Substantive reviews of this research note statistically significant gains in approximately three-quarters of the studies, as measured by neuropsychological tests, behaviour ratings, symptom checklists and behaviour ratings by family members and observations and reports of ongoing, successful use of the compensation strategies in functional tasks [3, 12, 15, 38, 45, 46]. Thus, many programmes have demonstrated success in producing overall improvements of substantial magnitude in their population of graduates.

Global improvement rates for individuals are rarely published. A re-analysis of data from a prior outcome study [47] finds 35 of 41 cases (85%) improved in their net performance on measures from the Halstead-Reitan Impairment Index. The original Israeli study [6] evaluated cognition only

descriptively, but improvement is reported in 13 of the 14 cases (93%). Hence, at this level of analysis, cognitive improvement appears to be the rule.

Research findings concerning the effectiveness of CR for the non-holistic treatment of isolated cognitive symptoms or compensation strategies are less consistent and compelling [38, 45, 46]. Therapies usually improve proficiency and/or speed on the training tasks, but there is little evidence that these changes reflect improved basic skills [32], a finding which cautions against assuming the practical value of Model Three approaches.

Most investigators also report that while skill training improves performance, it does not eliminate the impairments. Measures that are usually impaired in long-term follow-up of untreated cases (such as declarative memory, response selection speed and executive function) typically remain in the abnormal range after rehabilitation [10, 25, 48, 49]. Portraying the removal of impairment as the purported goal of treatment, critics interpret these findings as evidence that CR does not work [17, 20, 21]. One article extends this line even further, pointing out that the therapy does not repair the structural damage to the brain and consequently can never be successful [17]. These are straw-man arguments: Model One/Two programmes intend neither to eliminate cognitive deficits nor to repair damaged neurons [25], but rather to reduce disability and improve participation and adaptive fitness [2, 3, 29]. They seek to achieve these goals mainly by compensating for residual deficits, not by restoring skills [11, 23, 24, 32, 49].

Another line of reasoning challenges not the outcomes but the research designs that produced them. Here, it is argued that outcome studies in CR should meet the standards of present-day, 'evidence-based' pharmaceutical research, by conducting randomized, controlled trials, preferably with double-blinding of participants [18, 50]. Rigorous research designs are useful because they eliminate threats to causal inference, leaving the treatment as the most probable cause of the improvement [51]. Although such 'class one' studies are routinely used in academic research to examine short-term gains in a specific skill, this methodology is impractical on both ethical and financial grounds for clinical studies of the efficacy of established, intensive, multi-modal, individualized treatment protocols addressing long-term, global adaptation [19, 52]. Outcome researchers recommend that findings from less rigorous models should be considered and caution that the lack of class one studies should not be taken to impugn the validity of a therapy [16, 51, 53, 54]. However, most criticisms of CR ignore findings from class two and three designs (including case studies and multiple-baseline within-subject studies) and present a finding of 'inadequate evidence of therapeutic efficacy' as an aggressive indictment [19–21, 50].

Additional criticisms of the published outcome research have been advanced. Perhaps the most pertinent concern is that the outcomes are sometimes measured so soon after onset that spontaneous recovery cannot be ruled out as an alternative explanation for the gains [16]. It has also been argued that some studies employ testing tasks as the training exercises, such that the improved test scores at discharge represent nothing more than rote practice effects [17, 20]. Countering these criticisms, some of the most important early studies employed only [7] or almost exclusively [6, 10, 47] subjects whose baseline assessment was made 1 or more years post-onset and reported gains on measures that did not mirror the training activities.

In overview, although the quality of the outcome research is variable, the consistency of the positive findings is regarded by most reviewers as compelling: 'While it is possible to marshal all manner of methodological criticisms about the neuropsychological treatment literature, what actually is most striking is how far it has developed in the past few years . . . Clearly it is now possible to respond to the question of whether (CR) works by citing numerous well-designed studies to the effect that it does' ([55], p. 112, see also [16, 33, 48, 56]). Sheldon Berrol States, 'Incorporation of therapeutic community environment (as the setting for CR) results in substantial improvement in functioning . . . An individual going through such a programme becomes more functional within the community and in society in general. We now know that recovery can occur in the brain-damaged individual' [10, p xvi]. Boake and Diller [15] find sufficient evidence of efficacy to justify the highest category of validation, recommending CR as a standard of practice.

Can treatment factors be defined adequately?

