ABSTRACT  There is a lack of empirical data on the ability and achievement characteristics of Australian university students seeking accommodation under the Disability Discrimination Act because of Specific Learning Disabilities (SLD). A series of 30 self-referred students was assessed individually using an extensive test battery (WJ-R) based on a modern, comprehensive model of intelligence and achievement. Comparisons with known characteristics of North American students with and without SLD are reported as well as individual profile patterns relevant to definitions of SLD. Intra-cognitive weaknesses were found in cognitive processing speed, memory, auditory and visual intelligence. Contrary to expectation, reading was not an area of weakness. As expected, basic writing skills were poor for many students (18 out of 30). The variability of profile patterns requires an individualised approach to assessment, careful translation into recommendations, and ongoing evaluation of learning outcomes.

Introduction

In recent years there has been an increasing focus on supporting students with Specific Learning Disabilities (SLD) in Australian universities, mostly as a consequence of the Disability Discrimination Act enacted in 1993 by the Australian Commonwealth Government, a law which provides for the fair and equitable treatment of individuals with disabilities. One concern in the development of disability policies in tertiary education settings has been the issue of how best to identify students with SLD in order to confirm their eligibility and suitability for special support services and accommodations. Many universities have reported difficulties in developing appropriate assessment and treatment protocols because of a relative lack of empirical research on the characteristics of university students with SLD in general and Australian students self-referring with these problems in particular (McLean, Bruce, & Powell, 1995).

In 1995 the University of Melbourne (in conjunction with Monash University) received Commonwealth Government funding to establish the Learning Disabilities
in Higher Education Project (McLean et al., 1995). The project officers strongly endorsed the US National Joint Committee for Learning Disabilities (1988) definition as the “best available for use in identifying learning disabilities amongst students in Australian universities” (McLean et al., 1995, p. 10). The definition suggests that learning disabilities are a heterogeneous group of disorders which are manifested by severe underperformance on specific learning tasks such as reading and writing, and that the disorders are presumed to be intrinsic to the individual. The project (McLean et al., 1995) also endorsed the use of Brinckerhoff, Shaw and McGuire’s (1993) model for assessing SLD in post-secondary educational settings that recommends that specific academic failure be confirmed as intrinsic to the individual by identifying limitations in basic cognitive processes. While stressing the need for verifiable assessment that is based on shared definitions of SLD, the University of Melbourne project has not yet published any new empirical data on the ability and achievement characteristics of this special group of students.

The only published empirical study, which has investigated ability and achievement characteristics in Australian university students with SLD, was conducted at the Schonell Special Education Research Centre at the University of Queensland. It provided a broad assessment of the psychosocial and educational situation of 22 Australian students with self-referred specific learning disabilities (SR-SLD hereafter). These researchers recommended the use of a formal assessment battery directed at assessing “reasoning skills most relevant to tertiary success (verbal, mathematical and abstract reasoning), as well as an assessment of current functioning in the areas of reading, writing and spelling” (Smith & van Kraayenoord, 1994, pp. 8–9). During the period 1990 to 1994 they administered such an assessment battery to 22 students with SR-SLD who attended the University of Queensland and the nearby Griffith University. The results were presented as the total number of students in various score intervals on each measure. They were informative in so far as they indicated some poor performances in writing and spelling. Overall however, the study results were somewhat limited in that they did not assess a more comprehensive set of basic cognitive processes and did not present the individual patterns of strengths and weaknesses for each student. The report explained that a combination of information about background history, current difficulties, and test results was used to classify students as learning disabled (14 out of 19), but did not provide details on how this was achieved.

The only other empirical report that could be located in Australia was a thesis presented at the University of Western Sydney (O’Brien, 1996). Seventeen students were tested with the WAIS-R (Wechsler, 1981). Tests of reading, spelling, and writing speed were also administered and many poor performances noted. Like in the Queensland study, the achievement tests were not co-normed with the measures of cognitive performance (WAIS-R). Consequently, any conclusions from these reports that refer to discrepancy definitions of SLD must be seen as limited by the fact that the tests that are compared were normed in different populations (and sometimes not even a student or analogous young adult population).

