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# the learning characteristics of gifted literacy disabled students

## Abstract

*Some gifted students have specific literacy learning disabilities in areas such as reading, writing and spelling. The present study uses a 'differentiated models of giftedness and talent' framework to examine the learning characteristics of these students.*

*The students, 65 gifted primary school students in Melbourne, had a disability in literacy performance in at least one of reading prose accuracy, prose reading comprehension, or isolated word reading accuracy. Their phonemic awareness (segmentation and blending), and general ability using the WISC-III were assessed. As well, to provide an opportunity for the display of their gifted knowledge, tasks examining their ability to infer from what they had read for texts read accurately were used.*

*Scores on the cognitive factors of the WISC-III identified three categories or 'profiles' of gifted knowledge: students gifted verbally, nonverbally and in both areas. The three profiles were associated with particular patterns in literacy knowledge.*

*Comparison with matching cohorts of gifted students who were not literacy disabled (N = 60) and non-gifted students who had a literacy learning disability (N = 42) suggests that the literacy disability is attributed to lower use of analytic information processing strategies that influenced phonemic awareness knowledge and alphanumeric symbolic coding ability. It also showed that the gifted literacy disabled students could display their gifted knowledge during reading comprehension when provided with appropriate tasks.*

*The implications of this study for the diagnosis and teaching of gifted literacy disabled students are discussed.*

## ***The learning characteristics of gifted literacy disabled students***

The existence of gifted students who have learning difficulties has been well documented (Brody & Mills, 1997; Fetzer,

2000; Hishinuma & Tadaki, 1996; Rivera, Murdock, & Sexton, 1995). These students display a learning capacity that is characteristic of students who are gifted, in parallel with a specific learning disability in areas of academic performance such as literacy and mathematics.

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This leads to the question of what is the nature of knowledge that permits both gifted or superior learning in some areas and learning disability in others. This issue can be conceptualised in terms of the Differentiated Models of Giftedness and Talent (DMGT) (Gagne, 2000; Ziegler & Heller, 2000). These models distinguish between giftedness (high level broad-based general ability or competences that are untrained, displayed spontaneously and attributed in part to genetic sources) and talent (outstanding skills or abilities in specific areas that are developed systematically and emerge gradually as the aptitudes are transformed into skills).

Literacy knowledge fits within the category of talent. The skills and abilities by which it is characterised are learnt through cultural interactions. Literacy teaching transforms the general ability of readers in particular ways. Students learn to recognise and use units of meaning in written text. They learn to identify meaning at the word, sentence, conceptual, topic and dispositional levels of the text. They also have actions that they can use to align their knowledge with the text information.

Readers use these areas of knowledge in a parallel or simultaneous way relatively automatically. As they read, they integrate the outcomes from the levels into an overall impression of the 'just read' text. They match this against their summary of the text they have read so far and their expectations of what the text might mention in the future. The process is referred to as multiple-level text processing (Kinnunen & Vauras, 1995). Comprehension at any time is the sum of the outputs from the various levels.

Literacy learning difficulties arise when the acquisition of these areas of knowledge is disrupted. Various psycholinguistic and

cognitive processes explain difficulties at each level. At the word level, difficulty learning letter strings has been linked with an immature knowledge of sound patterns in spoken language (phonological and phonemic knowledge), semantic processing, the efficient recall of names from memory (rapid automatised naming difficulties) and the coding of the visual properties of alphanumeric symbols (visual symbolic coding) (Compton, 2002; Metsala, 1999; Siegel, Share & Geva, 1995). At the sentence level, comprehension difficulties have been linked with immature grammar, poor understanding of sentence propositions and immature short term memory process. At the conceptual and topic level, comprehension difficulties have been linked with immature networks of meanings and the ability to predict using them (Siegel & Ryan, 1988).

The causes of the reading disabilities displayed by gifted learners have attracted little research. Brody and Mills (1997) refer to a 'processing deficit', a concept that has been only vaguely defined (McCoach, Kehle, Bray & Siegle, 2001). Its nature has been elaborated by Munro (2003). A cohort of gifted primary school students who had literacy learning disabilities displayed immature phonological and phonemic knowledge that influenced their ability to learn letter clusters effectively. As a consequence, these students showed word level reading difficulty.

The extent to which this difficulty influenced prose reading depended on the areas of knowledge in which the students were gifted, indicated using the Wechsler Intelligence Scale for Children III (WISC III; Wechsler, 1992). Students could be gifted in the areas of Verbal Comprehension (VCG), in Perceptual Organization (POG) or in both (VCG + POG).

Those gifted in both verbal and nonverbal areas of knowledge, the VCG + POG students, showed lower achievement in reading isolated word reading and spelling. Those gifted only in the nonverbal areas, the POG students, showed lower achievement in prose reading accuracy and comprehension as well. No student in the literacy disabled cohort had gifted knowledge only in the verbal area, that is, VCG.