The outcome studies are criticized for failing to use an effective dismantling design to reveal underlying curative factors [16, 17, 20, 52]. The outside reviewer desires a simple explanation of the therapy's curative mechanism, as the programmes present a complex and even mysterious appearance. Published rationales are liberally populated with broad, abstract hypothetical constructs [3, 7, 24, 32, 57] and it is often said that extended participation in a programme may be necessary to gain a deep understanding of its dynamics [7, 49].

The practitioner of holistic therapy, viewing the whole programme as an integrated curative process, can be expected to regard a dismantling design as

inappropriate. Only certain scholars insist that phenomena invariably should be reduced to specific underlying causes [8, 58]. This reductionist view, which characterizes science as the pursuit of general principles obtained from the precise, nomothetic study of specific, molecular phenomena, is closely associated in psychology with the 20th century behaviouristic movement, which zealously rejected other forms of scientific study and knowledge as suspect or invalid [59]. For example, adherents often denigrate the importance of case studies in their pursuit of general laws [60]. Many of the criticisms of CR are presented from an explicitly behavioural orientation [17, 20, 61]. Alternative schools of thought not only accept broad, general causes (and idiographic evidence) but also prioritize concepts reflecting human intention or individual self-determination [58–60, 62, 63].

Current evidence suggests that holistic therapy does not 'decompose' into smaller causal units. A study dismantling the NYU programme into three sub-programmes found little difference in their effects [16, 52, 64]. In a similar vein, the considerable variation in the specific curricula of the various holistic programmes has produced little difference in their outcomes. For example, at Robert Wood Johnson, five teams' highly distinct curricula achieved comparable results. One critic noted that the body of outcome research has shown no specific procedure to be clearly superior [16]. CR appears to resist dismantling because it functions as the unitary process it is designed to be, achieving its impact on adaptation primarily by altering general attitudes and beliefs, not specific skills or specific contexts. In turn, the failure to elucidate specific curative factors in research on holistic therapy is a compelling issue only for those who adopt a narrow construal of causality, while others find the putative requirement to be non-essential and 'simplistic' [55].

A more useful window on the therapeutic dynamics is derived from the analysis of individual differences in treatment outcome. For example, a number of studies have found the level of insight to be the best predictor of long-term outcome [21, 65–67]. Since defective insight is known to be a primary barrier to recovery without treatment [2, 23, 68] and major programme components were chosen to combat this problem [24, 32], insight appears to serve as a general curative factor [69]. In fact, recovery can be portrayed as a continuous process of expanding self-discovery which begins in the clinic but extends long past discharge [70]. In turn, holistic insight training is not modular; the whole therapeutic process is designed to build and reinforce deficit awareness. As in reconstructive psychotherapy, accurate self-learning is construed as an interrupted adaptive process which the therapy attempts to restore [71, 72].

A second factor suggested by individual differences in outcome is the quality of the therapeutic alliance [73], also linked with success in reconstructive psychotherapy [72]. At the outset of therapy, trainees are convinced to participate by external inducements such as identification with therapists, peers and the community as a whole [3, 70], as well as by peer pressure for self-improvement [30]. Those who acquiesce to these external incentives become successful in therapy tasks, which in turn tends to elicit the intrinsic motivation they will need to optimize adaptation on their own across a lifetime [44, 74, 75]. A dismantling design could not 'tease out' this factor, but at most weaken it by eliminating some part of the shared experience.

The third individual difference associated with success in holistic therapy is the capacity for self-responsibility and self-accountability [32, 46, 76]. Trainees learn that self-therapy extends beyond learning specific compensation strategies, to mastery of the discipline of self-re-programming ineffectual habits. Certain enduring personality traits contribute to treating such self-management as a priority, including internal locus of control and conscientiousness [70].

Therefore, successful therapy may be best understood as a trait-by-treatment interaction [23]. Holistic therapy elicits adaptation to disability first by encouraging trust and then by helping receptive trainees recognize the need to arduously scrutinize and re-programme their minds. These curative factors are neither specific skills nor the product of specific interventions, but rather alterations in generalized expectancies representing major objectives of the entire programme. A fourth general factor, addressing executive functions, is not an inherent component of holistic therapy and therefore will be detailed in a subsequent paper.

Does cognitive rehabilitation generalize?