Given the scarcity of empirical data on Australian university students with SR-SLD, the current study set out to further clarify the expected and actual
characteristics of Australian students with SR-SLD, some of whom may well have SLD as the cause of their academic concerns. In seeking clarification of the expected characteristics of university students with SR-SLD, it was necessary to turn to research conducted in other English-speaking countries, with studies conducted in the USA being the most informative. In that country a large number of studies have been conducted on children with SLD, but there too, much less was known about young adults, particularly those in tertiary education settings. Nonetheless, several studies could be identified which focused specifically on university students with SLD, namely Cordoni, O’Donnell, Ramaniah, Kurtz, and Rosenshein (1981), Cowen (1988), Dalke (1988), Morris and Leuenberger (1990), Salvia, Gajar, Gajria, and Salvia (1988) and Vogel (1986). The difficulty of doing research with this very select group of university students was clearly demonstrated by the small sample sizes obtained for these studies, namely 57, 25, 36, 74, 74, and 31 students with SLD, respectively. Mostly, these researchers adopted a “psycho-educational” framework, i.e. they examined the cognitive abilities of students with average or above average intelligence who presented with histories of severe underperformance in one or more areas of basic academic achievement. The following paragraphs highlight some of the main findings from these studies and relate them to the few details known about Australian university students with SLD.

Focusing on measures of achievement first, four areas of performance are clearly important to university success. Reading, writing and mathematics are most obvious in this regard. General knowledge is also informative because it reflects the success of the student in acquiring knowledge in both formal and informal learning settings. The American research by Cowen (1988), Dalke (1988), and Morris and Leuenberger (1990) suggested that reading and written language are likely to be areas of relative weakness, whereas mathematics and general knowledge are likely to be areas of relative strength in tertiary students with SLD. In Australia, Smith and van Kraayenoord (1994) identified slow reading speed, reading errors, and lack of comprehension as problems in over half of the students they tested. They also found that 9 out of 22 students obtained spelling ages below 14 years. Only 12 students were tested on writing mechanics, but all scored below the 50th percentile. However, writing composition results were evenly distributed, with half of the 12 students tested scoring above the 50th percentile. Numerical ability below the 25th percentile was found in 8 out of 22 students. General knowledge was not assessed.

Turning to research next that assessed the cognitive characteristics of university students with learning difficulties, several of the North American studies reported their findings in terms of strengths and weaknesses across four categories that were first proposed by Bannatyne (1968, 1971, 1974) [1]. Cordoni et al. (1981), Morris and Leuenberger (1990), Salvia et al. (1988), and Vogel’s (1986) studies showed that tertiary students with SLD consistently performed worst on Bannatyne’s Sequential category (which mostly includes short-term acquisition and retrieval, as well as cognitive processing speed), and performed best on Bannatyne’s Verbal Conceptualisation (which mostly includes crystallised intelligence) as well as his Spatial category (which mostly includes broad visual intelligence). Beyond the findings on the Bannatyne categories, Cowen (1988) used the Woodcock-Johnson Psycho-Educational Battery to show that tertiary students with SLD performed
worst on measures of cognitive processing speed and memory (including short-term acquisition and retrieval as well as long-term storage and retrieval), and that they did best on measures of reasoning (including crystallised intelligence and fluid reasoning). Also, Morris and Leuenberger (1990) found that tertiary students with SLD performed poorly on measures related to broad auditory intelligence.

In Australia, Smith and van Kraayenoord (1994) found that 16 and 13 out of their 22 students performed on the 50th percentile and above on measures of verbal and abstract reasoning, respectively. Unfortunately they did not assess any of the other basic cognitive skills shown to be relevant in the American studies. As mentioned before, while American SLD students performed relatively best on tests of Ban-natyne’s Verbal Conceptualisation and Visual category, they showed poor performance on Sequential category tests. Finally, O’Brien (1996) tested 17 students in Sydney and 12 of these showed a significant discrepancy between WAIS-R verbal and performance test results. Kaufman (1990, p. 285) pointed out that while learning-disabled children and adults often receive significantly better performance than verbal IQ scores (i.e. P > V), it has been found that “learning disabled college students fail to demonstrate the P > V profile, perhaps because they have managed to achieve despite their learning disability”. In line with Kaufman’s (1990) conclusion, O’Brien (1996) found only three students with significant P > V discrepancies, but five with no discrepancy, and nine students with the reverse pattern, i.e. significant P < V discrepancies.

