Uniting Management and Education in Pursuit of Efficiency: F.W. Taylor's Training Reform Legacy

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Abstract

This historical case study demonstrates the importance of education to the diffusion of management ideas and strategies. The article explains how management and education came to be united in the pursuit of efficiency and how they came to use similar assessment techniques to ensure the achievement of this goal. Documenting F.W. Taylor's interest in education, it reveals how scientific management, as promoted by management 'gurus', consultants, managers, educational administrators and related professionals, came to influence the early twentieth century reform of education and training in both the USA and Australia. It shows how Taylor's methods, principles and philosophy were transformed into a scholastic program, and how this program was infused into the administration and content of teaching and learning offered in NSW schools, technical colleges, universities and adult education, with long-term implications for the training of managers, students and workers.

Introduction

Management education has become big business, supported by the growth of management education associations. Their focus on quality and efficient program delivery can be traced to the early decades of the twentieth century, when Frederick Winslow Taylor, the 'father' of scientific management, and his followers engaged in a crusade not simply to reorganise work performance but to revolutionise the training and education of both workers and their managers. The diffusion of scientific management ideas and strategies strongly influenced the administration and content of training and educational programs — an influence that remains today. This article traces the origins of this diffusion in NSW,

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The author would like to thank the two anonymous referees and editor Anne Junor for their helpful comments.

https://doi.org/10.1177/103530460701700208 Published online by Cambridge University Press

extending earlier research on the role of scientific management ideas in shaping the technical education system (Taksa 1995) and research on the contested terrain of workers' adult education (Taksa 1996, 2003) during the early decades of the twentieth century. By identifying the manner in which management 'gurus', consultants, managers, educational administrators and related professionals in the USA and Australia infused scientific management into the training offered in the workplace, the school, the technical college, the university and the institutions of adult education, it seeks to explain how management and education were united by common goals and assessment techniques that revolve around the pursuit of efficiency. This influence has shaped vocational education and more specifically management education to the present day.

The received wisdom about scientific management is that it combined techniques dominated by time and motion studies, payment incentive schemes and 'the one best way' (Braverman 1974; Nelson 1975; Cochrane 1983, 1985). This narrative, however sidelines the importance of its underlying philosophy and principles, along with the process by which Taylor and his followers mobilised to ensure that the system's ambit encompassed not only the (re)organisation of work but also the (re)organisation and delivery of training and education. Judith Merkle (1980) was the first to stress that the diffusion of scientific management beyond the workplace was predicated on a combination of Taylor's techniques with his philosophy and principles. Building on Merkle's wider perspective, this article examines the educational dimensions of these three elements and the way that they were taken up by middle class professionals in NSW as part of a reform agenda in training and education. The focus is thus on the cultural diffusion of scientific management. The analysis begins by clarifying the definition of education adopted here.

A Cultural Perspective on Education and Training

According to Raymond Williams, any approach to the organization of education 'can be seen to express, consciously and unconsciously, the wider organisation of a culture and a society' and the way that culture has been actively shaped to particular social ends. From this perspective, what is conceived of as an 'education' is 'in fact a particular selection, a particular set of emphases and omissions' (Williams 1961: 145–6). For Williams and also Graff, the industrial training reforms introduced in most industrializing countries during the late nineteenth and early twentieth centuries, were not simply designed to extend literacy and the range of technical skill but more significantly, to inculcate a 'pattern of culture' and of power relations through the diffusion of particular values and habits (Graff 1981: 258–9). The promotion of literacy by these means, according to Dore (1967: 292), constituted 'a training in being trained' since it increased the likelihood of a positive response to further instruction and discipline.

The training methods advocated by F.W. Taylor were designed for precisely such ends. From a Gramscian perspective, this can be seen as one critical element in the operation of 'Taylorism [as] a hegemonic ideological force', and a means for diffusing the 'new pragmatic and secular "theology" of advancing

https://doi.org/10.1177/103530460701700208 Published online by Cambridge University Press

industrialisation', which 'arose from a foundation of science, technology and organization' and which aimed to subordinate workers totally 'to machine specialization and the cult of efficiency' (Boggs 1976: 46–47). For Gramsci, hegemony referred to 'the permeation throughout civil society … of an entire system of values, attitudes, beliefs, morality etc. that' supported 'the established order'. It was not a 'total or static' phenomenon but one that varied from society to society in scope, form and impact — an 'organizing principle, or world-view (or combination of world-views), that is diffused … into every area of daily life' through agencies of socialization like schools and 'the modern way of considering educational doctrine and practice' (Boggs 1976: 39–40). In this regard, Gramsci stressed 'the importance of the "cultural aspect", even in practical (collective) activity' and argued that '[e]very relationship of "hegemony" is necessarily an educational relationship' (Hoare and Smith 1971: 349–50), operating both as a "general conception of life" for the masses, and as a "scholastic programme" or set of principles' advanced by intellectuals and their social counterparts' (Boggs 1976: 39). Seen in this light, scientific management involved not just an industrial struggle but also a cultural struggle to diffuse 'bureaucratic-technological norms' both in the workplace and through educational programs and in this way to produce a new type of worker suited to a new productive process, a worker whose capacity for 'creative and critical thinking' was limited if not eliminated (Boggs 1976: 47).

Of course a 'cultural' perspective on scientific management raises many definitional issues. Three decades ago, Williams (1976: 76–77) pronounced culture to be 'one of the two or three most complicated words in the English language' because of its use in 'several distinct and incompatible systems of thought'. Nevertheless, all definitions of culture include notions of common experiences, habits of thought, language, symbols, shared perceptions of social relationships, morals, values, rituals, myths and patterns of behaviour, laws, rules, policies, and interpretations and representations of a given social reality (Heerma van Voss and Holtoon 1988; Gable 1989; Williams 1961; Williams 1976). Such dimensions certainly feature prominently in the many works on organizational and corporate culture produced by management consultants and scholars from the 1980s, well overviewed by Parker (2000). This article shares Parker's view that culture is not a 'cohesive whole' but a process that encompasses 'disparate collections of accounts, people, technologies and so on' (Parker 2000: 82). In other words, we need 'to speak of "cultures" in the plural' (Williams 1976: 79). Further, the creation of meanings and values is, as Williams pointed out, an inherently political process (Gable 1989: 36–38), which involves not only a 'whole way of life' but also 'a whole way of conflict' (Sider 1980: 15–16). In this regard, Heerma van Voss and van Holthoon (1988: 10–11) point out that whilst culture may be a semiotic system, part of a process of rule making, and a component in group identification, into which individuals have to be initiated by education, it is important to recognise that culture is also a mechanism of negotiation and transaction over the selection of repertoires and meanings, involving accommodation, contestation and resistance (Burke 1981; Hall 1981). These dimensions of culture influence the way management innovations and management education are received and diffused.