The ultimate goal of any treatment is generalization [2, 11, 24]. There is an active dispute about the best way in which it can be accomplished. Behavioural theorists hold that human nature is built of microscopic habits, with each response tightly bound to the situation in which it was learned and to the stimuli that elicited it. Habits are expected to remain situation-specific, with cross-situational consistency regarded as more myth than reality [77]. In keeping with this position, subsequent theorists have argued that TBI therapies should be performed only in the specific situation in which the behaviours are intended to be used [16, 21, 78],

i.e. therapy should be 'contextualized' [20, 50]. Ylvisaker advances a comprehensive methodology based on this concept, advocating that both assessment and treatment should be performed *in vivo*. Even the personnel who conduct the assessment and intervention should include, or be limited to, natural participants in the situation. Training targets should be real tasks obstructed by impairment, so that participation is enlisted by natural motivation to succeed at that task [77]. For example, to make a student less academically disabled, the expert should go to the schoolroom to work on assignments, conscripting the teacher, teacher's aide, a 'buddy system' peer, family or volunteers to teach and cue supportive strategies. A recent study by Ylvisaker and associates even found family members more effective than professional therapists [79].

Most CR therapists prefer to employ trainees' real-world concerns as the subject matter for training whenever possible [11, 37]. Thus, Ylvisaker's proposition is appealing on its face, but not in the extreme form in which it is articulated [20, 50]. He argues that training never generalizes and that the CR methodology of providing in-clinic treatment on artificial exercises is therefore fundamentally ineffectual. This remarkably broad indictment, issued not only against this rehabilitation model but also against traditional approaches to education and career development, is followed by a listing of theorists characterized as recognizing the contextual specificity of learning and of studies held to support this position. It is even claimed that this rejection of transfer and embrace of contextualized methodology represents a new consensus, the paradigm of modern cognitive, educational and vocational psychology [20].

The evidentiary base for the argument is admittedly thin [20]. This article points to the failures of 'trivial' forms of CR, such as memory retraining and generic attention treatment. Only a few neurorehabilitation studies purported to show advantages of contextualized therapy are mentioned, such as demonstrations of successful *in situ* job coaching and in-vehicle drivers' training. Such findings seem artifactual in light of generalizability theory, i.e. when the training task is essentially identical to the efficacy test, results are spuriously inflated by 'practice on the outcome measures themselves . . . contribut(ing) to the post-training performance' ([61], p. 200, see also [84]). The more practical question of whether contextualized training shows more temporal stability or better generalization to far-removed tasks and settings is never addressed. The rest of the evidence is borrowed from studies of other populations, such as children with mental retardation or developmental disabilities. The authors' claim that such cross-population comparisons can be enlightening flies in the face of the common clinical opinion that children with TBI and those with developmental disabilities have fundamentally different problems and needs [80]. The authors of this critical essay caution appropriately that their model of community activism depends on the willingness of the community members to participate [20], but offer no data concerning how often participation is successfully recruited and how long it is maintained. Moreover, both their review of evidence and discussion of theorist support are decidedly one-sided; no attempt is made to examine data or theory supportive of holistic therapy or decontextualized training.

Perhaps the most unfortunate corollary of this behavioural analysis is the pessimism it promotes about the adaptive potential of CR trainees [61], e.g. 'Patients . . . are unable to cope with novel situations' ([22], p. 357). Following this logic, survivors' vocational rehabilitation potential is portrayed as either limited to routine, repetitive jobs [22] or dependant upon special accommodations to simplify and support more substantial jobs [20, 81–83]. The failures of some decontextualized interventions to obtain vocational transfer should not be assumed to reflect limitations of the trainee without first attributing them to the limitations of the training model [70]. Contextualized accommodations can even be iatrogenic, preventing trainees from learning self-transferring skills that they may need to use in the future [33].

Although the papers critical of CR do not cite it, the contextualist argument dates to the work of Thorndike [85], who demonstrated, for example, that studying Latin has no measurable benefit for learning to read English. Sweeping indictments of transfer were controversial in Thorndike's time [86] and remain so to the present day. The argument against transfer is far from consensual, both in cognitive psychology and education. Sternberg, whose work is cited in support of the contextualistic argument [20], observes:

> There are two philosophical viewpoints on the best methods for promoting metacognitive and critical thinking skills: the cognitivist and the situative. Researchers and educators who embrace the cognitivist view argue for teaching thinking from the general to the specific. This approach suggests that students should first learn general reasoning strategies and problem-solving principles that can then be applied to specific domains ([87], p. 355).