The present study had three major aims. Given the relative scarcity of research on university students with SLD the first aim was to study a new sample and to provide a broad and comprehensive assessment of the cognitive processes that may be at the root of their study problems. Secondly, it sought to gauge the extent to which the American literature may be relevant to understanding Australian students with self-referred SLD by identifying similarities and differences between a new sample of Australian students and samples of North American university students with SLD. Third, it aimed to examine individual patterns of strengths and weaknesses in cognitive abilities and achievement and assess their consistency with discrepancy definitions of specific learning disabilities.

In approaching the first goal it was considered essential that any investigation into underlying cognitive deficits was grounded in a modern model of intelligence that also allowed for a cognitive processing account of test performance. Such a model was available in the Horn-Cattell “Gf-Gc” theory of fluid and crystallised abilities (Horn & Cattell, 1966; Horn, 1991). This theory has gained widespread acceptance as a model capable of integrating the vast database generated by intelligence research over the last 60 years or more (Kaufman, 1990; Woodcock, 1993). The model presents an information-processing hierarchy of functions that parallel intellectual development (Horn, 1985). At the highest level of functioning fluid reasoning and comprehension-knowledge allow for deep processing of information. This in turn, is based on visual and auditory processing and influenced by processing speed. At the earlier level short- and long-term memory functions are developed based on visual and auditory reception. Seen within this framework, it was clear that Smith and van Kraayenoord (1994) only assessed the highest level of functioning. However, as the
research reviewed before has shown, sequential processing can be poor at the same time as higher order thinking is essentially intact. Horn (1985, p. 296) pointed out in a similar vein that abilities near the bottom of his hierarchy have low correlations with abilities near the top. Therefore, the first goal of the current study was to examine a full range of cognitive abilities and processes in students with SR-SLD.

The second goal of comparing Australian students with SR-SLD with North American tertiary students with SLD was approached by formulating two hypotheses based directly on the research reviewed before. The first predicted that the order of mean scores in the four areas of basic academic achievement would indicate reading and written language as the relatively worst performances, whereas mathematics and general knowledge would be indicated as the best performances. The second hypothesis predicted that the order of mean scores on seven cognitive abilities would show long-term storage and retrieval, short-term acquisition memory and retrieval, cognitive processing speed, and broad auditory intelligence to be the relatively worst performances, whilst broad visual intelligence, crystallised intelligence and fluid intelligence would show up as the relatively best performances.

The third goal was to be approached by examining the extent to which the pattern of strengths and weaknesses for each individual was consistent with three widely recognised definitions of SLD that were based on intra-individual score comparisons, namely, intra-cognitive, intra-achievement, and aptitude/achievement discrepancies (Woodcock, 1984). The first two discrepancies identify widely divergent scores in basic areas of cognitive ability and academic achievement by comparing the score on the weak area with the average of the scores in the other areas. The third discrepancy compares the obtained score in the weak area of basic academic achievement with a predicted score in the same area of achievement based on a student’s average score on highly correlated cognitive abilities. While there may always be debate about optimal indicators of SLD, this study was going to follow Mather (1993) and treat the first discrepancy as a primary indicator of SLD, whereas the other two were going to be treated as secondary indicators.

**Method**

**Participants**

The participants were 30 students with SR-SLD who were studying at the Australian National University or the University of Canberra during two consecutive years. Both universities are located in Canberra, which is the national capital of Australia. The participants included 12 females and 18 males, with an average age of 27 years. The breakdown by year of study showed eight students in first year, eight in second year, eight in third year, and five in fourth year. The remaining student was completing a doctorate degree. The students obtained broad cognitive ability scores (the unweighted combination of scores on the WJ-R cognitive ability tests) that were all within one standard deviation of the mean score for the normative population of first year university students. All students were Caucasians and spoke
English as their first language, and all reported family backgrounds free of poverty and deviance.

Twenty of the students had been aware of learning difficulties since primary school, while the remaining ten became aware of study problems in high school. Six students reported that a psychologist or school counsellor had formally diagnosed them with SLD in the past. Six students reported that they had repeated one or more years of primary school or junior high school, and three had received special tuition as a consequence of their learning problems. None of the students remembered serious physical conditions in their medical histories, although four reported difficult birth procedures and three short periods of unconsciousness due to sporting accidents as children. No students presented with socio-emotional difficulties.