Considering Cultural Diffusion

Much of the scholarship on scientific management has skirted around the issue of diffusion by restricting the field of study to the system's effect on the labour processes of specific enterprises. In such cases evaluations of its influence have turned on how many firms and/or industries adopted the mechanisms of scientific management as these were laid down by Taylor. For example, Nelson suggested that the impact of scientific management was limited to the twenty nine enterprises systematised by Taylor's immediate followers because these adopted his most prominent techniques, notably: (i) preliminary technical and organisational improvements; (ii) a planning department; (iii) functional foremanship; (iv) time study; and (v) an incentive wage system (Nelson 1975: 70–71). On the basis of this type of analysis, Edwards (1979: 98, 101–04) argued that although scientific management was much debated among professional management theorists during the early decades of the twentieth century, it was not generalised in American industry; it was 'an idea whose time had not yet arrived' (Gordon, Edwards, Reich 1982: 146). This conclusion is problematic. As the rest of the article will show the approach to measuring impact underpinning it obscures the extent to which scientific management shaped early twentieth century reforms to managers' and workers' training and education.

Scientific management was not a monolithic entity implemented in its entirety according to the dogma laid down by Taylor. It was modified not only in those enterprises where it was first developed but also in those acclaimed as 'model' scientific management establishments (Drury 1922: 187–88; Gilson 1924: 39). As Layton (1974) argued, scientific management represented complex combinations of process innovations which were too difficult to transmit as a totality. Certainly direct borrowing occurred, but this was more in the nature of what Kroeber (1940: 1) referred to as 'stimulus' or 'idea diffusion' according to which a form of knowledge acts as a stimulus on others 'to do something similar, but in their own distinctive way'. Numerous organizations developed partial applications of the system without referring to Taylor or acknowledging him as the source. The key issue here, however, is the transmission of scientific management's philosophy, principles and methods in the educational arena by those who accepted its distinctive vision of an industrial society in which deteriorating social relations would be ameliorated (Merkle 1980: 50).

It is worthwhile remembering that scientific management's evolution occurred against the backdrop of the scientific-technical revolution, the formation of trusts, the rise of 'systematic management', the growth of bureaucratic structures and the unification of training and research in the modern university (Larson 1977; Merkle 1980; Nelson 1990). In this context, the diffusion of scientific management was a leitmotif that united the fragments of a complex matrix. Those who focus on the adoption of the system's mechanisms limit the process of diffusion to the relocation of technology (equipment, methods and experts to operate them) from one place to another. This perspective, accord-

https://doi.org/10.1177/103530460701700208 Published online by Cambridge University Press

ing to Headrick (1988: 9) simplifies the complexity of diffusion because it neglects to account for the transfer of 'knowledge, skills, and attitudes related to a particular device or process'. In other words, the orthodox view of scientific management's impact has focused on geographical relocation rather than what Headrick refers to as cultural diffusion by which he means the development of human capital to support the technology. In the rest of the discussion, attention will be given to the way Taylor and his followers facilitated the cultural diffusion of scientific management methods, principles and philosophy by transforming the system into a 'scholastic program' for all levels of education. In this regard, the paper argues that the new 'specialized training' associated with scientific management offered to bridge the gaps between the university or technical college and the factory floor and in doing so promoted and facilitated a separation of planning from execution in the educational arena (Noble 1977; Stabile 1984; Taksa 1995).

Taylor's own involvement in a range of educational associations played a critical role in facilitating the system's integration with the educational reforms implemented in the USA. At the same time, his system gave managers, originally professional engineers, an influential role in shaping the training given to workers and it supported the professionalising efforts of numerous occupational groups during the first two decades of the twentieth century (Copley 1969; Larson 1977; Deacon 1985; Reiger 1985). In fact, the connection that developed between scientific management and professionalisation in the USA affected the degree to which Taylor's ideas spread to other nations. According to McGuffie (1986), the influence of scientific management in Britain was limited not only by that country's highly segmented class structure but also its extremely conservative universities. As Merkle (1980: 228) put it, the absence of 'technocrats of uncertain social origins' in Britain ensured that 'there was no group whose greatest interest lay in the propagation of scientific management as a profession'. By contrast, in France, Henri Le Chatelier promoted a French variant of the system because he was convinced that it would help to improve the standing of the professional engineering elite (Drury 1922: 190; Humphreys 1986).

These two examples show that the diffusion of scientific management in different national contexts depended on two interrelated preconditions: a relatively fluid class structure, which gave professionals opportunities for social mobility and an integrated educational system, which provided the credentials to support such mobility. These were precisely the conditions that existed in Australia during the early decades of the twentieth century, where leading Australian professionals, public administrators and educators were increasingly drawn to American ideas on industrial reform (Hathaway 1915; Irvine 1915; Law 1917a and 1917b; Muscio 1917). Of course the structural limitations of Australia's political economy influenced the way that local engineers and manufacturers reacted to scientific management and the system's Antipodean diffusion was mediated by British precedents (Rowse 1978; Cochrane 1980, 1985; Taksa 1993). But these factors did not limit interest and support for the adoption of American models. On the contrary, Australia's middle class professionals embraced the gospel of scien-

tific management and promoted it as both a 'scholastic program' and a 'general conception of life' through the media of industry-related training and adult education in order to enhance Australia's industrial development (Roe 1984; Reiger 1985; Deacon 1989; Taksa 1995, 2003).

Reinterpreting Scientific Management as a Tool of Management Education

Taylor was convinced that his system had universal potential and he therefore argued that its principles could 'be applied with equal force to all social activities', including the management of homes, philanthropic institutions, schools, universities and government departments (Taylor 1911a: 8; 1912: 5–7, 88; 1916: 7–13). His followers reiterated this view and used it to legitimate their own efforts to apply his ideas and methods to reform government and educational administration. From this perspective, Taylor's combination of scientific and bureaucratic methods with an ideology that promoted social harmony and consensus between capital and labour made scientific management much more than the sum of all its component parts (Taylor, 1911a: 136, 139, 142). Its methods were simultaneously directed toward increasing production and consumption and implementing social change (Bendix 1974; Davis 1975; Littler 1978), while its 'philosophical principles' had significant ideological implications (Littler 1978; Merkle 1980; Stark 1980; Taksa, 1992), particularly for education and training.