He goes on to review evidence supporting each of these approaches. As his review illustrates, the limited empirical support for the cognitivist view

renders 'a monolithic local (situative) knowledge position difficult to sustain' [88]. Vygotsky, another theorist cited as supportive of contextualized learning [20], actually holds that all learning is automatically transferred from the conversational context in which it is learned to the instrumental contexts in which it is used [41].

Theory identifies two vehicles for transfer: general concepts through which the action can be applied and concrete experience using the action in a new setting [89]. An action schema thus links a core concept, which can be general, with a list of the situations in which it has been applied [90, 91]. For example, when one is taught to throw a ball in the front yard, one learns that the front yard is for ball-throwing, but does not need additional training to understand that one can throw it in the back yard; the general concept of ball-throwing is not bound to a setting. This explains why children with developmental disabilities trained to walk a balance beam do not improve in their academic subjects [20]: There is no common concept to mediate such generalization. Spontaneous generalization takes place only when conceptual commonalities are recognized or taught [91–94].

The cognitive processes through which learning can be transferred [92–94] become more powerful with the maturation of the mind. Elementary school children begin to generalize via concrete principles and at puberty they do so employing abstract generalizations [89]. A local concept can also be expanded by the teacher, both by exposing students to new applications and by teaching them the general concept [94–96] (the recently popular technique of 'reflective teaching' [97]). Concepts taught in this manner are flexible and readily applied to new situations and purposes [98]. For example, children trained to self-monitor while working on one subject transfer that skill to studying other subjects [99, 100]. Moreover, the self-monitoring process itself enhances their ability to transfer other strategies [101]. Sternberg [102] explains the capacity to apply learning to practical purposes as a generalized trait.

Far from consensual, the imperative that teaching should be contextualized has been the subject of debate as well as pointed criticism by some educational scholars:

> That action is situationally grounded is surely the central claim of situated cognition . . . The claim is sometimes exaggerated to assert that all knowledge is specific to the situation in which the task is performed, and that more general knowledge cannot and will not transfer to real-world situations . . . It is not the case that learning is totally tied to a specific context . . . How tightly learning will be bound to context depends on the kind of knowledge being acquired. Sometimes knowledge is necessarily bound to a specific context by the nature of the instruction . . . Knowledge is more context-bound when it is just taught in a single context . . . Knowledge does not have to be taught in the precise context in which it will be used, and grave inefficiencies in transfer can result from tying knowledge too tightly to specific, narrow contexts ([103], pp. 33–34).

Thus, one danger of the contextualized approach is that it can actually impede the transfer of skills and strategies to new situations and usages [52]. On this basis, contextualized training may be highly inefficient when a particular problem occurs in multiple contexts [25], whereas a cognitive training approach can develop a strategy that applies in many settings [24, 75, 104].

For example, a survivor with impaired declarative learning faces disability in many different situations: in forgetting the content of important phone calls, in returning from shopping trips without all of the needed items, in omitting all or part of a work order on the job, in getting lost after obtaining driving directions or in failing to learn the recommendations of a physician, attorney or tax accountant. In a pure contextualized approach, the first problem may be treated at the telephone stand at home, by training the strategy of writing down the phone message. There is no expectation of transfer from that training to the other memory tasks. Instead, the therapist needs to follow the person through his or her world, training the same strategy during preparations to shop, in the workplace, in the car and at the offices of each physician, attorney and any other relevant professional consultant.

In contrast, the holistic CR therapist begins by explaining the general concept [31, 49, 78], the first step in facilitating transfer [103, 105], e.g. 'Write it down if you intend to use it in the future'. This strategy is easy to understand and rapidly learned in a treatment programme by routinely asking members to report what happened in the last meeting. Those who use a note-taking strategy get reinforced and model the desired compensation for others, while those who refuse get embarrassed by unequivocal demonstrations of their memory defects. This event also encourages discussion of the real-world applications of the strategy, thus building the contextual span of the strategy's library of specific applications [106], while encouraging trainees to develop the general habit of seeking additional situations in which to use their strategies [37, 61].

Use of these strategies should be systematically transferred to home/community settings either by conducting training in the real world or by

homework assignments [11, 25]. The second author even assigns generalization homework on inpatient home visits. Written analysis of errors made in real-world activities also helps trainees to learn retrospectively where strategies were needed and to plan for using the needed strategies proactively when the situation recurs, a procedure supporting metacognitive self-management [31]. Such training empowers the trainee to act as the agent of generalization, monitoring the flow of events to assure prevention of known deficits and to problem-solve emergent ones ([23]; see also [14, 24, 107]).