This finding suggests that gifted verbal knowledge can compensate for difficulty in learning letter clusters. Verbal knowledge that is gifted can be conceptualised as comprising verbal semantic networks that are more differentiated and elaborated than that which is not gifted. This leads to an enhanced ability to retrieve the meanings of verbal concepts and to reason about them and to make links between ideas that may be unexpected. Students gifted in this area are likely to have extensive vocabularies, well-developed conceptual abilities, a broad general knowledge, good listening comprehension and oracy skills and reason abstractly at a sophisticated level.

When reading, verbally gifted students may need to use only few of the concepts mentioned in a text in order to identify its context and to comprehend at least some of its propositions. Their more extensive existing network of concepts may be sufficient to inform them of the context and the ideas likely to be mentioned in the text. As a consequence, they don't need to invest attention in encoding most of the written words to identify the likely intended relationships between the concepts in the text. Their existing knowledge would identify this more rapidly. Because there is less need for them to use the letter patterns in written text, they are less likely to learn them.

Students who are gifted only in the nonverbal areas of knowledge, the 'gifted visual-spatial' learning profile (Silverman, 1989) are less likely to have access to the elaborated semantic network available to the verbally gifted students. Their advanced imagery knowledge, linking ideas in nonverbal relationships, is less likely to match the verbal propositions in written text. As a consequence, they are more likely to need to process the written letter patterns in written text. A restricted letter cluster knowledge is less likely to be compensated by their gifted nonverbal knowledge.

An insight into the nature of the literacy learning difficulty of these students is indicated by their performance on the WISC III. Munro (2002) reported that both groups had comparative difficulty retaining unrelated information in auditory sequential short term memory and learning visual symbolic codes. This performance pattern is typically displayed by non-gifted readers who have learning disabilities. When accompanied by lower performance on the Arithmetic and Information subscales, it is described as the ACID-type profile (Keith & Witt, 1997; McCoach, et. al., 2001). It contributes to another two factors that underpin the WISC III; the Freedom from Distractibility and Processing Speed factors (Daley & Nagle, 1996; Sattler, 1988).

The retention of arbitrary information in auditory sequential short term memory and visual symbolic coding can be linked with the processes that explain how word reading is learnt. Emergent readers need to retain briefly relevant phonological and phonemic knowledge in an appropriate sequence so that it can be linked with letter clusters (Baddeley, 1990). As well, they need to learn written letter patterns as arbitrary visual-spatial codes. Readers who display ACID-type profiles have difficulty learning to read

and to spell words automatically (Brody & Mills, 1997).

This type of difficulty has also been described from the cognitive style perspective, one dimension of which distinguishes between analytic – sequential and global strategies (Riding & Cheema, 1991). Emergent readers need to use analytic sequential learning strategies (Rasinski, 1984; Truch, 1993). Students who have reading difficulties frequently show a global cognitive preference (Rourke, 1998).

The differentiated models of giftedness and talent (Gagne, 2000; Ziegler & Heller, 2000) can be used to synthesise these findings. Gifted literacy disabled (or 'GLitD') students have high level broad-based verbal and / or nonverbal general ability. In terms of the WISC III, they display gifted knowledge in either or both of Verbal Comprehension and Perceptual Organization. Munro (2002) showed that they do not have the specific knowledge necessary for learning letter cluster patterns as effectively as their peers. This knowledge allows the students to think analytically about sound patterns in oral language and to learn symbols that match the alpha numeric letter clusters in written language. Without it, they are less able to learn the letter clusters that provide the 'gateway' to one's knowledge when reading.

The differentiation of general ability into verbal and nonverbal aspects has considerable support. Approximately one half of gifted student cohorts identified using the WISC III show a verbal-nonverbal discrepancy of 11 points (a difference that is significant at the .05 level) (Sparrow & Gurland, 1998). Non-gifted cohorts also show evidence of this discrepancy (Rourke, 1998).

The aim of the present study is to examine further the knowledge characteristics of GLitD students. It compares the knowledge of these students with two matched cohorts: (1) students who are gifted and not learning disabled and (2) students who have literacy learning disabilities and whose knowledge is in the average span. It has been noted that GLitD are more frequently identified as having learning disabilities than as being gifted. A description of the unique knowledge of these students would permit more accurate identification. It would also permit a more appropriate intervention that allowed their gifted knowledge to be displayed, as well as targeting their learning disability.

The study examines: (1) similarities and differences in the areas of knowledge assessed by the WISC III subscales and the extent to which each of the VCG, POG and VCG + POG categories in the GLitD cohort display ACID-type profiles; (2) patterns in the literacy outcomes of each GLitD category and (3) the extent to which phonemic awareness and visual coding account for the literacy knowledge of GLitD students.

The study also investigates whether GLitD students show evidence of their gifted knowledge during reading comprehension when the tasks permit this. An earlier examination of the reading performance of these students (Munro, 2002) suggested the possibility that the reading comprehension tasks frequently used did not provide the opportunity for these students to show their gifted knowledge. The portion of tasks that assessed inferential and evaluative thinking in open-ended ways that encouraged multiple linking of concepts was generally low.