Taylor's methods, principles and philosophy of management education and management were expressions of and responses to the restructuring of capital in America between 1890 and 1920 and the rapid growth of corporate enterprises. Not only did these changes eliminate the personal contact between employers/sub-contractors and workers that had previously characterized the function of authority in the workplace (Drury 1922: 212; Nelson 1975; Noble 1977; Edwards 1979), but they also contributed to a growing gulf between capital and labour (Taylor 1895: 898; Edwards 1979; Merkle, 1980). For middle class reformers concerned about the social problems that accompanied these changes, scientific management provided a powerful solution that simultaneously addressed technical and social problems; it offered to adapt industrial practices to the larger scale of manufacturing by increasing the degree of coordination and control over the production process in ways that established new forms of contact between management and labour.

Technically scientific management was not entirely new, a fact Taylor (1911a: 139–40) acknowledged. Rather it 'made a new synthesis out of old practises' (Dodge 1905–6: 723; Urwick 1957: 8–9, 217). The real novelty of Taylor's approach lay in his insistence on combining scientific methodology with 'the unifying force of a clear-cut philosophy' (Merkle 1980: 99). As Taylor (1911a: 10) put it, in an approach now identified as 'unitarist':

> Scientific Management … has for its very foundation the firm conviction that the true interests of the two [employers and employees] are

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> one and the same … and that it is possible to give the workman what he most wants — high wages — and the employer what he wants — a low labor cost — for his manufactures.

In Taylor's view, this outcome could be achieved by managers who, as independent professionals, would find the 'one best way' to perform any task. The notion that, given sufficient investigation, such a way could be found, was a central pivot of his system and a slogan that was disseminated far beyond America's shores (Taylor 1903: 21, 101, 177; Taylor 1911a: 25, 106, 122). Later seen as an approach to imposing efficiency through standardization, the principle of the 'one best way' originally focused on research. As Taylor told those who attended a conference on scientific management in 1911, scientific mangers usually approached workers by saying:

> We do not know the best; we are sure that within two or three years a better method will be developed than we know of; but what we know is the result of a long series of experiments … these standards that lie before you are the results of these studies … the moment any man sees an improved standard … come to us with it; your suggestion will not only be welcome but we will join you in making a carefully tried experiment … If that experiment shows that your method is better … everyone of us will adopt that method until somebody gets a better one (Taylor 1911b).

Unlike later scholars, Taylor's contemporaries recognised that 'one best way' was a mutable standard that required constant refinement through experimentation. As E.E. Hunt, the Assistant to the Secretary of Commerce and a member of the American Committee on the Elimination of Waste in Industry put it in 1924, 'scientific management is a dynamic thing; its principles are the principles of growth and change'. (Hunt 1972: xii). Taylor's insistence on the documentation of experiments and their results was similarly novel. Hollis Godfrey, a member of the American National Council of Defence during World War One, therefore remarked in 1924 that he had seen 'nothing more significant than the constant advance in selective written records on industrial matters'. Before Taylor emphasised the need to record industrial processes, he added, written records had not been used as guides for the future (Cooke 1924: 35). Decades later Urwick (1957: 9) stressed that basically scientific management meant 'thinking scientifically … about the processes involved in the control of social groups who co-operate in production and distribution'.

Taylor's methods, principles and philosophy were linked by the assumption that traditional ways of doing things, as well as ways of thinking about the world, had to be discarded (Thompson 1917c: 244). For Taylor a new industrial culture could only be achieved if managers adopted four new principles. This meant assuming a range of new duties including: 1. the gathering together of the traditional, 'rule-of-thumb' knowledge, previously possessed entirely by craft workers, and developing a 'true science'; 'classifying, tabulating and reducing this knowledge to rules, laws and formulae'; 2. the scientific selection of workers; 3. the introduction of scientific education and development of workers; 4. the promotion of intimate friendly cooperation between management

and labour (Taylor 1911a 36; 128–30; Taylor 1912: 40–45). Taken together with the methods of scientific management, these principles introduced a number of fundamental changes to the organization of production. Time and motion studies and the standardization of methods and tools resulted in a greater division of labour than had previously existed (Taylor 1903: 58–60; Taylor 1911a 77–80, 177). The creation of a planning department, where experts co-ordinated information gleaned from the studies before passing it on to the workers in the form of written instructions, allowed the separation of planning from execution. In turn, the numbers, importance and power of supervisory, engineering and clerical staff were strengthened. The planning department was a laboratory which 'could be used as a machine to carry out experiments, to alter behaviour, to train or correct individuals' (Foucault 1987; 203, 205). In effect, Taylor's philosophy and methods sought to structure the behaviour and consciousness of workers and obtain their consent for a new industrial culture in which professional engineers could dominate the ranks of management by regulating both formal and informal arrangements directly and indirectly associated with industrial production (Copley 1969, vol. 2; Noble 1977). As a corollary, Taylor's ideas on training, his advocacy of new training methods, as well as his involvement with educational reform associations were based on an attempt to communicate and generalize the ideals and practices of scientific management and to extend surveillance and discipline beyond the workshop.

Hence, in tracing the diffusion of these methods and principles, we need to focus not solely on them but also on the intersection between the spreading impact of changing management practices and the educative role of those who advocated the philosophy underpinning them. Here we are helped by Gramsci's interpretation of philosophy, not as the 'individual' elaboration of systematically coherent concepts, but as reflecting a cultural battle to transform the popular 'mentality' and to diffuse philosophical innovations in such a way that they come to be experienced as universal truths. From this perspective attention needs to be extended to include the initiatives of those seeking to change 'the conceptions of the world that exist in any particular age and thus to change the norms of conduct that go with them' (Hoare and Smith 1971: 344, 348). Hence, we must now turn to the activities of those groups of people who sought to universalise scientific management principles.

In 1910 Taylor's followers re-titled his system, 'scientific management' (Drury 1922; Copley1969, vol 1: 6–7; Merkle 1980: 58), which not only invested it with an aura of impartiality, but also allowed progressive industrial managers, politicians and social scientists to promote the system in the very universal terms espoused by Taylor (Zerzan 1984: 141). On this basis he and his apostles reinforced the efficiency craze, then sweeping the USA, by engaging in a publicity campaign that encouraged wider interest among engineers, managers and even educators, many of who ardently championed Taylor's 'harmony of interests' gospel and its practical 'scientific' manifestations, through their consultancies and publications (Hoxie 1915; Thompson 1917a, 1917b, 1917c; Drury 1922; Callaghan 1962; Merkle 1980).

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Middle class reformers who empathised with Taylor's vision (Merkle 1980) focused on two related spheres for reform. The first centred on the workplace, where scientific management was used to institutionalize new forms of communication between managers and workers. The second field centred on industry-related training, at both technical and professional levels. The new forms of workplace communication relied on formalized systems of information exchange based on written instructions that enhanced the disciplinary power of technical experts, as well as their capacity for surveillance. At the same time these instructions reinforced managerial control, constituting 'the individual as a describable, analysable object … under the gaze of a permanent corpus of knowledge'. In short, Taylor's arrangements were designed to transform the individual worker from 'a subject in communication' to an 'object of information' (Foucault 1987).