Therapists need to be wary of learning and executive deficits as potential barriers to self-management [19, 33, 54, 61], but generalization training aids even severely impaired survivors (i.e. those in coma at hospital admission) to learn corrective procedures [16, 23, 102, 108]. For example, trainees readily learn the consequences of failure to write down assignments, schedule their homework, monitor for errors, control emotional overload and thoroughly think through their actions in high-stakes therapy situations. These strategic behaviours can then be elicited and reinforced with instrumental success, self-congratulations and group acclaim within the programme [49]. For all but the most impaired subjects, these behaviours soon become habitual through repetition thanks to relatively intact procedural learning and carryover to specific real-world situations is mediated by *in vivo* conditioning [11, 19, 21, 25, 54].

It is more difficult to train deliberate transfer of strategies to new situations, the desired end-result of therapy. Trainees become the agents of volitional transfer to the extent that they expect to obtain benefits, recognize that the strategy is relevant to their own valued goals, feel that they have internal control over the outcomes and the ability to succeed and are motivated to pursue those benefits [26, 69, 85, 109]. Thus, if they distrust their therapists or themselves, deny their deficits or feel indifferent to their errors, they do not carry over the compensation strategies [33, 110]. As expected, failed recovery is associated with characterological defensiveness, rebelliousness, external locus of control, hopelessness concerning the future and the expectation that personal goals will not be met through therapy [3, 73, 111]. In contrast, exceptional generalization is facilitated by the superior intrinsic motivation, full insight and personal accountability [23, 47, 49] that provoke relentless vigilance for and mastery of deficits [2]. Thus, by mobilizing insight and effort, the non-specific curative factors promote high-level transfer of training.

The most compelling demonstration of generalization is provided by the vocational attainments after holistic therapy, an outcome category omitted from the articles critical of CR [112]. Long-term studies have consistently found approximately half of the programme graduates maintaining competitive jobs over multi-year follow-up intervals, as late as 11 years post-discharge [10, 12, 45, 46, 113]. This result represents a remarkable improvement over the baseline established by previous research for untreated cases of severe TBI [24, 114]. Since nothing else has been found that equips untreated survivors to keep their jobs, leaving no confounding causes to be ruled out by a randomized control group, the outcome is *de facto* definitive [51]. The research similarly finds high levels of social function, independent living and community participation [35–37] in comparison to outcomes without holistic therapy [115, 116].

Moreover, the accomplishments of the most exceptional graduates are markedly inconsistent with the known outcomes of TBI with extended coma, e.g. graduating with high honours from a university after injury in high school, promotion to department head in two Fortune 500 corporations, legal studies begun after injury culminating in a passing score on the California bar exam and employment as an attorney, initiation of successful careers in elementary and middle-school education, resumption of careers in crisis psychotherapy, law and high-level management and so on. Their achievements, still maintained 5–16 years later, are self-attributed to high levels of the same five factors found to be associated with treatment success generally [22, 42]: (1) therapeutic alliance, (2) insight, (3) self-accountability, (4) automatization of specific coping strategies and (5) metacognitive self-management.

In advancing their critique, Ylvisaker et al. ([20], pp. 200–201) conceded:

> If restorative exercises can have the effect of substantially reducing the individual's cognitive impairment and thereby improving functional performance in a generalizable manner, then clinicians would be well advised to use this approach. Similarly, if training in compensation strategies delivered outside of the routines of everyday life could result in habituation of strategic behaviour that is sufficiently flexible to apply to a wide domain of tasks of everyday life and sufficiently durable to be maintained over time, then . . . there would be no reason to challenge (this) approach to intervention.

The discussion could end on this note, but the present authors believe that their argument poses a false dialectic.

Experienced therapists do not rely entirely on either decontexualized cognitive exercises or situative learning. Even the most vigorous advocates

of contextualized treatment introduce broad, general compensatory constructs and teach transfer [20, 117]. It is common practice for clinicians to treat general compensation training and *in vivo* conditioning as complementary tools rather than incompatible alternatives. In turn, the extent to which a treatment plan relies on each tool should be gauged primarily on a trainee's potential to learn concepts and execute transfer.

Is cognitive rehabilitation appropriate for everyone?

