

From Thought, to Words, to Print: Early Literacy Development in Grade 2

Hetty Roessingh¹, Susan Elgie²

¹ University of Calgary, ² University of Toronto, OISE (retired)

This study examines the relationship of the underlying skills of printing, spelling and vocabulary choices as they influence the quality of writing at the end of Grade 2. Four classes of Grade 2 (N=85) writing in response to an expository prompt were scored holistically on a trait based rubric, and then scored for spelling accuracy and control/legibility of printing. The samples were then profiled using public domain software to glean insights into the vocabulary children can marshal and mobilize to describe 'the ideal zoo.' The findings accord well with Berninger's (1994) developmental constraint model of early literacy. The study makes a contribution in highlighting the need for explicit skills instruction (printing and spelling) and the emergent ability of 'excellent' young writers to take risks with vocabulary; to demonstrate understanding of register and genre requirements; and to effectively use pre-writing activity (sketching/drawing) as a concrete reference point for transposing thought to word to print.

Cette étude porte sur l'influence des habiletés de base (écriture, orthographe, choix de vocabulaire) sur la qualité de la rédaction chez des élèves à la fin de la 2e année. Quatre classes d'élèves en 2e (N=85) ont rédigé en réponse à un texte informatif. On a d'abord évalué leurs rédactions dans une perspective d'ensemble avec une grille visant certains aspects, ensuite en notant l'orthographe et la lisibilité (dextérité avec le crayon). Par la suite, on a établi des profils à partir des échantillons et en utilisant des logiciels du domaine public de sorte à glaner des idées sur le vocabulaire que peuvent rassembler et utiliser les enfants pour décrire « le zoo idéal ». Les résultats cadrent bien avec le modèle développemental de Berninger (1994) axé sur les contraintes en littératie précoce. La contribution de l'étude consiste en soulignant la nécessité de l'instruction explicite des habiletés (écriture et orthographe) et en mettant en relief la capacité en émergence chez les « excellents » jeunes écrivains de prendre des risques avec le vocabulaire, de démontrer une compréhension des exigences liées au registre et au genre, et de mettre à profit les activités préparatoires (esquisse, dessin) pour transposer les idées en mots et ensuite en textes.

Developing literacy skills is inarguably the single most important achievement in a child's early educational experiences. Future achievement, long term educational opportunities, and the work place require increasingly higher literacy levels predicated on strong foundational literacy concepts and skills. Outcomes of large scale assessment programs such as Alberta's provincial achievement tests (PATs) indicate that significant numbers of young learners fail to achieve the acceptable standard of early written literacy learning and too few are able to achieve the standard of excellence commensurate with their reading scores (Alberta Education, 2014). This disparity was the catalyst for our investigation into the assessment of early written literacy

among young learners at the end of grade 2.

The end of grade 2, or early grade 3, represents a critical phase in children's early literacy development. This phase is associated with control over the lower level developmental skills of printing and spelling that can be expected at this point (Berninger, 1994, 1999; Pontart, Bidet-Ildi, Lambert, Morisset, Flouret, & Alamargot, 2013; Roberts, Derkach-Ferguson, Siever & Rose, 2014) and that in turn unlock vocabulary knowledge and the executive functions such as planning and organizing, associated with generating quality text, and the transition to academic literacy learning. This juncture in children's literacy development, therefore, represents the earliest point where meaningful assessment of written literacy learning can occur. These assessment outcomes can inform the design and implementation of interventions for young learners in need of support to achieve early literacy benchmarks.

The data for this study consisted of 85 samples of writing from four Grade 2 classes, in response to an expository prompt (see Appendix 1). They were scored holistically on a trait based rubric (see Appendix 2), and for quality of printing on a 3x4 rubric adapted from (Alston, 1983, 1985: see Appendix 3) and spelling accuracy (Gentry, 1982: see Appendix 4). The samples were transcribed and profiled using public domain software to glean insights into the vocabulary children can marshal and mobilize to describe 'the ideal zoo.' The questions that frame this inquiry may be stated as follows:

1. How important are control over printing and accuracy of spelling to the quality of writing of young children?
2. How important is productive vocabulary knowledge to the quality of writing of young children?
3. What additional factors emerge from the children's writing that explain their engagement and variability in outcome measures?

Review of the Literature

We recruit our ideas for our assessment approach to early literacy learning from three broad streams of research: the developmental skills of printing and spelling, capacity theory, and the psycholinguistic literature that underscores the importance of cognition and vocabulary in producing quality text.

Printing and spelling: The importance of transcribing skills. Youngsters in grade 2 are shifting from emergent literacy (where drawing, beginning printing, and other efforts at representing thought are included in the broader conceptualization of literacy development) to early literacy which increasingly expects children to privilege print as the primary mode of representing thought (Collelo, 2001; Temple, Nathan, & Temple, 2013). The early literacy work of grade 2 pupils largely involves developing and automatizing foundational skills for literacy development—namely printing and spelling, using the words that are extant in their oral repertoire (Biemiller, 2003).