Fourteen of the students had completed a post-secondary school qualification prior to their present degree study. Twenty-four of the students reported a normal progression through their present degree course. Only one student had a record of fail grades in his first year of study. When asked about their present difficulties 22 reported problems in written language skills, 11 reported problems in mathematical skills and 10 reported problems in reading skills.

Measures

The WJ-R or Woodcock-Johnson Psycho-Educational Battery-Revised (Woodcock & Johnson, 1989, 1990) was used to measure the cognitive and achievement profiles of the study participants. The WJ-R was normed in the USA using a nationally representative sample of over 6000 subjects in the age range 24 months to 95 years. Most important for the current study, separate norms were provided for tertiary students.

The WJ-R was chosen because it provided direct measures of seven cognitive abilities selected for the present study as a consequence of being based on the Horn–Cattell Gf-Gc theory (fluid and crystallised abilities) of multifaceted intelligence (Horn & Cattell, 1966). The WJ-R also had the advantage of providing measures in four areas of basic academic achievement, namely reading, written language, mathematics, and general knowledge. Most important for the calculation of ability/achievement discrepancies, the ability and achievement batteries were normed together on the same population. The WJ-R has been reviewed by one of the most highly respected experts in this area: Kaufman (1990, pp. 602–604) evaluated the WJ-R as being “incredibly comprehensive” with “excellent psychometric properties”. He also commented very favourably on the originality of the test construction, large standardisation sample, strong factor analytic support for construct validity, excellent reliability and statistical sophistication.

Procedure

The participants were referred to the study by the Australian National University Disability Adviser and the University of Canberra Equity Officer (Disability). Both officers were responsible for arranging support for students with disabilities, includ-
Australian University Students with SR-SLD

During the years 1994 and 1995 the officers routinely informed all students with SR-SLD about the study. Thirty of the 40 students who presented to disability support staff with SR-SLD during the period of the study volunteered to be assessed.

The first part of the assessment procedure involved completion of a mailed out questionnaire included in the information pack sent to all prospective participants. The questionnaire required the students to provide details of their current study (faculty, degree, year of study, subjects and grades), past education (major subjects and grades), and details pertaining to learning difficulties (e.g. when first aware of problems, kind of problems, previous assessments and previous attempts at remediation).

Participants then attended five hours of psychological assessment. Normally the testing was divided into two sessions on separate days to reduce fatigue and maintain interest. The first session of about three hours began with the gathering of background details (family history of learning disabilities, medical history and experiences in primary and high school). The first session then proceeded to the administration of the first 14 cognitive ability tests contained in the WJ-R Cognitive Battery. The second session of about two hours was used to administer the first nine tests contained in the WJ-R Achievement Test Battery.

All subjects were tested by a Masters level Clinical Psychologist (S. L.) who had received extensive training in psychometrics and test administration. He also held a degree in Special Education. All participants received the tests in strict accordance with the standardised administration procedures to ensure that comparisons with the other participants as well as the normative student population were valid.

The final part of the study procedure entailed a one-hour interview with each student to explain the results of the assessment. Immediate reactions to the assessment were carefully noted, and additional counselling was provided when necessary. Students were encouraged to discuss their reports with their disability officers.

Results

The group profile on the four areas of basic academic achievement was analysed using a Multivariate Analysis of Variance (Manova) approach. The first part of the analysis was the omnibus test of flatness. The second part of the analysis was to conduct the appropriate contrasts for the flatness tests using simple one-sample $z$ tests against the norming population mean of 100 and standard deviation of 15. The tests were conducted with a correction for post hoc inflation of experiment wise Type 1 error rates, that is, an experiment wise alpha of $p = 0.05$ was achieved by setting alpha for each comparison at $p = 0.0125$.