In the workplace, the training methods advocated by Taylor revolved around the combination of record-keeping, written instructions, payment incentives and 'functional foremanship'. Written artefacts and bureaucratic techniques, including accounting and wage records, time cards, lists of mnemonic symbols for the identification of tools and manufactured articles, drawings, timetables, reports, charts and order of work slips, were pivotal features of scientific management. For Drury such techniques provided adequate records of past achievements and enabled 'closer touch' with workers because records provided information on each individual's performance, punctuality, attendance, integrity, rapidity, skill, accuracy and, as Taylor put it, each worker's 'attitude towards his employers and fellow-workmen' (Taylor 1895: 857,862; 1903: 115–16; 1911a 23, 36–38, 119; Drury 1922: 202, 222).

Under scientific management the use of written instruction and return cards was intended to provide the chief means for instructing both foremen and workers in all the particulars of their work. Included in such cards were all accounting details, descriptions of work procedures and specific tools to be used, the exact time allowance for each element of the work and the particular pay rate for the job (Taylor 1911a), although their form depended on the nature of the instructions to be conveyed (Taylor 1911a, 1912; Gilbreth 1973). As Taylor saw it, written instructions helped to transform supervisors into 'teachers' responsible for helping workers perform their duties according to the details outlined on the cards (Taylor 1912). But because workers resisted this new form of managerial control, Taylor also devised a number of supplementary techniques to ensure compliance in the pursuit of industrial harmony. First, he promoted the adoption of rigid standards because he believed this would force workers to obey directions. Second, he linked the payment of additional wages to the exact performance of written instructions. Taylor also advocated the division of supervisory functions among numerous specialist foremen, an innovation he called 'functional foremanship' (Taylor 1903: 78, 100–06, 108, 128; Taylor 1911a: 123). This had immense implications for training. As Nicholas Thiel Ficker told the readers of the *Australasian Manufacturer* (10 February 1917: 23), when 'Frederick W. Taylor inaugurated a new epoch "of functional effort"', he demonstrated the

https://doi.org/10.1177/103530460701700208 Published online by Cambridge University Press

'dearth of properly trained' people and 'a corresponding necessity for some systematic scheme of industrial education along scientific lines to fit men for positions of industrial leadership'. In effect, functional foremanship represented a direct attack on traditional modes of co-operative training among workers.

The demand for management to take on the training of workers appeared in all of Taylor's major publications. It illustrated an astute judgement of his contemporaries' anxieties about the influx of unskilled immigrants to the USA and the alleged obsolescence of the traditional apprenticeship system. The tendency for both developments to reinforce the prevailing social and industrial dislocation greatly perturbed America's social reformers (Nelson 1975; Brody 1980). To this, Taylor and his colleagues responded by proclaiming that scientific management constituted a 'practical system of vocational guidance and training', an idea which impressed Professor Hoxie (1915: 13, 34–37) who praised the attention given to instruction and training in scientific management shops. As he saw it, scientific management deserved 'the support of all classes whatever be its limitations and shortcomings' if it could 'show the way through practical vocational adaption (sic) … to the elimination or alleviation of' evils, such as 'discontent, degeneracy, crime, inefficiency and poverty'. Hoxie was not alone in this view. However, the appeal of scientific management principles was not simply based on their promise to alleviate prevailing social problems. Middle class professionals also found them attractive because they ratified 'an aristocracy based on technical knowledge, formal education, and organizational skills rather than inherited wealth, social and family ties, or business acumen' (Nelson 1990: ix).

Taylor's social background and training located him squarely in this professional middle class milieu and led to his involvement in a plethora of formal and informal occupational and reform-oriented associations. He was an active participant in the Society for the Promotion of Engineering Education (SPEE), which had been formed by engineering educators in 1894 and which worked to bring college and apprentice training into line with industrial requirements by co-operating with the nation's trade associations, various engineering societies and the National Association of Corporate Schools (NACS) (Haber 1964; Noble 1977; Merkle 1980). In 1906, Taylor actively reinforced these links when he became President of the American Society of Mechanical Engineers (ASME) and particularly vocal in demanding the reform of engineering and industrial education. One important opportunity for his crusade occurred when he received an honorary doctorate from the University of Pennsylvania, at which time he also delivered an oration as part of the dedication of the University's new million dollar engineering building. This oration was titled: 'A Comparison of University and Industrial Methods and Discipline; Being a Protest against the Excesses of the Elective System and Loose University Discipline, and a Plea for Bringing Students Early into Close Contact with Men Working for Their Living' (Kanigel 1997: 386). Subsequently printed as a pamphlet, it attacked existing educational methods and presented proposals for the reform of industrial and professional education, which attracted extensive attention in aca-

demic circles. According to Kanigel, Pennsylvania State University 'was among the first engineering programs to absorb Taylorist ideas, through Hugo Diemer, a Taylor devotee' who had, by 1909 'begun the country's first true industrial engineering department', followed soon afterward by Cornell and Purdue (Kanigel 1997: 489–90).

In the meantime in May 1907, Taylor accepted an invitation from Professor Ira N. Hollis to serve on the Harvard University's Division of Engineering Visiting Committee and the following year Taylor received a visit from 'the first Dean of Harvard's graduate school of business, Edwin F. Gay', who 'was soon introducing "industrial organisation" to the [school's] curriculum', where Taylor 'regularly lectured' (Gay 1972; Kanigel 1997: 489). These connections allowed Taylor to reiterate his views to the Harvard Engineering Society, as well as to Dr Alexander C. Humphries, President of the Stevens Institute, where some of the professors had become his active followers. One particularly influential supporter was the President of the Carnegie Foundation for the Advancement of Teaching, Henry S. Pritchett, who ensured that Taylor's ideas were diffused beyond the factory and embodied in the 'business training' offered to American engineers by both technical schools and universities (Copley 1969).

Against this backdrop an increasing number of papers presented before the ASME during 1907 and 1908 focused on 'Industrial Education', and the discussions which followed provided a forum in which Taylor and his supporters could exchange views with representatives of some of America's leading corporations (Jackson 1907; Gantt 1908). Scientific management's emphasis on training through 'instruction cards' in order to specifically outline the task to be done, how it was to be done and the time allowed to do it, dovetailed nicely with the corporations' growing interest in supplementing the 'instruction' of 'green' apprentices with formal classes held during working hours (Russell 1907: 1121–1143). Even after the expiry of his term as ASME President, Taylor continued to extend his personal links with educational reform associations. When the National Society for the Promotion of Industrial Education (NSPIE) was formed in 1906–1907, he joined its first board of managers, together with other founding members, such as President of General Electric, Charles A. Coffin, C.R. Dooley from Westinghouse and Dugold Jackson from the Massachusetts Institute of Technology (Fisher 1967).