Berninger's (1994, 1999) model of early literacy involves two key elements: transcription—the control over the skills needed to produce legible script, including knowing how to spell the words; and text generation—the process of transforming ideation into words and elaborated text. A large, longitudinal program of research lead by Berninger over the past 30 years has provided fine grained insights into the workings of the neurological system as it plays into the transcription skills that are necessary for early literacy learning. Clinical tasks designed to

measure neuro-motor development, orthographic knowledge, visual-motor integration such as speed of sequential finger movement all provide valuable information that has direct relevance to pedagogy. These tasks track the involvement of neural circuitry in the brain, and how this system interacts with the psycholinguistic mechanisms, the underlying requirements of quality writing in children.

Roberts et al. (2014) conducted a study in the Calgary Board of Education to investigate young children's neuro-motor development and readiness to learn to print. Their findings indicate that by the second half of grade one the vast majority of young children, estimated at 90-95%, have maturational levels sufficient to control the kinesthetic demands of gripping and pushing a pencil. At this point children can benefit from direct instruction in a programmatic approach to learning to print, in this case *Handwriting Without Tears* (HWT: Olsen, 2003, 2013). This is a multisensory approach to direct and explicit teaching of handwriting using materials and activities that are engaging and developmentally progressive, aiming to develop habits in producing written work with characteristics of consistent size, shape and spacing in printing letters (i.e. manuscript). Other studies have suggested that speed of production (Morin, LaVoie, & Montesinos, 2012) is equally important, and that by grade 2, children are capable of joining their letters (i.e. cursive style).

Despite belonging to the generation of digital natives that takes easily to and may prefer digital literacy (Prensky, 1981), a growing body of research indicates that proficiency in the use of 'language by hand' is crucial in the early stages of literacy development (Christensen, 2009; Konnikova, 2014). Control over language by hand transfers to keyboarding skills as young learners transition to producing their assignments and engaging in everyday literacy tasks on various technology inspired tools and gadgets (Connelly, Gee & Walsh, 2007).

Capacity theory: Competing demands on working memory. McCutchen (2011) has advanced the construct of capacity theory as it relates to the role of working memory and long term memory in literacy development. Transcription and text generation place significant and competing demands on working memory—a short and fleeting working space for immediate task management, spanning perhaps 3 to 5 seconds. When too many competing demands are placed on working memory, the individual must allocate precious resources to the lower level demands of the task at hand, whether this involves playing the piano, being involved in extreme sports, learning a second language or—increasingly in current debates—learning to print and spell (Bounds, 2010; Konnikova, 2014; Korbey, 2013; Medwell & Wray, 2008).

The solution to opening up working memory capacity to attend to other aspects of a given task (such as creative interpretation of a musical piece or generating interesting text) involves off-loading the lower level skills by automatizing and developing sufficient speed, placing them under the degree of control as to make their execution unconscious (Bonfield, 2012). Various researchers (Christensen, 2009; Graham, Berninger, Abbott, Abbott, & Whitaker, 1997; Jones & Christensen, 1999; Medwell, Strand, & Wray, 2007; Medwell & Wray, 2014) have reported that automatic letter writing is a key predictor of length and quality of written composition in the primary years.

Cognition, vocabulary knowledge, experience and early literacy learning. Early cognitive and vocabulary development are closely intertwined. Indeed, Hart and Risley (2003) suggested vocabulary knowledge is a close proxy for cognitive development, and they would choose vocabulary size as the more accessible index in early childhood development. From a cognitive perspective age 7-8 represents a critical point in children's development. In Piagetian terms, children reach concrete operations and establish themselves as structured thinkers

(Blake & Pope, 2008; Ginsburg, & Opper, 1969). It is marked by their understanding of *conservation*. At this stage, children are increasingly able to transform and manipulate concept information related to shape, size, space, direction and speed for example, and place objects in categories based on similarities and differences in the aforementioned properties. Active engagements with real life objects are key to children's abilities to form mental models or schemes of the external world. Recall that shape, size and spacing are key concepts associated with letter formation as well, a requirement for successful engagement in learning to print. Dewey (1938) argued for continuity between experience and education; new concepts, cognitive and linguistic information are best learned when grounded in the familiar.

Juggling too many features at once, however, is still difficult; the working memory capacity can only 'hold' so much information simultaneously. In addition, there is a latency period or lag as children focus their attention on the exigencies of learning to print, a process that may take the latter half of grade 1 and most of the grade 2 year to sufficiently control.

Early literacy development is accomplished by most children with a restricted vocabulary—perhaps the 220 words represented on the Dolch list (Dolch, 1948), and an additional 100 content words that represent the things they want to write about. Children must see, say, hear and print these words hundreds of times before they can make the sound to letter correspondence (i.e. phonics), apply phonics information to spelling patterns, memorize unusual spellings of high frequency words and develop sight word recognition needed for rapid intake and comprehension of written language which in turn, is needed for productive, written efforts. The vast majority of youngsters can achieve early literacy benchmarks which tap the foundational skills of printing and spelling using only a limited vocabulary of high frequency words in their oral repertoire (Biemiller, 2003).