Table 1 shows the means and standard deviations for the group of SR-SLD students. The order of average standard scores on the four areas of basic academic achievement (from best to worst) was reading, general knowledge, mathematics and written language. The scores on the four areas of academic achievement were found by Hotelling’s criterion to deviate significantly from flatness, $F(4, 26) = 48.25$,
TABLE 1. Means, standard deviations, and z score comparisons with the WJ-R university student population means

<table>
<thead>
<tr>
<th>Basic achievement area/Cognitive ability</th>
<th>Mean standard score</th>
<th>Standard deviation</th>
<th>Z Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading</td>
<td>110.67</td>
<td>11.48</td>
<td>3.894*</td>
</tr>
<tr>
<td>Knowledge</td>
<td>106.17</td>
<td>11.69</td>
<td>2.252</td>
</tr>
<tr>
<td>Mathematics</td>
<td>103.07</td>
<td>14.63</td>
<td>1.120</td>
</tr>
<tr>
<td>Written language</td>
<td>89.23</td>
<td>11.64</td>
<td>-3.931*</td>
</tr>
<tr>
<td>Crystallised intelligence</td>
<td>114.90</td>
<td>13.16</td>
<td>5.440*</td>
</tr>
<tr>
<td>Fluid intelligence</td>
<td>110.43</td>
<td>10.68</td>
<td>3.809*</td>
</tr>
<tr>
<td>Broad visual intelligence</td>
<td>108.73</td>
<td>13.42</td>
<td>3.188*</td>
</tr>
<tr>
<td>Short-term acquisition &amp; retrieval</td>
<td>95.70</td>
<td>13.97</td>
<td>-1.570</td>
</tr>
<tr>
<td>Broad auditory intelligence</td>
<td>94.67</td>
<td>12.53</td>
<td>-1.947</td>
</tr>
<tr>
<td>Long-term storage &amp; retrieval</td>
<td>94.53</td>
<td>10.27</td>
<td>-1.996</td>
</tr>
<tr>
<td>Cognitive processing speed</td>
<td>89.87</td>
<td>16.75</td>
<td>-3.700*</td>
</tr>
</tbody>
</table>

* p < 0.05 after Bonferroni corrections.

p < 0.001. The results of the one-sample z tests are also shown in Table 1. On average, the students showed significantly lower scores than the WJ-R normative tertiary student population on written language. They showed significantly higher scores than the normative tertiary student population on reading. The scores on mathematics and general knowledge did not differ significantly from the normative tertiary student population.

The group profile on the seven areas of cognitive ability was also analysed using the Multivariate Analysis of Variance approach. The Manova was conducted in the same way as for the academic achievement scores. The appropriate contrasts following the omnibus test of flatness were conducted with a correction for post hoc inflation of experiment wise Type 1 error rates, that is, an experiment wise alpha of p = 0.05 was achieved by setting alpha for each comparison at p = 0.0071.

The second part of Table 1 shows that the order of average standard scores on the seven areas of cognitive ability (from best to worst) was crystallised intelligence, fluid intelligence, broad visual intelligence, short-term acquisition and retrieval, broad auditory intelligence, long-term storage and retrieval, and cognitive processing speed. The scores on the seven areas of cognitive ability were found by Hotelling’s criterion to deviate significantly from flatness, $F(7, 23) = 24.42$, $p < 0.001$. The results of the one-sample z tests showed significantly lower scores than the WJ-R normative tertiary student population on cognitive processing speed. They also showed significantly higher scores than the normative tertiary student population on crystallised intelligence, fluid intelligence and broad visual intelligence. The scores on long-term storage and retrieval, short-term acquisition and retrieval, as well as broad auditory intelligence did not differ significantly from the normative tertiary student population.

The intra-cognitive, intra-achievement and aptitude/achievement discrepancies
present within each student’s test score profile were assessed using the $\pm 1.5$ criterion for the standard deviation of difference scores based on the discrepancy norms provided by the WJ-R for first year university students, as recommended by McGrew (1994). For each area of basic academic achievement and for each cognitive ability, this criterion identified those scores which were more than one and a half standard deviation units below the level of performance predicted from the remaining achievement or ability scores. For the aptitude/achievement discrepancy this criterion identified those scores on basic academic achievement which were more than one and a half standard deviation units below the level of achievement predicted from the four most highly related cognitive abilities. Discrepancies of more than $-1.50$ standard deviation units were found in about 6.5 per cent of the norm population of first year tertiary students.