Support for this possibility comes from the observation that gifted Verbal

Comprehension knowledge facilitated prose but not isolated word reading (Munro, 2002). This was attributed to the superior comprehension of word meanings and the relationships between them, the richness of semantic networks and the repertoire of thinking strategies available providing a scaffold for higher prose accuracy and comprehension. VCG students could link ideas through semantic inference more effectively and did not need to process the written data to the same extent.

It is also possible that superior Verbal Comprehension may lead to GLitD students interpreting the text differently from peers with average verbal ability. Given appropriate tasks, they may show reading comprehension trends that are more typical of their gifted verbal knowledge than of their learning disability.

Advanced imagery knowledge, indicated by superior Perceptual Organization, may also lead to GLitD students interpreting the text differently from peers with average nonverbal ability. In this case the inference may not be semantic, but rather imagery based, leading to a different interpretation of the text. When imagery coding is used, information is interpreted in terms of specific episodes. When given a reading comprehension tasks, POG students may be expected to construct specific contextual representations that are very well elaborated in terms of the richness of ideas.

These students are more likely to employ their high level imaginary and contextualising abilities if they believe they are appropriate to the task and believe that the outcomes of this thinking will be valued. In drawing on their elaborated contextualised knowledge, they may, for example, generate outcomes that show far

transfer of the ideas. Their thinking may move in directions not pursued by the text they are reading.

The present study examines the reading comprehension of GLitD students both on conventional tasks and on open ended inferential tasks that encouraged divergent outcomes. The latter tasks were assumed to provide an indication of the extent of semantic and contextual networking by the readers. The present study proposes that while retelling a text, regular learners were more likely to supply responses that are constrained by what is said in the text. The responses of gifted learners, including GLitD students on the other hand, are predicted to be more likely to include plausibly related ideas that are not mentioned in the text. Verbally gifted students are predicted to mention ideas that are linked in linguistic logic with the text ideas. Nonverbally gifted are predicted to mention ideas that suggest specific context links and that could co-occur in the same context and time as text ideas.

## *Method*

### *Design*

The study compares patterns in the general ability and literacy knowledge of three cohorts of elementary school age students; (1) GLitD students, (2) students who are gifted and don't have literacy learning disabilities (G non-LitD) and (3) students who are not gifted and have literacy learning disabilities (Non-G LitD).

### *Participants*

The participants were 167 elementary school students from schools in metropolitan Melbourne. They were part of a pool of students who had been referred by their

**Table 1:** The number of students in each cohort, their mean age in months, standard deviation and range

cohort	number of students	mean age (months)	standard deviation	range of ages
GLitD	65	105.4	13.7	78 – 124
G non-LD	60	102.6	11.4	71 – 126
Non-G LitD	42	109.4	14.1	76 – 121

schools for a psycho-educational assessment. Those categorised as having learning disabilities met the accepted criteria for developmental learning disability; a literacy learning disability not attributed to sensory, intellectual, cultural, emotional or socio-economic factors. The number of students in each cohort, their mean age in months, standard deviation and range are shown in Table 1.

### *Assessment procedures used*

Students' performance was assessed using the following procedures:

- (1) Prose reading accuracy and comprehension using the Neale Analysis of Reading Ability 3 Forms 1 and 2 (Neale, 1999).
- (2) Individual oral word reading accuracy using the Reading Recognition subtest of the Peabody Individual Achievement Test -Revised (Markwardt, 1997).
- (3) Spelling production accuracy using Spelling (Fryar, 1997). Spelling accuracy score was the difference between each student's spelling and chronological ages in months.
- (4) Spelling recognition accuracy using the Spelling subtest of the Peabody Individual Achievement Test -Revised (Markwardt, 1997). Students selected from a set of four letter clusters the

correct spelling for a word heard.

- (5) Phonemic awareness using Assessing and teaching phonological knowledge (Munro, 1999).
- (6) General ability using the Wechsler Intelligence Scale for Children III (Wechsler, 1992). Each students' general ability was described in terms of the sub-scale scores, two of the four factor scores (Verbal Comprehension (VC), Perceptual Organization (PO)) and components of the ACID profile. The justification for using the factor scores rather than the verbal and performance index scores to analyse patterns in learning is provided by Keith and Witta (1997). The version of the ACID profile used was the CAD profile, recommended by Kaufman (1994). The CAD comprises Coding, Arithmetic and Digit Span. The Information subtest was omitted because its revised form on the WISC III does not satisfactorily distribute students who have reading difficulties. The CAD profile was calculated using the procedure recommended by Prifitera and Dersh (1993).

It should be noted that previous investigations of verbal-nonverbal discrepancies have generally used differences in verbal and performance intelligence indices rather than discrepancies in factor scores. The verbal - nonverbal discrepancies have been

associated with various categories of learning disability, for example for subtypes of dyslexia (Cohen, Hynd & Hugdahl, 1992).