Youngsters' linguistic repertoire also expands rapidly at this point reflecting a cognitive leap that may not yet be manifest in their early written efforts. There is general consensus in the research literature that children at the age of 5 have a productive vocabulary of approximately 5,000 words or about 2,500 word *families* (run, runs, running, ran constitute one word family: August, Carlo, Dressler & Snow, 2005; Beck, McKeown & Kucan, 2002; Chall & Jacobs, 2003). Vocabulary knowledge typically increases at a rate of some 1,000 word families each year thereafter (Biemiller, 2003). Increasingly this vocabulary becomes more cognitively complex (e.g. 'design' is more complex than 'draw;' 'create' versus 'make;' 'construct vs. 'build') and abstract (Cummins, 1984). By these accounts, 8 year old children should have a vocabulary size of approximately 8,000 word families. Metaphor, idioms, technical uses of common words, and the shift to words with Greek and Latin roots add to the complexity, especially of written texts that learners encounter at school.

A well-developed vocabulary contributes to quality writing over time in many ways (Olinghouse & Wilson, 2012; Roessingh, Elgie, & Kover, 2015). It allows for nuance, precision and efficiency of meaning ('adorable' versus 'cute' 'pretty' 'nice;' 'angry' and 'furious' versus 'mad;' 'merry-go-round' versus 'a thing with a pole in the middle that goes round and round and you ride on it'); helps create cohesion through the use of open class nouns/super ordinates ('equipment' and 'structures' versus a listing of monkey bars and slides), synonyms, antonyms, examples and definitions that provide the conceptual glue to good writing; and it conveys a sense of register awareness ('I hope you like my ideas.' versus 'I hope you will consider my suggestions.'). Children who lack lexical resources often resort to repetition ('fun, fun, fun'), padding, circumlocution and produce text that has the feel of 'chatting' or 'talk on paper' (Roessingh, 2013).

The affordances of corpus and computational linguistics permit insights into lexical variability manifest in children's written efforts through software available in the public domain (Cobb & Roessingh, 2007: www.lextutor.ca/vp/kids). Length (total number of words: TNW), the number of *different* words (NDW) and lexical sophistication or the 'stretch' from high frequency words to low, are all indicators of lexical strength in a given sample of writing (Olinghouse & Leaird, 2009). *All* children avail themselves heavily of the first 1000 word families in their written work, reflecting as much as 80-85% of their word knowledge, particularly if they are tasked with narrative genre production. It is the distribution and reach of the remaining 15-20% that reveals much about a child's lexical repertoire. The lexical bar must be set at a high level to elicit the full range of the learners' vocabulary knowledge, and thus a task involving expository prose is needed (Olinghouse & Wilson, 2012; Roessingh, 2012).

Our study design, therefore, concerns the dimensions of printing, spelling and the emerging role of vocabulary as these contribute to quality of writing at the end of grade 2. In addition we note evidence of other processes in play that facilitate the transition of language from thought to word to print.

Study Design

This section provides a brief description of the school setting and its early literacy program. The methodology including the prompt and the protocol, data analysis and the development of the database containing all the data is described. This research complies with the ethics protocol required by the University of Calgary (Ethics certificate #5982) and the Tri-Council (SSHRC) that has funded much of this research program. The key pillars of this protocol involve informed consent, confidentiality and anonymity of participants, and the right to withdraw from the research study.

Context. The writing samples for this study were generated by 4 classes of grade 2 children (N = 85) all of whom attended a public school in Calgary. The school is recognized for its strong, consistent focus on developing foundational concepts and skills, especially in the K-3 program. Children who attend this school are typical learners; achievement outcomes on standardized testing programs are average. Direct, programmatic, systematic instruction in foundational skills begins early (in the kindergarten year). About 30 minutes is allocated every day for instruction and practice of concepts and skills that underlie emergent and early literacy learning, using *The Writing Road to Reading* program (Spalding, 2003).

Choosing to partner with this school for the purposes of the research study at hand presented both advantages and limitations. On the one hand, we can be certain of the pedagogical approaches taken in the early literacy program. All teachers followed a consistent, direct and explicit approach in their instruction, and the materials adopted were similarly and consistently used by teachers in the K-3 years. On the other hand, findings will be more difficult to generalize to other school settings. However, since understanding the role of the developmental skills of printing and spelling were a prime goal of this study, this setting was an ideal candidate for our exploration of the topic concerning early literacy learning.

Methodology

The prompt and the writing procedure. Because we sought to glean research insights into grade 2 learners' *actual* level of development (Vygotsky, 1978) tapping the full range of their

lexical resources, we asked children to provide their suggestions for what to do to make the Calgary Zoo the best zoo in the world (see Appendix 1). The zoo had flooded and sustained major damage in June 2013 and this topic continued to arise in the news media and in classrooms as the first-year anniversary approached. This prompt was field tested earlier for its potential to capture children's early literacy abilities (Roessingh, 2012; 2013). It fulfills many of the criteria identified as necessary for engaging children in work that would motivate them, that is, their familiarity with the topic and the real-life potential and authentic-like nature of the task (Dewey, 1938).