Both obliquely and overtly scientific management infused industrial training in the USA. Herman Schneider, Dean of the College of Engineering at Cincinnati University consciously spread Taylor's principles of scientific selection and scientific education through his Cincinnati Plan, which inaugurated a co-operative course in 1906 through which students alternated between the classroom and the factory. The Plan spread to 75 companies which had adopted the course by 1919. It was also replicated by the University of Pittsburgh and subsequently similar arrangements were made by the Municipal University of Akron, Case in Cleveland, Drexel in Philadelphia, Union in Schenectady, Marquette in Milwaukee, Harvard in Cambridge, and New York University in New York City (Noble 1977). As McGuffie (1986: 79, 86) points out, the new industrial training effectively translated 'the ideology of

professional management … into practice'. From here scientific management's educational influence rapidly extended beyond industrial training.

The growing potency of business values, coupled with a cost-conscious reform-minded public, helped spread Taylor's gospel. In 1910 the Carnegie Foundation for the Advancement of Teaching published Morris L. Cooke's report on 'Academic and Industrial Efficiency', which:

> urged measurement of faculty 'production' in terms of 'student-hours' and other quantitative measures, that teachers be inspected in class, that faculty work fewer but more intense hours, that comparing the efficiency of colleges and universities required standardization among them (Kanigel 1997: 490).

As Kanigel points out in this regard, the effects of this report 'are felt today, as any college professor [in the USA] who's ever filled out a state-mandated faculty productivity form can attest'. Arguably, his view overstates the impact of this one publication and underestimates the extent to which scientific management was diffused more generally in the educational arena through a range of media. For instance, in 1910 a course on scientific management principles was launched at both the Harvard Business School and also at the Amos Tuck School at Dartmouth. Within a short time these principles were also being applied to virtually all aspects of secondary schooling (Copley 1969; Callaghan 1962). In 1911 the Efficiency Committee of the National Education Association (NEA) recommended that teachers use a range of "labour saving devices". Increasingly, pupils were represented as the raw material of the education business and the school was likened to a factory. Educational administrators rapidly began identifying those aspects of education which could be measured for efficiency and referring to standards and instructions, records, selection, training and rating of both pupil and teacher efficiency, 'pupil cost', 'investment per pupil' and 'school plant'. In turn, as school administrators enthusiastically embraced scientific management, increasing numbers of articles, books and reports on economy, efficiency and standardisation in education were produced. Two notable examples were *Scientific Management and High School Efficiency*, by Harrington Emerson and *Scientific Management in Education*, by J.M. Rice published in 1912 and 1914 respectively. In the meantime, the main topic of discussion during the 1913 Convention of the Department of Superintendence was 'Improving School Systems by Scientific Management'. In this way Taylor's record keeping and accounting techniques pervaded the field of education in the USA so that notions of investment, waste and the standard unit costs of the 'student hour' formed the criteria for measuring the relative value of different subjects, like maths, English or Latin (Callaghan 1962).

Perhaps of all Taylor's followers, it was Gantt who did the most to extend scientific management philosophy and principles to vocational education. Traditional training undertaken 'in the atmosphere of the union' promoted and perpetuated hostility to employers instead of co-operation, thought Gantt (1919: 111–112) who wrote: 'To avert this hostility we must begin by giving workmen a different training'. 'The policy of the future', he stressed, 'will be to teach and lead, to the advantage of all concerned'. From his perspective, Taylor's instruc-

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tion card method was 'a system of education with prizes for those who learn' (Gantt 1919: 256). In his own task and bonus system, much like Taylor's 'differential' and Gilbreth's '3-rate' pay schemes, rewards were given to those workers who co-operated with the management in exactly following instructions. And although Gantt thought that the methods associated with scientific management were 'simply the means to an end', he argued that they could 'never be utilized properly until the rank and file have been trained to operate them' (Gantt 1919: 8). 'To my mind', he wrote, 'the training of workmen … is one of the most important functions of the management', and although slow and expensive 'it is the only method which holds out any hope of producing even a partial solution of our present industrial problems'. He therefore concluded, 'If these methods were introduced extensively, it is without question that the habit of the shop would influence that of the community, and there would be a general increase in efficiency' (Gantt 1919: 148, 220–21).

Taylor's ideas on written instructions and training were taken up and widely disseminated not only by followers like M.L. Cooke and H.L. Gantt, but also F.B. Gilbreth, C.B. Thompson and F.A. Parkhurst, amongst others (Drury 1922: 153). These men were pivotal in helping to spread Taylor's gospel internationally. Cooke's (1910) 'Academic and Industrial Efficiency' report was received by the Royal Society of NSW in the same year it was published (Royal Society of NSW 1910: xxiii). Later, during World War One, the *Australasian Manufacturer* published numerous articles on scientific management by Thompson (1916, 1917) and Gantt (1917) and by 1917, the impact of this diffusion was being felt. In July the leading public sector engineer and NSW Railway Commissioner, James Fraser implemented a modified version of scientific management in the Government Tramway and Railway Workshops, known locally as the Job and Time Card System. A year later, evidence of the local circulation of Parkhurst's *Applied Methods of Scientific Management* was presented during the hearings of the Royal Commission appointed to investigate the causes of the General Strike that had been sparked by Fraser's reforming zeal (Curlewis 1918). These developments built on earlier efforts to draw on the philosophy, principles and methods of scientific management to reform education in NSW.

Scientific Management and Educational Reform in NSW

Despite obvious differences between the USA and Australia, analogous developments in the two countries during the late nineteenth and early twentieth centuries made Australia a fertile ground for scientific management (Boehm 1979: 8). Like their American counterparts Antipodean professionals wanted solutions for a wide range of social and industrial problems that arose from growth in manufacturing during the 1880s and the depression and strikes of the early 1890s, which included a growing detachment between employers and employees, as was then occurring in the USA (Irvine 1915; Rickard 1976).[1] In this regard, education and industrial training were of particular concern.

J.W. Turner and G.H. Knibbs laid the basis for a positive reception to American educational reform models when they travelled to the USA in 1902 as part

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of an inquiry into instruction methods for the Royal Commission on 'Primary, Secondary, Technical and other Branches of Education'. For Turner, American models were most appropriate for Australia since both countries belonged to what he called 'the New World' (Knibbs and Turner 1905, vol. 4: 211). Peter Board, the NSW Under-Secretary and Director of Education from 1904, later reiterated Turner's sentiments in his Report on the way secondary education was organised in the USA (Board, 1909a). As Board (1909b: 703–05, 711) saw it, the evolution of industry would ensure that the school would 'become the adjunct of the workshop, and the workshop a class-room of the school'. On this basis he championed the adoption of American models because he thought they could help to promote a 'science of education' in Australia by promoting the substitution of observation, experiment, analysis and synthesis for 'imitative methods'. For this reason he argued that students had to be taught to appreciate the lessons of scientific inquiry.