- (7) Participants' creative ability was rated by their teachers using the Checklist for Identifying Creative Children (Sattler, 1988).
- (8) Participants' display of indicative behaviours of gifted learning disability was rated using a checklist entitled Indicative behaviours of gifted learning disability, compiled from descriptions by McEachern and Bornot (2001), Ferri, Gregg and Heggoy (1997) and Dix and Schafer, (1996) and rated on a 5 point scale in terms of the comparative frequency of each behaviour by the participants' teachers.
- (9) To examine the prediction that the quality of the reading comprehension of GLitD students is more like that of other gifted learners than non-gifted learners, a set of reading comprehension tasks that examined students' ability to infer from the ideas mentioned in each text contained in the Neale Analysis of Reading Ability 3 Forms 1 and 2. Three inferential questions were prepared for each text. Each question examined a reader's ability to infer in one of the following areas :
  - (1) Infer a role, an agent, a location, time or action from the information given.  
An example was: What training do you think the knight's horse might have received ?
  - (2) Infer likely events before and after those mentioned in the text. An example was: What do you think the cat did before it left its kitten at the door ?
  - (3) Infer unstated cause and effect, 'read between the lines'. An example was: Why was the knight on horseback ?
  - (4) Infer the nature of possible changes.

An example was: What might have happened if the thunder had been louder ?

- (5) Infer character traits. An example was: What words do you think would describe the knight ?
- (6) Infer the main idea. An example was: What is the main message in this story?

These items did not have a single correct response. Instead, each student's responses were assessed in terms of the following criteria: The extent to which the response

- (1) mentioned ideas not mentioned in the text;
- (2) showed evidence of far transfer;
- (3) mentioned ideas that were plausible in terms of the topic of the text;
- (4) mentioned ideas that were not expected;
- (5) showed elaboration of the ideas mentioned in the text; and
- (6) showed multiple links with other areas of knowledge.

Each student's response for each criterion was rated on the following 3-point scale: 0 for a response that did not meet the criterion, 1 for a response that met the criterion partially and 2 for a response that met the criterion at a high level. A panel of experts in reading comprehension moderated a sample of the responses and provided inter-rater reliability. The items were administered for those texts that a student read with an accuracy of less than 16 errors.

### *Procedure*

The gifted participants (GLitD and the G non-LD students) were selected according to a number of criteria:

- (1) each had an intelligence quotient of at least 128 points on either or both the

Perceptual Organization (PO) or Verbal Comprehension (VC) factors on the WISC III.

- (2) each received a mean rating exceeding 4 on the Checklist for Identifying Creative Children (Sattler, 1988) and on the Indicative behaviours of gifted learning disability.

Following selection, the participants in each gifted cohort were categorised according to differences between the factors Verbal Comprehension and Perceptual Organisation. The criterion used was a difference of at least 12 for a .95 probability level (Sattler, 1998). Three categories were available:

- (1) the 'both gifted' group, for which Perceptual Organization and Verbal Comprehension scores were both in the gifted range and differed by less than 12 points,
- (2) the 'gifted PO' group, for which the Perceptual Organization score exceeded the Verbal Comprehension score by at least 12 and
- (3) the 'gifted VC' group, for which the Verbal Comprehension score exceeded the Perceptual Organization score by at least 12.

A similar criterion was used to identify categories in the non-gifted literacy learning

disabled group. Although all students in this group were within average spans of VC and PO scores, three categories were identified, based on a difference of at least 12 between the two scores; VC greater than PO, VC and PO similar and PO greater than VC.

The learning disabled participants (GLitD and Non-G LitD) students displayed a discrepancy in literacy performance of at least 1 standard deviation below the mean for their chronological age in at least one of reading prose accuracy, prose reading comprehension or isolated word reading accuracy (a criterion recommended by Brody & Mills (1997), Marsh and Wolfe (1999) and Mendaglio (1993)).

The prose and individual word reading patterns, spelling ability and phonemic awareness of each group were compared using MANOVA procedures and the comparison of mean scores. Inferential reading comprehension ratings of the three cohorts were compared.

## Results

Each student was located in one of the three VC versus PO categories by computing a VC-PO difference index. The number of students in each category for each cohort is shown in Table 2.

**Table 2:** The number of students in each category of VC-PO for each cohort

category of VC-PO <sup>1</sup>	Number of students		
	GLitD	Non-G LitD	G non-LD
VC-PO >12 (VCG)	17	18	11
VC-PO is between -12 and 12 (VCG+POG)	26	23	17
VC-PO < - 12 (POG)	22	19	14
Total	65	60	42

<sup>1</sup> The reference to gifted learners applies only to the GLitD and G non-LD cohorts.

**Table 3:** The mean VC and PO scores for each category of gifted knowledge for the GLitD cohort

category of VC-PO	VC score		PO score	
	Mean	sd	Mean	sd
VCG	131.2	4.5	105.7	8.5
VCG+POG	134.6	5.8	132.3	6.3
POG	106.1	9.7	135.0	6.6

These data indicate, for each cohort, an approximately equal distribution of students across the three categories of VC-PO. Trends within the GLitD cohort are examined initially.

### *Comparison of trends within the GLitD group*

The mean VC and PO scores for each category or domain of gifted knowledge for the GLitD cohort are shown in Table 3.