The writing samples were elicited by the regular classroom teachers during class time. Up to 60 minutes was allocated for the entire process that included brief discussion, drawing/coloring and writing. The sample represents first draft writing, completed independently with no further discussion with peers or the teacher. The teachers removed identifying information and masked the writing samples before forwarding them to the first author for analysis.

Scoring and data entry/analysis. The writing samples were marked holistically using a rubric adopted from the Edmonton Public Schools (2008) Highest Level Achievement Test (HLAT: see Appendix 2). The 85 writing samples were rated by two independent researchers who were trained in the use of the HLAT rubric. Ratings assigned were 1: Limited; 2: Satisfactory; 3: Proficient; and 4: Excellent. The two sets of ratings were highly correlated, at greater than .98. The slight differences between the two raters were reconciled to form a combined final rating.

The handwriting was assessed holistically on a 4 point scale based on Alston's (1985) framework (see Appendix 3). Spelling errors were counted (repetitive errors of the same word is counted only once) and recorded for calculation. A spelling score (also on a 4 point scale), based on Gentry's (1982) framework was recorded (see Appendix 4).

The samples were then transcribed and all errors corrected in preparation for vocabulary profiling. The resulting texts were submitted to the online vocabulary profiling tool developed for the purposes of analyzing children's oral or written production from a vocabulary perspective (www.lextutor.ca/vp/kids), organized by 10 frequency levels or bands (from high to low frequency) each consisting of 250 word families.

Vocabulary profiles were generated for each sample, and data recorded for various indices of lexical diversity, including total number of words or *tokens* (TNW), number of different words (NDW), word coverage at level 1 (representing the 250 highest frequency word families), level 4 and all additional individual levels to 10, and off-list (beyond the 10th level of children's oral productive word knowledge). Our observation of the data led us to formalize a vocabulary measure that we had used previously with children's writing: the Low Frequency Threshold (LFT). The LFT is intended to reflect the highest level at which children use vocabulary comfortably. To derive it, we recorded the frequency level (of the 10), which had two adjacent higher frequency levels (higher frequency levels having lower identification numbers) with a sum of 1 token or less. For example, if level 4 had 4 tokens, level 5 0 tokens and level 6 1 token, the low frequency level (LFT) would be 4. If this situation did not arise in the data, the LFT was set to 10, representing the level, or band, with the lowest frequency words. All quantitative data were initially entered into an Excel spreadsheet; analysis was carried out using SPSS release 19.

Findings

This section begins with descriptive statistics on the quality ratings and vocabulary measures.

An inferential analysis in response to research questions 1 and 2 follows. A mainly non-parametric approach was taken to the inferential analysis. As will be explained further, five writing samples with less than 50 words were omitted from the inferential analysis, although included in the descriptive section. Finally, an example of student work is presented.

Description of data. Figure 1 shows the distribution of the quality ratings of the writing of children from four Grade 2 classrooms. As shown in the graph, the profiles of the classes were fairly similar. The rating of Satisfactory was by far the most frequent, especially in classes B, C and D. Ratings of children’s writing from class A were somewhat higher than those from the other 3 classes. Table 1 shows the overall distribution of ratings of writing quality, spelling and printing. Table 2 shows the distribution of selected linguistic measures of the children’s writing.

Substantial differences in the length (number of words) in writing samples by quality rating were immediately evident as shown in Table 1 and Figure 2. Table 2 also shows that the differences in percentage of words at high frequency usage levels did not differ much between samples rated of different quality; the difference between Limited and Excellent samples in percentage of words in Bands 1 through 4 was less than 2%.