This rhetoric of science and efficiency was soon adopted by other Australian intellectuals when praising American educational reforms and their value for Australian circumstances. The spread of American literature, coupled with the increasing number of Australians to visit the USA also helped to spread American notions of efficiency (Northcott 1918; Turner 1920; Megaw 1966; Churchward 1979; White 1981). In this context, the New Education movement provided an important conduit for Australia's leading public servants and educators to advocate their views and to influence the legislative and administrative framework for educational reform (Barcan 1988). The close association between scientific management and American educational reform was particularly appealing to middle class engineers, like the University of Sydney lecturer, S.H. Barraclough, as well as educational administrators, like Peter Board and James Nangle. All three were concerned about the need to reform the training methods offered by the Sydney Technical College (STC).

As had occurred in the USA during the first decade of the twentieth century, in NSW progressive university-trained engineers became prominent in education reform circles. Not only did their participation in the New Education Movement enabled them to influence the reform agenda but also to establish themselves as the rightful group to influence the practices of the engineering artisan. In this context they emphasised the connection between engineering and science by arguing for the elimination of the 'great rule of thumb' and the improvement of technical education, both of which they thought were critical to national efficiency and industrial development (Burge 1904: 7, 9–10).

Barraclough was especially vehement in extolling the value of emulating American educational reforms. In his 1905 Address to the Engineering Section of the Royal Society of NSW, he argued that the fulfilment of Australia's 'cherished' ideal of shorter hours, higher wages, restricted numbers of workers and limited output from them, made it imperative to amend its system of training, particularly since new scientific discoveries called for changes in methods and greater amounts of technical knowledge which could no longer be learned 'at the bench or in the shops' (Barraclough 1905). This was hardly surprising given that he had been taught by Robert Henry Thurston while studying for his Masters

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Degree at Cornell University's Sibley College of Engineering, between 1892 and 1894.[2] Thurston's influence, as the first engineer appointed Professor of Mechanical Engineering at the Stevens Institute of Technology was immense, not just on Barraclough but also F.W. Taylor, who obtained his Masters of Engineering from Stevens. Many years later, one of Taylor's supporters argued that Thurston's vision had 'found its most widely known expression in Frederick W. Taylor's classic paper on Shop Management' (Kimball 1917, 560–61). Like Taylor, Barraclough's vision for a reformed system of technical training promoted a greater sub-division of labour and the university-trained engineer's managerial role. In his view there were three 'clearly recognisable, although not sharply defined types' of labour in the community: the skilled and unskilled artisan; the foreman type; and the professional scientific type. To cater for the needs of all three types he proposed the introduction of a systematic scheme of instruction which would co-ordinate primary and secondary education on the one hand, and the University on the other, with the industrial life of the community (Barraclough 1905).

Barraclough's ideas on the stream-lining of education had much in common with those expressed by Peter Board (1909). Like the latter, Barraclough acclaimed the use of scientific methods in the university training given to engineers. In 1908, he promoted the adoption of continuous rolls of students, professional records of graduates and recording systems for technical stores by the P.N. Russell School of Engineering. To improve workshop training for students he proposed a systematically planned syllabus and the creation of distinct lines of authority for those who ran the engineering workshops and laboratories. He also recommended that 'a definite and detailed scheme be issued in writing defining the duties' of each of the Engineering School's attendants. Like Board, who had promoted timetables for primary education from 1903 and introduced them in 1906 (Board 1903; Snow 1991), Barraclough advocated time management in education. He therefore:

> regretted that the system of keeping Time Sheets in the Workshop has fallen through as it was an excellent object lesson for the students in the Shop, and a good check on the work that was being done and the cost of it. I think that some system of 'costing' should be introduced.[3]

Such ideas would be brought to fruition in the area of industry-related training by James Nangle following his appointment as Superintendent of Technical Education in 1913. It was Nangle who succeeded in ensuring the adoption of 'scientific' principles and methods, as elaborated by F.W. Taylor (Proudfoot 1984; Cobb 1986).

Reforming Technical Education

The new technical education scheme developed by Nangle, with Board's support, was approved by the Minister of Public Instruction on 28th November 1913, and it came into operation in February 1914 (Nangle 1915-16). By rationalising courses the scheme promoted closer relations between the Sydney Technical College (STC) and 'the various employers who subsequently engaged the services of the students trained' there. It also integrated technical education with the

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other branches of the Department of Public Instruction. Trade Schools were established for those who were already employed in a trade and who had 'a certain degree of preparatory knowledge'. Those who were not so endowed were first required to obtain certificates from either a Commercial Superior Junior Technical School or an evening Continuation Junior Technical School. Henceforth the main object of the STC would be 'the training, first of competent tradesmen, and secondly, of a more limited number of students who would fill the positions of foremen' (NSW Minister for Public Instruction 1914).[4]

The integration of such functional divisions between training institutions in a centrally-controlled but hierarchically-differentiated education system reinforced occupational divisions. Trade courses were linked to apprenticeships in ways that limited workers' theoretical knowledge, while at the same time restricting the more advanced courses that encompassed the 'technology of the various trades and technical professions' to those who were deemed to be 'capable of reaching positions such as that of foreman, works manager, or clerk of works'. Limited opportunities for working class mobility, for those who entered the field of engineering through traditional avenues, were also created through exemptions from first year university examinations for any 'special' students who performed well in the newly established 'sub-professional' diploma courses (Nangle 1914: 100, 102).