General linear modelling procedures supported the categorisation, showing that the differences between the three categories for the VC and PO indices were  $F(2, 64) = 23.04$ ,  $p < .01$  and  $F(2, 64) = 18.89$ ,  $p < .01$  respectively. Multiple comparisons of means (Scheffe) indicated that the VC scores for the VCG and the VCG+POG categories did not differ ( $p > .05$ ) and were higher than for the POG group ( $p < .01$ ). The PO scores for the POG and the VCG+POG groups did not differ and were higher than for the VCG group.

A more comprehensive description of the knowledge of each domain of gifted knowledge is indicated by comparing differences between them in each area of knowledge measured by the WISC III subscales. The mean performance of each GLitD category on each subscale (means and

standard deviation) and the level of significance of the difference between each pair of means are shown in Table 4. Differences between the three categories for each subscale were examined using multiple comparisons (Scheffe test). Each subscale is described in terms of the aspect of knowledge it assessed.

These data indicate that the POG group differed from the other two categories of GLitD students on all measures of verbal conceptualisation. While their mean performance on each aspect of verbal conceptual knowledge is within the average span, it was less well developed. This group, on the other hand, exceeded the VCG category in nonverbal reasoning in all areas of nonverbal reasoning. The three categories did not differ in the three components that make up the CAD profile ( $p > .05$ ).

### *Reading and spelling performance*

Trends in the literacy performance for the three categories of GLitD students were compared by computing, for each student (1) prose reading accuracy and comprehension scores (percentile ranks), (2) isolated word reading accuracy, automatic word reading accuracy and word attack (percentile ranks), and (3) spelling recognition score (percentile ranks) and spelling production discrepancy score (chronological age – spelling age in

**Table 4:** The mean each subscale performance (mean, standard deviation) of each GLitD category and difference between each pair of means.

Subscale	VCG (1)		VCG+POG (2)		POG (3)		<sup>1</sup> Comparisons between means for each category		
	Mean	sd	Mean	sd	Mean	sd.	1 vs 2	1 vs 3	2 vs 3
Recall general information	14.86	2.67	13.63	1.89	11.04	2.95	ns	**	**
Reason similarity between two concepts	17.00	1.63	15.63	3.20	12.70	2.32	ns	**	**
Solve arithmetic word problems	10.86	2.67	13.13	3.01	10.55	3.73	ns	ns	ns
Describe the meanings of words	14.43	2.23	15.69	2.30	10.48	1.78	ns	**	**
Explain social phenomena	14.86	2.12	14.94	2.41	9.96	2.92	ns	**	**
Retain digits in short term memory	10.29	1.50	8.88	3.98	8.77	3.01	ns	ns	ns
Recognise missing features from pictures	11.14	3.58	14.25	2.35	15.52	2.45	*	**	ns
Arrange pictures to tell a story	11.17	1.37	15.94	1.65	16.39	3.14	*	*	ns
Arrange blocks into a spatial design	12.21	1.70	15.56	2.37	16.96	2.29	ns	*	ns
Arrange parts to make an object	10.57	2.99	15.13	2.80	16.00	2.04	**	**	ns
Learn an arbitrary visual code	9.14	4.81	10.00	3.79	10.61	2.93	ns	ns	ns

<sup>1</sup> \*\*  $p < .01$ , 2-tailed; \*  $p < .05$ , 2-tailed; ns not significant,  $p > .05$

**Table 5:** Mean performance for each area of literacy (mean, standard deviation) for the three categories of GLitD students

Area of literacy knowledge	VCG		VCG+POG		POG	
	Mean	sd	Mean	sd	Mean	Sd
prose reading accuracy	35.0	24.1	40.5	22.5	12.9	11.9
prose reading comprehension	49.0	29.6	51.0	25.9	18.0	14.0
automatic word reading accuracy	15.0	14.1	19.7	16.1	4.4	4.2
word reading accuracy	26.3	8.4	20.6	9.7	13.8	10.1
word attack	23.5	10.4	21.5	13.4	34.5	21.9
spelling recognition	27.6	16.1	22.4	13.7	25.3	30.6
spelling writing score	17.2	19.8	11.3	9.9	35.4	19.9

months). Mean performance for each area of literacy (mean and standard deviation) are shown in Table 5. Differences between the three categories for each subscale were examined using multiple comparisons (Scheffe test) for the relevant standard scores.

The three categories of GLitD students differed in their literacy performance trends. The VCG and VCG+POG groups achieved higher prose reading accuracy and comprehension scores than the POG group ( $p < .01$ ). The three categories did not differ in isolated word reading accuracy, word attack or spelling recognition ( $p > .05$ ). The POG group showed a higher spelling discrepancy score than the VCG and VCG+POG groups ( $p < .01$ ).

The three categories differed in the comparative difficulty of the literacy tasks. The VCG and VCG+POG groups found prose reading easier than isolated word reading and spelling, while the POG group found all of the literacy tasks of approximately equal difficulty ( $p > .05$ ). These trends support the claim that the VCG and VCG+POG groups can use their gifted verbal knowledge to scaffold both accuracy and comprehension when reading narrative prose.