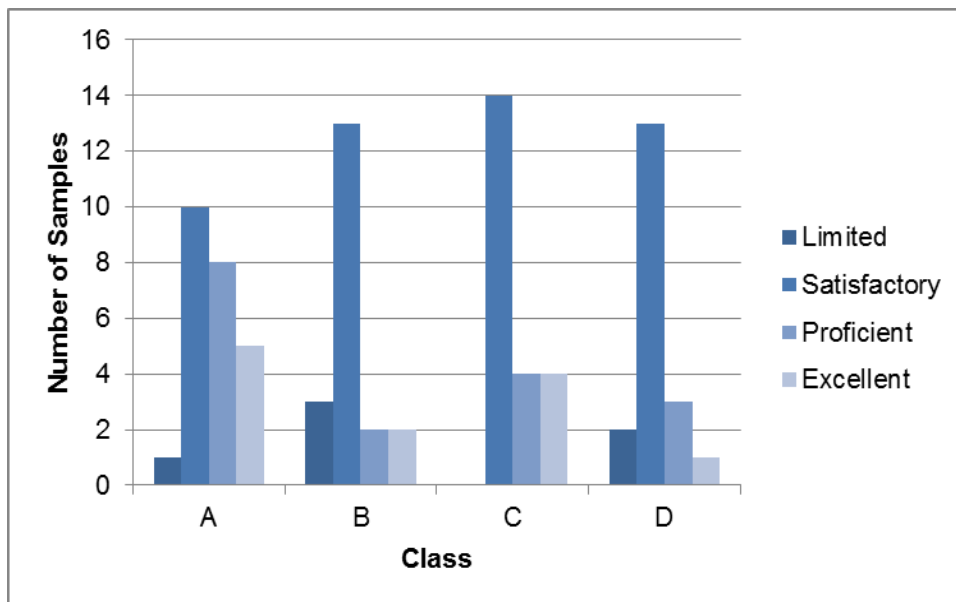


Figure 1. Distribution of quality ratings from the four intact classes.

Table 1

Distribution of Ratings: Entire Sample

Rating	Writing		Spelling		Printing	
	N	%	N	%	N	%
1 Limited	6	7%	4	5%	5	6%
2 Satisfactory	50	59%	18	21%	32	38%
3 Proficient	17	20%	39	46%	41	48%
4 Excellent	12	14%	24	28%	7	8%

Note: N = 85

Table 2

Descriptive Statistics on Selected Linguistic Variables by Rating: Entire Sample

Rating	Total Number of Words	Number of Different Words	% Words Correctly Spelled	% Words in Band 1	% Words Bands 1-4	% Off-List Words
	<i>M (SD)</i>					
1 Limited	42.17 (10.53)	30.50 (9.57)	85.33 (8.55)	57.38 (14.26)	85.32 (8.26)	10.36 (7.17)
2 Satisfactory	95.36 (38.86)	57.48 (18.81)	86.82 (8.86)	64.53 (8.52)	84.59 (6.73)	6.59 (4.22)
3 Proficient	138.65 (30.32)	74.53 (11.44)	92.53 (5.79)	67.28 (5.77)	86.38 (4.17)	5.93 (3.39)
4 Excellent	192.33 (47.62)	99.75 (19.57)	92.33 (4.42)	64.27 (4.18)	83.64 (4.49)	6.54 (3.11)
Total	113.95 (54.17)	64.95 (24.43)	88.64 (8.18)	64.54 (8.26)	84.86 (6.08)	6.72 (4.24)
Range: All Samples	26-295	17-133	63-100%	35-79%	69-98%	0-19%

Note: Based on 6 Limited, 50 Satisfactory, 17 Proficient, and 12 Excellent cases.

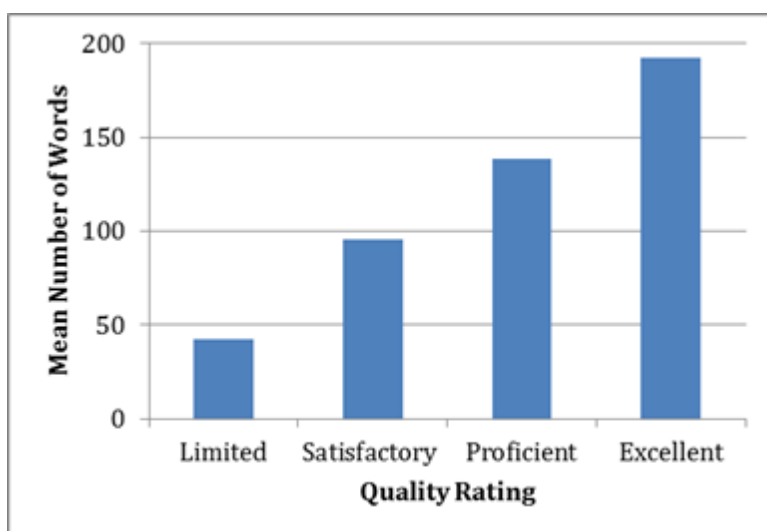


Figure 2. Mean number of words of writing samples at each quality rating.

Table 3 reveals an overall positive relationship between rating and the low frequency threshold (LFT). All of the Limited samples had a threshold of 4. However, writing rated as Proficient and Excellent ranged from thresholds of Band 5 to Band 10. Thus while all Limited writing was at a low threshold, some students whose vocabulary use was at a relatively low threshold were nonetheless able to use simpler vocabulary effectively and receive Proficient and even Excellent ratings.

Relationships with quality rating. This section describes analyses carried out on 80 of the 85 writing samples, those that had 50 or more words. We made the decision to omit five samples because of distributional issues with linguistic calculations on samples with less than 50 words. The single remaining case with a ‘Limited’ rating was included with the ‘Satisfactory’ samples. The five dropped samples ranged from 63% to 100% in spelling, 1 to 3 in printing and were all at level 4 in LFT.

A non-parametric statistical approach was used for bivariate analyses. As well, an ordinal logistic regression was used to explore which variables contributed most to the quality rating.