The results of this analysis are shown in Table 2. The first line in the Table shows that five students presented with a significant intra-cognitive discrepancy in cognitive speed of processing. For these five students, as few as 6.5 per cent of the normative population of first year university students with the same average level of performance on the other cognitive abilities scored as low or lower on cognitive speed of processing. These five students also presented with a significant intra-achievement discrepancy in written language, which means that as few as 6.5 per cent of the normative population with the same average level of performance on the other areas of basic academic achievement scored as low or lower on written language. The final result is that three of these five students showed a significant aptitude/achievement discrepancy in written language. This means that as few as 6.5 per cent of the normative population with the same average level of performance on those cognitive abilities which best predict written language achievement, scored as low or lower on written language.

The rest of Table 2 can be read in the same way. In each case where a specific discrepancy is noted for a subgroup, the performance was significantly lower than expected and aptitude/achievement discrepancies refer to a significantly lower performance in the area indicated for the subgroup in the intra-achievement discrepancy column. Several patterns were observed across the three indices of a possible SLD. For example, relatively low processing speed could be associated with relatively low performance in written language, mathematics, or no relative problem in any area of achievement measured in this study. Another notable pattern was evident for nine students who did not exhibit any significant intra-achievement discrepancy or aptitude/achievement discrepancy, despite showing significant weaknesses on tests of cognitive processing speed, broad auditory intelligence, short-term acquisition and retrieval, or long-term storage and retrieval. Finally, it can be noted that where students displayed intra-achievement discrepancies, it was almost always their written language performance that was poorer than expected, given their other achievements.

In summary of the findings on significant discrepancies, 25 of the 30 students exhibited a significant intra-cognitive discrepancy, many involving cognitive speed of processing. Twenty-one students showed a significant intra-achievement discrepancy, 18 in written language and three in mathematics. Sixteen students
Table 2. Number of students with significant intra-cognitive, intra-achievement, and aptitude/achievement discrepancies

<table>
<thead>
<tr>
<th>Number of students</th>
<th>Intra-cognitive discrepancy</th>
<th>Intra-achievement discrepancy</th>
<th>Number with aptitude/achievement discrepancya</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Cognitive processing speed</td>
<td>Written language</td>
<td>3 out of 5</td>
</tr>
<tr>
<td>3</td>
<td>Cognitive processing speed</td>
<td>Mathematics</td>
<td>2 out of 3</td>
</tr>
<tr>
<td>4</td>
<td>Cognitive processing speed</td>
<td>Nil</td>
<td>Nil</td>
</tr>
<tr>
<td>3</td>
<td>Broad auditory intelligence</td>
<td>Written language</td>
<td>2 out of 4</td>
</tr>
<tr>
<td>2</td>
<td>Broad auditory intelligence</td>
<td>Nil</td>
<td>Nil</td>
</tr>
<tr>
<td>3</td>
<td>Short-term acquisition &amp; retrieval</td>
<td>Written language</td>
<td>2 out of 3</td>
</tr>
<tr>
<td>2</td>
<td>Short-term acquisition &amp; retrieval</td>
<td>Nil</td>
<td>Nil</td>
</tr>
<tr>
<td>2</td>
<td>Long-term storage &amp; retrieval</td>
<td>Nil</td>
<td>Nil</td>
</tr>
<tr>
<td>1</td>
<td>Broad visual intelligence</td>
<td>Written language</td>
<td>Nil</td>
</tr>
<tr>
<td>5</td>
<td>Nil</td>
<td>Written language</td>
<td>3 out of 5</td>
</tr>
</tbody>
</table>

a Aptitude/Achievement discrepancies are in the area of basic academic achievement indicated under Intra-Achievement discrepancies.

presented with both intra-cognitive and intra-achievement discrepancies. Twelve of the 30 students presented with a significant aptitude/achievement discrepancy, with 10 out of 12 receiving significantly poorer scores for their written language than expected on the basis of their abilities.

Discussion

The present study was limited in that it did not implement strict selection procedures for the study participants. All the students who volunteered for the study were accepted, regardless of the nature and severity of their learning difficulties. There was no requirement for them to have a formal prior diagnosis of SLD (although some had). Given the paucity of empirical data on students with SR-SLD in Australia and the fact that they had all asked for assistance and possible accommodation under the Disability Act, the acceptance of all volunteers into the study was seen as justified. However, the participation rate in the study was only 75 per cent. It is possible that some or all of the ten students who did not volunteer to take part in the study possessed a completely different set of academic achievement and cognitive ability characteristics.