The comparatively low isolated word reading and spelling performance is common to the three categories. These data suggest that the component of literacy knowledge that leads to the low literacy learning disability of GLitD students is impoverished letter cluster knowledge. The comparatively low ability to recognise correctly spelt letter strings is consistent with this.

It was noted earlier that word level learning draws on the information processing abilities included in the CAD profile. The three GLitD categories showed this profile; the CAD scores for the VCG, VCG+POG and POG categories were 3.17 ( $sd = 2.49$ ), 3.30 ( $sd = 2.67$ ) and 2.84 ( $sd = 2.47$ ). These indicate lower performance on tasks involving visual symbolic coding, auditory sequential short term memory and arithmetic. The three categories did not differ in performance on this variable ( $F(2, 64) > .05$ , Sheffe  $> .05$ ).

The association between GLitD CAD scores and literacy ability for the three categories was examined. The extent of correlation (Spearman's rho) for each measure of word level knowledge is shown in Table 6.

**Table 6:** The association between GLitD CAD scores and literacy ability for the three categories of GLitD students

Area of literacy knowledge	Category of GLitD		
	VCG	VCG+POG	POG
prose reading accuracy	-0.71**	-0.46*	0.51*
prose reading comprehension	-0.74**	-0.55*	0.27
automatic word reading accuracy	0.59*	0.47*	0.89**
word reading accuracy	0.47*	0.09	0.48*
word attack	0.32	0.43*	0.47*
spelling recognition	0.65**	0.58**	0.72**
spelling writing score	-0.62**	-0.33	-0.71**

\*\*  $p < .01$ , 1-tailed; \*  $p < .05$ , 1-tailed.

**Table 7:** Mean phonemic segmentation and blending performance for the three categories of GLitD students

phonemic awareness knowledge	VCG		VCG + POG		POG	
	Mean	Sd.	Mean	Sd.	Mean	Sd.
segmentation span	83.7	17.7	82.4	18.3	89.2	14.8
blending span	81.4	13.2	82.6	12.8	92.2	13.1

CAD performance was most closely aligned with word level literacy knowledge. The negative correlation between prose reading and CAD score for those students gifted in VC is consistent with the earlier observation that these students are less likely to draw on word level knowledge when reading the types of texts used in the Neale Analysis. The isolated word reading and spelling ability of these students was positively associated with CAD performance. For those students gifted in PO knowledge, on the other hand, CAD performance was more generally associated with literacy performance.

### *Phonemic awareness*

A major cause of word reading disabilities is phonemic awareness. Mean phonemic segmentation and blending performance (standard score, mean = 100, sd. = 15) for each category of GLitD students are shown in Table 7.

The three categories did not differ in phonemic segmentation and blending spans ( $p > .05$ ). The data suggest that the GLitD students show immature phonemic development in both segmentation and blending.

### ***Comparison with related cohorts***

To examine further possible causes of the literacy learning difficulties, the performance trends of the GLitD students were compared with two other cohorts; those of gifted not learning disabled students and nongifted learning disabled students.

### ***Comparison with the G non-LD cohort***

The WISC III profiles for each category of GLitD were compared with the corresponding profiles for students who were gifted but not literacy learning disabled. The mean VC and PO indices for each category of the G non-LD are shown in Table 8.

Differences between matching categories in the two cohorts were examined using MANOVA procedures with age controlled.

The two cohorts did not differ for either VC or PO index ( $p > .05$ ) for any of the categories.

Comparison of subscale performance for matching categories indicated that, for all three categories, the GLitD group had lower vocabulary, coding ability and digit span than their matched G non-LD peers ( $p < .01$ ). As well, the VCG+POG and VCG GLitD groups had lower arithmetic scores ( $p < .01$ ). The POG group had lower object assembly scores than their able literacy learning peers. The two cohorts did differ in the influence of CAD score on literacy performance; for the G non-LD students, CAD performance did not influence literacy performance ( $p > .05$ ).

Comparison of the literacy performance of the two cohorts indicated, not surprisingly, that the G non-LD categories achieved higher scores than their GLitD peers ( $p < .01$ ). This outcome extended to prose reading by GLitD students who were gifted in VC, the conditions in which the high level verbal general knowledge seemed

**Table 8:** The mean VC and PO scores for each category of the G non -LitD cohort

category of VC-PO	VC index		PO index	
	Mean	sd	Mean	sd
VC gifted	136.2	7.6	105.0	8.5
Both gifted	133.6	4.2	130.2	6.3
PO gifted	108.5	6.45	144.5	7.7

**Table 9:** The mean VC and PO scores for each category of the non - GLitD cohort

category of VC-PO	VC index		PO index	
	Mean	sd	Mean	Sd
VC greater than PO	112.33	4.04	94.00	7.55
VC and PO similar	106.23	7.18	107.69	7.78
PO greater than VC	96.25	6.34	116.00	10.72

to scaffold the reading activity. The two cohorts differed in both measures of phonemic awareness; the GLitD group had lower segmentation and blending scores than their matched able literacy learning peers ( $p < .01$ ).