Spearman correlations were used to investigate the relationship between frequency levels of vocabulary (percentages of words used in Bands 1 to 10 by frequency of usage) and writing quality rating. The correlations were small and none was significant; they are not reported here.

Spearman correlations between the linguistic measures and quality rating were also calculated. The correlation of total number of words or length of the sample and number of different words was very high at .94; for reasons of parsimony, we chose to use just length in further analyses. The correlation between spelling rating and percentage correctly spelled words was similarly high at .93; we chose percentage correct as our measure of spelling.

Table 4 contains the Spearman correlations among the retained variables in the analysis subsample and shows that writing quality rating was moderately and significantly correlated to length in words, spelling, printing and the LFT. While the LFT was moderately correlated to

Table 3

Percentage of Writing Samples by Lowest Frequency Threshold and Quality Rating

LFT Threshold	Rating of Quality				Total
	Limited	Satisfactory	Proficient	Excellent	
Band 4	100.0	10.0			7.5
Band 5		22.0	5.9	8.3	16.3
Band 6		36.0	23.5	8.3	28.7
Band 7		16.0	11.8	16.7	15.0
Band 8		8.0	35.3	16.7	15.0
Band 10		8.0	23.5	50.0	17.5
<i>N</i>	(6)	(50)	(17)	(12)	(85)

Note: None of the writing had an LFT threshold of 9.

Table 4

Spearman Correlation Coefficients Among Selected Variables

	1	2	3	4	5
1. Total number of words (TNW)	1				
2. % of words correctly Spelled	.126	1			
3. Printing quality	.263*	.225*	1		
4. Low Frequency Threshold (LFT)	.511**	.067	.211	1	
5. Writing quality	.675**	.318**	.361**	.488**	1

Note: *N* = 80. * *p* < .05 ** *p* < .01

Table 5

Summary of Two Ordinal Regression Models Predicting Writing Quality

Writing Quality	Initial Model			Final Model		
	Coefficient	SE	p <	Coefficient	SE	p <
Contrast 1	12.05	3.75	.001	23.23	5.85	.001
Contrast 2	13.49	3.81	.000	25.84	6.08	.001
Printing	1.24	0.40	.002	14.47	5.62	.010
Spelling %	9.08	3.98	.022	0.65	0.52	.212
LFT	--	--	--	0.04	0.01	.000
Length	--	--	--	0.44	0.19	.019

Model Statistics

Fit: Pearson χ^2 (98) = 81.04, $p = .893$ Pearson χ^2 (154) = 167.17, $p = .221$

Nagelkerke Pseudo R^2 $R^2 = .27$ $R^2 = .68$

Note: $N = 80$. Contrast 1 compared Proficient to Satisfactory; Contrast 2 Excellent to the lower two ratings.

length in words, correlations among the other predictor variables were small or negligible.

We fitted two ordinal regression models to these data, using the PLUM (Polytomous Universal Model) procedure in SPSS with a logit link function. In the first model, we predicted writing quality from 'Spelling' percentage correct and 'Printing.' Both predictors were positive and significant; the fit was good. Adding the variables of 'Length' and LFT increased the explanatory power of the model; all the variables were positive but 'Printing' lost significance. The goodness-of-fit for the second model was acceptable and the Nagelkerke pseudo R-Square was .68. (The two parameters shown in Table 5 concern the location of the data, and the significance levels indicate that there is sufficient variability in the data to warrant fitting the model; however, they are not important for understanding the predictive relationships in the data.)

In summary, the quantitative analyses showed that measures of printing, spelling, sophistication of vocabulary and length of text all were related to the rated quality of writing. However when all four predictors were entered simultaneously, the contribution of printing to writing quality was explained by the other three variables.

Example of student writing. Figure 3 below provides an illustrative sample of grade 2 writing at the excellent standard. Explanatory commentary is provided to illuminate the qualities of excellence reflected.

Figure 4 illustrates the vocabulary profile generated from www.lexutor.ca/vp/kids

Discussion

We begin this section with comments on the distribution of the scores, reflecting on the expectation that the majority of young children should reach early literacy targets in the lower level developmental skills of printing and spelling. We then turn to our initial inquiry questions, structuring the discussion to link to the extant research and the novel contribution our findings can make.