In relation to the first study goal of gaining a broader understanding of the cognitive difficulties experienced by tertiary students with SR-SLD, the order of mean scores on a well-developed and standardised test battery showed a tendency to be less proficient at short-term acquisition and retrieval, long-term storage and retrieval, cognitive processing speed and broad auditory intelligence, in combination
with a tendency to be most proficient at tasks demonstrating broad visual intelligence, and crystallised as well as fluid intelligence. Such a pattern suggests that most of these students were going to do relatively well in their university studies, because their strengths were in the higher order reasoning skills known to be predictive of success at university (McGrew, 1994). However, their capabilities in memory, cognitive processing speed and broad auditory intelligence did not match their reasoning skills. Consequently they may perceive themselves to be handicapped in routine study tasks such as note-taking in lectures, information gathering from texts, assignment writing and examinations, at least in terms of time taken and error proneness.

When compared with North American tertiary students with SLD, the order of mean scores found in the four areas of basic academic achievement was not entirely consistent with the study prediction. The most notable difference was the finding that the mean performance on reading was above average in comparison to the norm population of tertiary students. This finding is discrepant from the North American research that showed tertiary students with SLD performed relatively poorly on reading achievement (Cowen, 1988; Dalke, 1988; Morris & Leuenberger, 1990). One of the many possibilities that may explain this finding involves the selection procedures at Australian universities in comparison to North American colleges, which may work to exclude poor readers but not poor writers. Another possibility is that poor writers are more likely than poor readers to present to support services for assistance with their learning difficulties. However, no data is available to judge these suggestions.

Despite differences in reading performances, the Australian students appeared to be similar to their North American counterparts in showing a mean score on written language that was below average in comparison to the norm population of first year university students. More detailed analyses demonstrated that these results were mostly based on poor spelling, punctuation, capitalisation and word usage. However, in line with their generally high reasoning skills, students were still able to convey their ideas in writing as well as other university students. The finding of a generally poor level of proficiency in basic writing skills is consistent with the studies reported by Cowen (1988), Dalke (1988) and Morris and Leuenberger (1990). These results are also consistent with the two Australian studies mentioned before. Smith and van Kraayenoord (1994) found more indications of poorer writing mechanics than problems in writing composition, while O’Brien (1996) reported that 70 per cent of her students tested below average in their handwriting speed (cf. Whiting, 1994).

The order of mean scores across the seven cognitive abilities was generally consistent with the predictions based on the North American research on tertiary students with SLD. That is, the Australian students with SR-SLD performed relatively worst on tests of cognitive abilities related mostly to Bannatyne’s Sequential category, namely, short-term acquisition and retrieval and cognitive speed of processing, and they performed best on tests of cognitive abilities related to Bannatyne’s Verbal Conceptualisation and Spatial categories, namely, crystallised intelligence and broad visual intelligence. The research by Cordoni et al. (1981), Morris
and Leuenberger (1990), Salvia et al. (1988), and Vogel (1986) consistently showed a corresponding pattern of results on the Bannatyne categories. Further similarity with North American students with SLD was evident when the order of mean scores was considered against the more directly comparable findings on the Gf-Gc theory constructs provided by Cowen (1988), and Morris and Leuenberger (1990). They also showed fluid reasoning to be an area of good performance, while memory (long-term and short-term) as well as broad auditory intelligence were areas of poor performance (as found in the present study).

In relation to the third study goal, the majority of the students exhibited a pattern of scores which was consistent with the intra-cognitive (25/30 students) as well as the intra-achievement (21/30 students) discrepancy definitions of SLD. Less than a half of the students (12 students) presented with a significant aptitude/achievement discrepancy. Using the intra-cognitive discrepancy as the primary indicator of SLD, in line with accepted clinical practice (Brinckerhoff et al., 1993; Mather, 1993; Woodcock, 1984), this study suggests that limitations in at least four types of basic cognitive abilities may serve a markers for some process whereby some students fail to acquire basic writing skills whilst at the same time developing good levels of proficiency in reasoning skills, reading and written expression. Further investigation of the role which memory, visual and auditory intelligence, or processing speed may have played in the development and maintenance of problems in basic writing skills would require very involved and individualised case discussions. Unfortunately, this detail is beyond the scope of this paper as it concentrates on the main discrepancy indices of SLD and thus tries to obtain some overview of the kind of problems presenting in this diverse group as a whole.