**Comparison with the non-GLitD cohort**

The WISC III profiles for each category of GLitD were compared with the corresponding profiles for students who were gifted but not literacy learning disabled. The mean VC and PO scores for each category of the nongifted cohort are shown in Table 9.

Comparison of matching categories with the GLitD cohort indicated that the VCG category scored a higher VC index than its non-gifted match and that the POG and VCG+POG groups scored higher indices in both areas than their non-gifted matches ( $p < .01$ ).

Comparison of subscale performance for matching categories indicated that, for all three categories, the GLitD group’s coding and short term memory scores that did not differ from the matching learning disability category. The VCG+POG group had higher

scores on all other subscales than the matching VC and PO similar group, the POG group had higher scores than the PO greater than VC group for all PO subscales and the VCG had higher scores than the VC greater than PO group for information, similarities, vocabulary and picture arrangement ( $p < .05$ ).

Comparison of the literacy performance of the two cohorts indicated that, for the VCG+POG and VCG groups, the GLitD cohort achieved higher prose reading scores than the matched non-gifted cohorts ( $p < .01$ ). On all isolated word reading and spelling tasks, the two cohorts did not differ. The POG group did not differ from its non-gifted cohort on any task. The two cohorts did not differ in phonemic awareness for either segmentation or blending ( $p > .05$ ). Literacy performance for the non-gifted literacy disabled categories was generally associated with CAD score for word reading accuracy, both for prose and for isolated word reading accuracy and for spelling recognition and production ( $p < .05$ ).

**Predicting prose reading ability**

The various areas of knowledge that are most predictive of prose reading performance for each category of GLitD

**Table 10:** The predictor equation for prose reading performance for each category of GLitD students

	VCG	VCG+POG	POG
accuracy score	-449 -38. x Block Design(.78)	84.6-4.6 x Coding (.55)	-13.8 +2.8 x Arithmetic +2.8 x Block Design (.58)
comprehension score	510 -43 x Coding (.58)	119.9-7.4 x Coding (.58)	-17.1 + 3.3 x Information (.26)

students were examined using multiple regression procedures. Performance on each of the WISCIII subscales were used as predictor variables and entered using the stepwise method into the regression procedure. This permitted direct links to be made between the areas of general ability and reading performance. The predictor equation and the adjusted R<sup>2</sup> are shown in Table 10 . The regression equation in each case was significant ( $p < .01$ ).

These data show the predictive influence of Coding ability on reading comprehension performance of GLitD students gifted in VC. For those gifted only in PO, on the other hand, Information (that is, general knowledge) predicted comprehension. Reading accuracy was predicted by Block Design for those gifted either in VC or PO, while for those gifted on both factors, Coding predicted accuracy performance.

For the non gifted literacy learning disabled students, on the other hand, differences between students on the WISC 111 subscales did not predict prose reading performance. A similar outcome was observed for the gifted students who did not have literacy learning disabilities.

### *Inferential reading comprehension*

For the texts read with an accuracy of less than 16 errors, each student's responses to the inferential reading comprehension tasks

were evaluated on a 3-point scale (0 = no, 1 = partial and 2= yes) in terms of the extent to which the response: (1) mentioned ideas not mentioned in the text; (2) showed evidence of far transfer; (3) mentioned ideas that were plausible in terms of the topic of the text; (4) mentioned ideas that were not expected; (5) showed elaboration of the ideas mentioned in the text; and (6) showed multiple links with other areas of knowledge.

The individual inferential comprehension ratings were used to compute a mean inferential index for each category of students in each cohort. The mean ratings for the three cohorts (maximum = 2.00) are shown in Table 11.

For the texts they read accurately (that is, with less than 16 accuracy errors), the GLitD and gifted students obtained a higher a mean inferential index than their non-gifted peers ( $p < .05$ ). The GLitD and gifted students did not differ in their inferential index ( $p > .05$ ). These findings show that the GLitD students, when given appropriate opportunity to display their knowledge of the text read, did so at a level that matched that for their gifted peers.

The responses of the gifted and GLitD students were more likely to refer to mention ideas that, while plausibly related, were not mentioned in the text. They showed evidence of far transfer of the concepts mentioned. The verbally gifted students mentioned ideas that were linked

**Table 11:** The mean inferential index for each category of students in each cohort

Cohort of students	VCG	VCG+POG	POG
Gifted literacy disabled students	1.44	1.63	1.39
Gifted literacy able students	1.83	1.91	1.58
literacy disabled non-gifted students	.32	.29	.24

linguistically to the text ideas. The nonverbally gifted referred to ideas that were plausibly linked in terms of specific context links.