Dear Calgary Zoo Board members,

Hi, I am I am 8 years old. First of all you should make the playground bigger and have a pole, 2 more slides and 3 swings. You should get some pandas. The pandas habitat should have lots of bamboo, a tire swing, some logs, grass and some trees. For the penguin house make it colder. The dinosaurs should move and make sounds. Add some more stronger huger dinosaurs. Make the giraffe, fish and hippo house a taller roof. Put the peacocks in a pen so they will not run away. The peacock pen should have a high roof and lots of trees. For the bears make it more bigger and add more dark green plants. Right beside the penguins house make a huge pool full of salt water for some dolphins. Make a under ground walk way to see the dolphins. Add seals in a rocky sandy habitat with deep water. Make it near the dolphins habitat. Make a walk way under ground to. Make a barn and a huge field

Comments: 206 words. 8 spelling errors (92.8%). Neat, legible, controlled printing (spacing, size, shape) with a sense of enough speed to generate ideas (4). Opens and closes. Good sense of task and genre requirements (e.g. First of all ...). Advances several ideas though they are not always well connected. Moves from a playground, to panda habitat, to penguin house, to dinosaurs. Still, there is an effort at elaborating the ideas, especially for the panda habitat (bamboo, tire swings, some logs) and the peacock pen (high roof, lots of trees). There is also a good effort at creating cohesion: pen → so they will not run away; huge pool → salt water → dolphins; underground walkway → see the dolphins. Nice use of descriptors: dark green plants, rocky sandy habitat. There are a couple of made-up words (huger) and syntax errors (more bigger), but overall, good control over mechanics. The vp clearly reflects a 'rainbow' effect, demonstrating good lexical variability and solid use of vocabulary beyond the low frequency threshold of Band 4 and into the mid-range, though most of the low frequency words (beyond Level 7) are content words for the names of animals (pandas, peacocks), and not yet general academic vocabulary such as enclosure, protection, equipment. Overall, an excellent piece of writing!

Figure 3. Sample of student writing, 'Excellent' rating.

user treatment of proper nouns and program decision to class numbers as 1k although not contained in 1k list).

Freq. Level	Families	Types	Tokens	Coverage%	Cum%	Words in text (tokens):	206
Kid250 - 1:	47	49	124	60.19	60.19%	Different	111
Kid250 - 2:	11	13	15	7.28	67.47%	words (types):	
Kid250 - 3:	11	11	15	7.28	74.75%	Type-token ratio:	0.54
Kid250 - 4:	11	11	15	7.28	82.03%	Tokens per type:	1.86
Kid250 - 5:	6	7	7	3.40	85.43%		
Kid250 - 6:	5	5	8	3.88	89.31%		
Kid250 - 7:	4	4	9	4.37	93.68%		
Kid250 - 8:	2	2	3	1.46	95.14%	Pertaining to onlist only	
Kid250 - 9:	1	1	1	0.49	95.63%	Tokens:	200
Kid250 - 10:	1	2	2	0.97	96.60%	Types:	106
Off-List known:	1	1	1	0.49	97.09%	Families:	100
Off-List unknown:	?	5	6	2.91	100.00%	Tokens per family:	2.00
Total	100+?	111	206	100%	100%	Types per family:	1.06

For easy editing as MS Word table - [Edit/print-friendly table](#)

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Integral text: dear calgary zoo board members hi i am i am eight years old first of all you should make the playground bigger and add one pole two more slides and three swings you should get some pandas the pandas habitats should have lots of bamboo a tire swing some logs grass and some trees for the penguin house make it colder the dinosaurs should move and make sounds add some more strong huge dinosaurs make the giraffe fish and hippo house a taller roof put the peacocks in a pen so they will not run away the peacock pen should have a high roof and lots of trees for the bears make it more bigger and add more dark green plants right beside the

Figure 4. Vocabulary profile generated by 'VP-Kids'

We found that overall, 90% of children in this sample at the end of grade 2 reached a quality standard of satisfactory or better, principally in the central two categories of satisfactory or proficient. This finding aligns with those reported in the research literature (Roberts et al., 2014). Similarly, though spelling ratings showed more dispersion, few samples scored at the lowest category. The range of percentage of words correctly spelled was from 63% to 100%. Interestingly, the difference between mean percentage correct spelling in essays rated limited and excellent was only 7%. This finding aligns with those reported by Gentry (1982) indicating that by the end of grade 2, children can be expected to be at the transitional stage in their development. Taken together, these findings align with research that underscores the importance of the foundational skills of printing and spelling, and speaks to the impact of direct and explicit instruction that is the focus of so much of the early grades curriculum at this school.

Question #1: How important is control over printing and accuracy spelling to the quality of writing of young children?

The pattern of bivariate correlations showed that printing and spelling were both positively, moderately, significantly related to rating of writing quality. Both were significant when entered simultaneously into an ordinal regression model predicting writing quality. Thus both of these literacy building blocks are important. However when additional variables were added to the model, printing lost significance. These findings accord with those presented in the research literature (Berninger & Fayol, 2008; Christensen, 2009; Joshi, Treiman, Carreker, & Moats, 2008).

An analogy can be made to the development of young pianists (Bonfield, 2012). While all competitors in the local Calgary Honen International Piano competition must have the technical skill to execute near-perfect renditions of their pieces, there is that ‘something more’ that distinguishes between those who are merely good technicians and those who are destined to become great performers. While perhaps not yet evident at the end of grade 2, when most children are still working on the technical elements of writing, we noted the beginnings of the impact of vocabulary knowledge on the writing of samples judged to be of excellent quality. The writing sample included in Figure 3 above, illustrates this point.