Industrial management methods were central to the scheme's administration and courses. Registration forms (effectively entrance tests) were introduced in the Trade Schools to select students on the basis of their literacy. Simultaneously, the STC also adopted new record-keeping procedures for courses in order to chronicle students' results, as well as 'their experience during their daily occupations'. The record-keeping system introduced by the College involved the use of 'job-cards' which included each student's name, roll-book number, the total hours of attendance per week, the number of the job exercise and the time allotted for completion. Spaces were also left on cards for students to enter dates and times when exercises were started and finished. The STC's job-cards were filled in after every exercise was completed. They not only enabled marks to be allocated for accuracy and general knowledge but, perhaps more importantly, for the time taken by each, individual student to complete their own personal tasks. In situations where cards were inappropriate, such as for lectures or practical work in laboratories, progress was measured by a time tested 'Quiz'. Marks were then recorded in a roll-book in which information from the job-cards was also collated. Finally, all such information was recorded on a summary card for each student and kept in the Record Office until the end of the year when examiners checked each student's progress. To bridge the gap between the classroom and the workshop, the information on these cards was also forwarded to employers who were invited to fill in a form 'giving a brief account of the work and progress of each apprentice during each half year' (Nangle 1914: 104-08). Such innovations were well received by the NSW Chamber of Manufactures' whose Council meetings Nangle attended to ensure support for his goals, among which he included adoption of the 'economy of motion'. As the Chamber's journal reported, students had to be taught the

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best and shortest way of doing a job because Australia's industrial conditions, especially the shortage of skilled workers, required 'the greatest amount of labour with the least possible expenditure of energy'. (*Australian Manufacturers' Journal [AMJ]* 25 November 1913: 4–5, 8, 12–13; 25 August 1916: 5, 36).

The reforms made to technical education complemented a range of reforms implemented by the University of Sydney. Under the terms of the *University Amendment Act*, 1912 tertiary education was infused with a utilitarian ethos. Like the STC, the University was pushed into closer association with the world of industry and commerce (Murray-Smith 1966; Barcan 1988). At the same time Nangle forged closer links between the Technical College and the University. To advise him on appointments, content of instruction, equipment and examiners, he formed course advisory committees that included trade union, industry and professional representatives and Technical College staff. One member of the Engineering Trades Committee was S.H. Barraclough (Nangle 1916; Barraclough 1914–15).

The reforms to educational administration implemented by Board, Nangle and Barraclough not only enabled workers to be selected, individualised and 'normalized' in the classrooms of technical colleges (Foucault 1987) but also drew on Taylor's methods and principles to separate planning of work from its execution across educational institutions and to define which social groups should provide training. In this way, they helped to translate Barraclough's vision of a functional division of labour into practice in the educational sphere, while complementing the divisions that were gradually being implemented in industrial workshops.

Reforming Adult Education

Middle class interest in workers' education pre-dated the educational reforms outlined to this point in the discussion. In fact, Australian University Extension Boards began providing lectures for workers from 1886 at far-flung workplaces, including the goldfields and shearing sheds, as well as at Railway Institutes, Workmen's Literary Clubs in mining districts and even Trades Hall in Sydney (Friesen and Taksa 1996). Their attention to workers' education increased substantially during the first decade of the twentieth century, partly in response to developments in Britain and partly as a result of the momentum of the New Education Movement. Here, too, Peter Board played a pivotal role in creating the legislative and administrative framework for the formation of a Workers' Educational Association (WEA) on the model established in Britain in 1903 (Barcan 1988). He was not the only one to show an interest in emulating this imperial model. A number of prominent Australians were spurred into action, particularly after a Conference held at Oxford University in 1907 resulted in the adoption of the university tutorial class system, which strengthened links between the WEA and English universities (Mainsbridge 1920).

One particularly influential Australian to promote the adoption of this scheme was the eminent public service reformer, member of the Sydney University Extension Board and future Professor of Economics, R.F. Irvine who,

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together with Board, obtained the support needed to introduce the scheme after the first Labor Government was elected in NSW in 1910. Both men's aspirations appeared to coincide with Labor's commitment to educational reform and enhanced educational opportunities for workers (Friesen and Taksa 1996). In 1912, the Government provided the legislative framework and funding needed to establish the WEA and also the WEA-University Joint Tutorial Classes (Barcan 1988), which not only provided the labour movement with an opportunity to influence the subjects taught to workers', but also gave middle class professionals a central role in the administration and leadership of this model of adult education (Whitelock 1974).

The Australian branch of the WEA, which was formally established in 1913, offered middle class professionals an avenue for promoting 'useful' knowledge to support their vision of industrial development and social harmony. For those like Director of Education Peter Board, Professors R.F. Irvine and Francis Anderson, F.A. Bland, and Justices G. Heydon and A.B. Piddington, the WEA's guiding principle of 'non-partisanship' was an essential precondition for making it a 'common meeting ground to all' (WEA 1914: 24–25). These men helped to create the WEA's institutional structures, taught its classes and organized and participated in its conferences because such activities enabled them to publicise middle class values and practices among workers who were becoming increasingly militant and politically influential.

The inauguration of classes on industrial history, initially taught by Professor Irvine, attracted a large number of workers[5] (Alexander n.d.) and a subsequent course on industrial law attempted to fulfil the 'strictly utilitarian' educational demands of unionists (WEA 1914, 1915, 1916). But despite the initial collaboration between the WEA's labour movement and professional middle class members, the organization rapidly became a contested terrain that centred on a national efficiency campaign in which the shadow of F.W. Taylor loomed large.

National Efficiency, Scientific Management and the WEA

The pursuit of national efficiency responded to the disruptive impact of World War One on domestic economic conditions, living standards and social relations, which heightened a sense of deprivation and exploitation among workers and increased their industrial mobilisation (Turner 1979; Macintyre 1986). At the same time middle class professionals responded to the war and the rapid escalation in working class militancy by uniting to prosecute the war effort. As was occurring in the USA, efficiency was transformed into 'a patriotic duty' (White 1981: 134–5; Kanigel 1997: 486–7).

In Australia, the National Efficiency campaign launched in early 1914 by Victoria's Commissioner for Public Works, F. Hagelthorne, provided an important channel for the diffusion of the social harmony gospel associated with scientific management. Although it focused on promoting Empire loyalty, this campaign also drew extensively on progressive networks between Australia and the USA, and advocated the emulation of American scientific and industrial

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achievements as the best means for prosecuting the war effort.[6] At its helm were leading public servants and academics who were simultaneously associated with the Australian Round Table and the WEA-University Joint Tutorial Committees, the most prominent being Peter Board, R.F. Irvine, G.H. Knibbs, Professor Edgeworth David, H.B. Higgins, Meredith Atkinson, G.V. Portus, F.W. Eggleston and Gerald Lightfoot (Harris 1914; Foster 1986).

The campaign itself was inaugurated with a series of lectures on 'Industrial Efficiency' in which Professor Irvine played a particularly prominent role. In his own presentation Irvine argued that the crisis of war called for the inauguration of special organisation 'for the efficient use of all our resources of men and material' (Irvine 1915: 5) and further that, scientific management principles and practices provided the best remedy for Australia's inefficiency, its waste of natural and human resources and its need for 'more effectual training of the population'. Unfortunately, Irvine informed his audience, this system's aim of reducing costs and stimulating industrial energy had generally been misunderstood in Australia. Accordingly, he suggested that education be employed to overcome the prevailing negative attitude to it (Irvine 1915).