One text mentioned that a threatening animal had been killed and that the nearby villagers would not be threatened by it in the future. In response to a question asking the students to anticipate how the lives of the villagers may change in the future, examples of the responses of the verbally gifted students mentioned that the person who killed the animal would be made a hero for his bravery and would be given medals, that the villagers wouldn't need to protect their animals so much, that they wouldn't need to flee to safety so much and could use their time better and that they wouldn't be experience any of the wounds caused by the threatening animal. Examples of the responses of the nonverbally gifted students mentioned that the villagers (1) could now travel safely over the land where the animal had lived and make farms there; (2) wouldn't have to take as many safety precautions when they went outside; (3) made the animal's cave into a monument for those who had been its victims; (4) wouldn't have to worry about finding the animal's eggs and destroying them.

In response to a question asking why the knight may have travelled to the animal's cave on a horse, the verbally gifted students typically mentioned that a horse may (1) have been the only means of travel available; (2) have allowed the knight to travel most quickly, easily or quietly, without disturbing the animal; (3) have allowed the knight to attack it most easily. The nonverbally gifted students mentioned (1) that the animal's cave may have been too close to the village to allow other attack measures; (2) that the horse was another animal and that it might hide or mask the presence of the knight; (3)

that the animal might think it could easily defeat a horse; (4) that the knight could avoid the animal on a horse more easily than on foot.

## *Discussion*

The outcomes from the present study can be integrated to compile cognitive profiles of GLitD students. In terms of the DMGT model, the GLitD students in the present study displayed gifted knowledge in either or both the verbal and nonverbal areas of general ability. They differed from their gifted able literacy learning peers in that they displayed lower auditory sequential memory skills (measured using the Digit Span task), lower coding ability and lower vocabulary knowledge, possibly due in part to earlier reading and writing limitations. GLitD students gifted in Verbal Comprehension also had lower Arithmetic subscale scores than their able learning peers.

The GLitD students had similar coding and auditory sequential memory skills to the matched literacy learning disabled students who were not gifted. They generally showed higher reasoning in those aspects in which they were gifted. An exception was their vocabulary performance; the two cohorts did not differ in their vocabulary knowledge.

In terms of acquired literacy knowledge, the data indicate patterns in literacy learning difficulty that was linked with the cognitive profiles. The three GLitD categories differed in prose reading ability but not in individual or isolated word reading. All showed immature word level knowledge, both in word reading accuracy, the recognition of letter clusters and spelling ability. For the GLitD students gifted in Verbal

Conceptualisation, prose reading ability was generally predicted by Coding score. For the students gifted in Perceptual Organisation, Arithmetic and Block Design predicted accuracy and Information score predicted comprehension. In other words, components of the CAD profile predicted reading ability for the three GLitD groups. The component that predicted each comprehension for each category differed.

Knowledge of phonological awareness is a necessary prerequisite for literacy learning. Not surprisingly, all of the GLitD categories had lower phonemic segmentation and blending scores than their gifted peers and did not differ from their non-gifted, literacy learning disabled peers. They displayed immature analytic phonological knowledge that was associated with lower graphophonic knowledge. They also showed lower auditory sequential memory than their gifted non-disabled peers.

The findings assist in clarifying the nature of the processing deficit used to distinguish gifted literacy disability from other causes of under-achievement. It is an analytic sequential processing difficulty that influences learning letter cluster patterns and comprises phonological and coding components.

### *Implications for teaching*

The findings of the present investigation have implications for the education of students who are both gifted and have specific literacy disabilities. First, they indicate the existence of these students. Second, they indicate that these students differ in the knowledge they bring to the literacy learning context and in the causes and reasons for their literacy learning difficulty.

They have implications for identifying GLitD learners. They suggest the need to use literacy learning profiles that include indicators the areas of verbal and nonverbal gifted knowledge. Diagnostic procedures need to pinpoint gifted areas of knowledge, the aspects of reading that are in place and those that may be accounting for the difficulty. The literacy tasks need to allow the display of gifted knowledge.

Fourth, they suggest the need for differentiated instruction that targets the specific literacy learning characteristics of each student. Students who can comprehend text adequately but who have difficulty with word level reading need different instruction from those who have difficulties in both accuracy and comprehension. Subsequent studies may examine the value of teaching students who display superior Perceptual Organisation knowledge to recode their knowledge to a verbal form prior to reading. It is possible that the recoded knowledge can better scaffold reading.

Fifth, and perhaps most important, the literacy teaching program needs to ensure that the student's superior knowledge is recognised and valued. Many GLitD students report that their areas of gifted knowledge are often ignored in instructional support programs. Teachers need to ensure that these students perceive that their knowledge is appropriately recognised and valued.

### *Conclusion*

The present study has identified groups of students who are both gifted learners and who have literacy learning disabilities. These students are prevented from using their superior knowledge to comprehend and reason about content they read by their

difficulty learning to read words relatively automatically. They have access to average or above average networks of verbal concepts but are restricted in using these to maximum advantage because they cannot process the written text information efficiently.

When given tasks that elicit their gifted knowledge, their performance is typical of other gifted learners. Many of these students are highly talented and have the potential to contribute substantially to the creative and innovative capital of their cultures. While they continue to experience literacy learning disabilities, the likelihood that they will have the opportunity to make such contribution is low.

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