When putting these findings into a broader perspective, it may be useful to distinguish three realms of discussion: our relative lack of basic knowledge about SLD in university students, how to assess them and deal with them through the provisions of the Disability Act, and the interactions between these students and their lecturers and courses. The focus of the current report is clearly on the most basic questions, which are concerned with the actual, rather than any assumed disabilities these students may have. As such, it contributes to the extremely meagre database on Australian students with SR-SLD. In order to facilitate future contributions to this research base, the report recommends a sound methodology for the assessment of these students. We wish to emphasise the need to employ co-normed ability and achievement tests, because this requirement is seldom spelt out clearly. This is not a dogmatic recommendation favouring the WJ-R battery. Other tests have been co-normed as well, e.g. the recent Wechsler tests. It also needs to be pointed out that the calculation of discrepancy scores is not sufficient to gain a full understanding of these students and that a detailed analysis of individual test performances often provides vital clues for further investigation leading to specific recommendations.

Moving to the second level in this discussion, it is clear to most professionals in the area that obtaining a psychological/educational expert report on SR-SLD students claiming assistance under the Disability Discrimination Act is only a first step and that countless problems remain. A central issue pertains to the translation of assessment results into educational recommendations and accommodations. Often
it is common sense that is applied to compensate for specific problems rather than specific knowledge of strategies that have been evaluated empirically. In some cases this may work well, e.g. when time requirements are adjusted for students with slow processing speed, and accuracy rather than speed is marked. However, there is a great diversity of problems in this group of students, as shown in this report. This means that considerable expertise is required of psychologists, disability officers and study skills personnel not only in the many facets of SLD, but also in any detailed strategies which can be recommended. Modern work pressures often favour a tendency to respond to complex demands by resorting to lists of standard recommendations. This creates a risk that they become common practice without full evaluation of their effectiveness. Given the diversity of learning disabilities, such evaluation needs to occur for each individual case. Unfortunately, research accompanying students while they work through their study problems using specific strategies recommended on the basis of clearly identified specific learning problems over the course of their degrees appears to be completely absent from the literature.

Finally, the role of the lecturer needs to be considered. At a time of increasing student—staff ratios and additional demands to modernise teaching, e.g. by providing Web-based courses, teachers may ask how they can attend to the diverse and specific demands of this group when they already struggle to serve the majority of students. Lecturers in courses other than psychology or education may have very little information or understanding of this group of special needs students. Research into the knowledge and attitudes of university lecturers in relation to SR-SLD students as well as their actual interactions with them also appears absent from the literature, but should be given some priority in the future. This paper offers some insights into the nature of the basic difficulties these students struggle with. Further information, resources, and links can be found at the following websites (among others): http://student.admin.utas.edu.au/services/disability/publications_resources/we JUST LEARN DIFFERENTLY.html and http://student.admin.utas.edu.au/services/alda/opening_all_options/index.html.

Acknowledgements
The authors would like to acknowledge the cooperation of the students who participated, as well as the assistance provided by Margaret Miller (ANU Disability Adviser), John Galvin (University of Canberra Equity Officer Disabilities) and Joanna Buckingham (ANU Study Skills Centre).

Address for correspondence: Bernd Heubeck, School of Psychology, Faculty of Science, The Australian National University, Canberra ACT 2000. E-mail: Bernd.Heubeck@anu.edu.au

Note
[1] The dominant measures in research investigating the cognitive ability profiles of children, adolescents and adults have been the Wechsler Intelligence Scale for Children and the
Wechsler Adult Intelligence Scale (Kaufmann, 1990). Bannatyne (1971) found that learning disabled children exhibited a hierarchy of results on subgroups or categories of Wechsler sub-tests. That is, mean scores were highest for the Spatial category (consisting of Picture Completion, Block Design, and Object Assembly) as well as the Verbal Conceptualisation category (consisting of Comprehension, Similarities and Vocabulary) whereas mean scores were lowest for the Sequential category (consisting of Digit Span, Arithmetic and Digit Symbol) and the Acquired Knowledge category (consisting of the Information, Arithmetic and Vocabulary).

References