The American Congress of Rehabilitation Medicine task force agreed on the basis of their review that the effectiveness of CR has been adequately demonstrated, proposing that scholars move on to focus on the individual differences in treatment responsiveness [46]. Factors associated with the failure of CR have been documented by prior research: injuries of profound diffuse severity [16, 38] (coma duration exceeding 2 months [47]) or debilitating multifocal damage (which may introduce physical disabilities) [16, 39, 43, 48] and cases of protracted antisocial behaviour, low motivation or defensiveness, most often associated with major personality or character disorder [10, 23, 47, 49, 76]. In addition, decontextualized treatment is unlikely to be effective with children who have not completed cognitive development. These cases call for a combination of environmental supports and behaviour modification [21, 32, 118], including contextualized training and strategies cued by *in situ* collaborators [50]. Finally, therapy initiated after a delay may encounter too many practical obstacles from major time commitments to renewed vocational, educational or family responsibilities.

Is cognitive rehabilitation too expensive to be practical?

Health insurance companies routinely refuse coverage for Model One therapy [16, 23, 81]. Model Two programmes are impacted by managed care, but authorization can be obtained for limited services. A few programmes are supported by special funding, such as the federal Model Systems grants. Nevertheless, this restriction of services to a tiny fraction of the clinical population [70] prevents CR from being the standard of care [19].

One potential answer to this compelling problem is to cut down the training model, while overweighting activities that best mobilize the curative factors. Such a streamlined programme developed by the senior author reduced contact hours by 80% while slightly improving the rate of competitive employment [31]. A further reduction to 37 hours of individual therapy and 20 hours of group therapy assisted a man who suffered 15 days of coma and bifrontal contusions to return to and maintain (across 4 years, thus far) a job as a department director for a high-technology company, thanks to dedicated and skillful home therapy provided by his wife [70]. Thus, satisfactory outcomes can be achieved by a Spartan protocol when the trainee's situation, personality, symptoms and residual capabilities permit ready access to the curative factors.

Here is a current case of foreshortened therapy. A 58-year-old man, whose motorcycle accident resulted in 21 days of coma, right frontal contusion and left temporal subdural haematoma with oedema and encephalomalacia, has received 58 sessions of speech therapy and 26 of neuropsychological therapy, with his wife participating in the latter sessions. Four hours per month of free milieu therapy are provided by a community organization (directed by the senior author). He keeps a 24/7 daytimer, tape records and transcribes all therapy sessions and uses written notes to support recall at home and in the community. He has written up 80 cognitive errors and self-initiated corrective strategies have prevented 78 from recurring. One error was repeated on two occasions when his strategy proved incomplete. He recognizes his tendency to make errors on tasks in four task categories and under two specific emotional states and through targeted adaptation has reduced the frequency of errors in these contexts. He expects to use these techniques for the rest of his life. His determination is consistent with a history of educational/vocational success (chemical engineer and plant supervisor for a major manufacturing company) and a conscientious, emotionally stable personality.

Techniques magnifying the impact of feedback may permit further streamlining. Virtual-reality-implemented training is a promising source of improved-potency feedback [119].

Current technology allows the trainer to 'capture' real environmental settings at home and in the community and use them as the virtual context for in-clinic training, while showing after-action feedback as a computer-controlled image that replays events through the trainee's eyes [120].

Conclusions

The case against CR is largely a stereotypy error. Some Model Three practitioners offer a naive, ineffectual form of neurorehabilitation that only attempts to drill impaired cognitive skills, but of course there are poorly conceived exemplars

of any school of therapy. Well-developed neurorehabilitation programmes, whether holistic or contextualized, target abilities *and* participation, work by creating strong rapport and a conditional expectation of success to harness motivation, training insight and familiarity with generic strategies and taking steps to assure that the strategies will be used in the real world. The evidence for holistic CR is voluminous and diverse, while support for contextualized training is sparse but vigorous.

Holistic CR is distinctive in its breadth: It addresses many different impairments and disabilities and strives to support participation across the lifestyle. Hence its goal is nothing short of full recovery: across-the-board independence and self-managed adaptation to life [23]. By preparing the subject to act as the agent of generalization, equipped with adaptive strategies that are conceptually based and maintained by re-programmed executive functions, it produces durable adaptive systems. They continue to function even if the survivor changes jobs, alters family constellation, develops a second, chronic health condition or moves to Buffalo. Contextualized therapy does not aspire to this flexibility, yet it remains the treatment of choice for those who lack the insight, conviction, cognition circumstances or financial support to adapt on their own. TBI is a challenge far too formidable to face without all of the tools at hand.

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