In fact, all the speakers in this lecture series saw a crucial link between the further training of workers and the triumph of scientific management over labour's ability to restrict output. They echoed F.W. Taylor's argument that workers had to be made to see the fallacy of their belief that increased production inevitably reduced employment and they strongly advocated the adoption of scientific education, one of Taylor's four principles. For Meredith Atkinson, Lecturer and Organiser of the Sydney University Tutorial Classes from 1913, scientific education provided the best way of eliminating workers' antipathy to efficiency methods. By emphasising the value of persuasion rather than compulsion, Atkinson echoed the views expressed earlier by Josephine Goldmark, one of Taylor's progressive supporters in the USA (Taylor, 1911a; Goldmark 1912; Atkinson, 1915; Irvine, 1915).

The war reinforced the urgency for changing those attitudes and practices that enabled workers to take collective industrial and political action and that therefore threatened to undermine the quest for national efficiency. These circumstances encouraged the advocacy of F.W. Taylor's philosophy and a desire to transform it into 'a "general conception of life" for the masses' (Boggs 1976: 39). The conference on 'Trade Unionism in Australia' organised by Atkinson in 1915, under the auspices of the WEA, the Economic Research Society of Sydney and the Labor Council of NSW, provided a perfect medium. Here, too, F.W. Taylor cast a long shadow over Atkinson, Irvine, F.W. Eggleston and Gerald Lightfoot all of whom decried the trade unions' antipathy to efficiency methods generally and more specifically, to 'the new school of scientific management'(Irvine 1915b: 33–35; Hoxie 1915). As Eggleston put it, 'We have our higher wages, our increased comfort, and the like; but we have not inaugurated a new order'. In his view there was a great need for a general re-organisation of industry and a 'revolutionary change in the relations of employer and employee' (Eggleston 1915: 80–81). In short, he wanted a Taylorian 'mental revolution' (Taylor 1895).

This language of efficiency provided middle class reformers with an important vehicle for promoting social harmony. Its permeation of the WEA did not, however, achieve this goal. The cultural battle to diffuse Taylor's philosophical innovations through educational and industry-related training programs as a means of transforming the popular 'mentality' was stopped short. Unlike the students who encountered the scholastic program infused with scientific management methods and principles in school, college and university classes, those who attended WEA courses were under no compulsion to adopt the Taylorian world-view. Involvement with the WEA was voluntary and workers certainly voted with their feet. The numbers attending tutorial classes rapidly diminished. In NSW, the forty-five union officials enrolled in classes dropped to twenty-two in 1916–1917 and by 1923 this group was down to three. Against this backdrop, the WEA began to focus increasing attention on promoting scientific management education to those who aspired to professional occupations, including teaching and management (Joint Committee For Tutorial Classes 1917, 1923; Taksa 1991, 2003). In 1917, it published Bernard Muscio's lectures on 'Industrial Psychology', which were little more than a summary of scientific management principles and practices (Muscio 1917) and which was used for teaching philosophy and psychology to aspiring professionals. Two years later, those who had earlier preached national efficiency used the WEA's conference on Adolescent Education to focus specifically on further education, vocational fitness and vocational selection (Phillips 1919). For Peter Board these methods provided a way of overcoming 'the greater influences of the street corner, the workshop' and 'other aspects of the worker's social life' (Board 1919: 23). Here, too, Irvine disparaged the way workers drew conclusions about economic subjects, from 'newspapers, public meetings, and club talk'; mediums, which he thought 'distorted or poisoned the popular mind'. For Irvine, only an understanding of 'Economics as a science' and the adoption of 'a science of business administration … molded (sic) by Economics and scientific management' would facilitate social integration. Irvine's advocacy of scientific management rested on the belief that the application of scientific analysis to industrial problems challenged what he referred to as 'traditional systems' (Irvine 1919: 40, 43). Such views were also reinforced in Elton Mayo's *Democracy and Freedom: An Essay in Social Logic*, which was also published by the WEA in 1919 and which criticised the way that Labor Governments had undermined 'mutual understanding' through 'the device of State control' over industrial relations (Mayo 1919: 13). For men like Mayo (1919: 16, 30, 38–39, 50–51) the only solution for 'wrong conception of the group-interest' was political education.

Conclusion

Scientific Management not only had an impact on the organisation of work but also of the training and education of workers and their managers. Its transfer to Australia involved far more than the geographical relocation of Taylor's methods and their implementation. This aspect of the system was diffused as part of an amalgam of philosophy and principles and its locus extended beyond the industrial workplace to the school, the technical college, the universi-

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ty and the institutions of adult education. Those middle class professionals who infused scientific management into the administration and content of a variety of training and educational programs saw the system as a means of shaping the human capital acquired by different social groups and of inculcating a new world view based on the notion of social harmony.

Their efforts certainly succeeded in institutionalising the '"scholastic programme" or set of principles' (Boggs 1976: 39) advanced by Taylor. Management and education were certainly nailed together on the masthead of efficiency. The assessment measurement techniques and goals of education promoted by the educational reformers who championed Taylor's philosophy, principles and methods and implemented them in the USA and Australia are evident today in the programs offered by most business schools and universities.

Notes

[1] Some examples are provided in: Correspondence between George Beeby and Frederick W. Taylor, 1912 and Correspondence between Charles G. Heydon and Birge Harrison and Frederick W. Taylor, 1914 in Frederick W. Taylor Collection, Samuel C. Williams Library, Stevens Institute of Technology, New Jersey; Correspondence, H.B. Higgins to Felix Frankfurter, 1914 and 1915 in Higgins Collection MS.2525, Australian National Library.

[2] Correspondence, S.H. Barraclough to Professor Robert Henry Thurston, Series 3, Folder 3, Sir S.H.E. Barraclough, Personal Papers, Group P.10, University of Sydney Archives.

[3] Memorandum to Professor Warren on the General Organisation of the Engineering School from S.H. Barraclough, 24-09-1908, Barraclough Papers, Sydney University Archives.

[4] Report of the Minister of Public Instruction for the Year 1913, *NSW Parliamentary Papers*, Vol. 1, Part 1, 1914, p. 19.

[5] In the year 1914–1915, recorded participants included: 45 trade union officials, 15 miners, 10 carpenters, 6 plasterers, 4 boot operatives, 37 from engineering and mechanical industries and 7 shop assistants, as well as 40 teachers, 46 involved with clerical occupations and 36 with household duties.

[6] Correspondence: William C. Redfield to Frederick Winslow Taylor, 5 November 1914; Correspondence: J.C. Morrell to F.W. Taylor, 10 November 1914; Frederick W. Taylor Collection, Samuel C. Williams Library, Stevens Institute of Technology, New Jersey.

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