Question #2: How important is productive vocabulary knowledge to the quality of writing of young children?

The bivariate correlations showed that the LFT and length of composition had moderate and strong, positive, significant relationships to rating of writing quality. When added to the regression model, both made significant positive contributions to the explanation of variance in writing quality. It is of note that the major explanatory variable of all those investigated was length in words. However, children whose vocabulary usage level was more sophisticated and spelling better also wrote better quality compositions, when the variance due to length was already explained. All three variables were important. These findings reinforce those recorded by Olinghouse and Wilson (2012).

In our earlier work with older learners at the end of grade 3 (Roessingh, Elgie, & Kover, 2015), we found quite strong patterns with writing quality of frequency of vocabulary used as assessed by the 10 frequency bands of 250 words. These patterns were weak in the age group investigated in the current study (end of grade 2). However, we have found interesting patterns with the Low Frequency Threshold (LFT), which ranged from 4 to 10. Our technical use of LFT was defined in the methods section above, but a more colloquial understanding of it would be that it is the lowest frequency level at which a writer is a somewhat fluent language user, recalling that the higher the number of the band (1 to 10), the lower the frequency of the language used.

Question #3: What additional factors emerge from the children’s writing that explain their engagement and variability in outcome measures?

While the children’s drawing, coloring and responses to the three ‘reflection’ questions completed at the end of the writing were not part of the analysis, it is clear from examining their writing samples that these played an important role for many children in transforming thought to words to print (Gibson, 2008). Clear linkages were often made between the illustrations and the ensuing writing effort. This observation can be understood in the context of Piaget’s developmental stage theory: concrete operations. The prompt itself also plays into Piagetian theory; children at this stage have achieved conservation and are able to write about space, shape, distance, relationships and categories of objects (e.g. the Arctic exhibit, jungle exhibit; the playground area). It would seem that the competing demands of dealing with multiple properties of objects, however, can be mediated by way of drawing before writing, and having

the drawing available as a scaffold for the writing task. Drawing and coloring play an important role in transforming thought to words to print (Collelo, 2001; Ginsburg & Opper, 1969).

The authenticity of the writing task resonated with the children; many actually thought their writing would go to the board members of the zoo. This was evident from the three reflection questions the children were asked to complete upon finishing their writing.

'... doing a big commitment and gets you to feel happy and be glad that our class got to be doing this.'

'... this letter is for an important group.'

'It is going to go to a place not at school and the others just go to the hallway.'

'This is different because we are writing about changing something and it's real.'

'This piece of writing is different from other writing because we are doing this for public, not for our classroom.'

'I did it neat! I did it so it made sense ... because it is a letter and I have not done a lot of letters in grade 2.'

'This piece of writing is different to other writings because it is a letter written to real people not just the teacher.'

Another finding worth noting is the tendency of weaker writers to offer a 'laundry list' of ideas, resulting in fragmented content. It is most marked by the lack of cohesion, especially across sentence boundaries. Young writers who have acquired vocabulary signaling superordinates for categories (e.g. equipment, exhibits) demonstrated better effects at cohesion. As noted previously, this is associated with a shift in cognitive growth at this age.

Weaker writers also over-used words such as 'awesome' 'amazing' 'spectacular,' and 'fun'. There was often a formulaic and forced feel to the writing, adjectives were used out of context ('the *fragile* entrance door') and interchangeably: a sense the words were indiscriminately parachuted in from the class bulletin board.

Future prompts and protocols for assessing writing in early grade 3 might take these findings into consideration. Children's best efforts will be elicited when the task set before them is developmentally appropriate, authentic, engaging and personally relevant. The prompt needs to be open ended enough to tap the universalities of the diverse cultural and linguistic background experiences of Canada's grade 2–3 children while allowing them the opportunity to contextualize their writing within the particularity of their life experiences.

Conclusion

The early schooling years are demanding for children. Literacy learning is a complex, multi-faceted undertaking that involves the interaction and integration of cognitive, linguistic and neuro-motor activity in working memory (Berninger, 1999; Christensen, 2009; Graham, 2009; Medwell & Wray, 2010). Failure for the lower level developmental skills of printing and spelling to take hold in the early years may have serious proximal and distal consequences for literacy development (Berninger & Favol, 2008; Graham, 2009; Medwell, Strand, & Wray, 2007; McCutchen, 2011; Pontart et al., 2013). Remediation is far more difficult than working within the critical period to teach the foundational concepts and skills required for successful early literacy learning.

The findings suggest that direct and explicit instruction, beginning at an early stage, makes a difference to the early literacy outcomes by age 8. The vast majority of youngsters are able to attain these benchmarks beginning with phonemic awareness activities as early as kindergarten,

together with experiences with plasticine, paper, scissors, crayons, puzzles and blocks. Little fingers must work hard to develop the strength and dexterity to begin formal printing and spelling lessons in grade 1. Through play based learning, these same activities make a major contribution to language development (Westervelt, 2015). Early identification and direct and explicit instruction are the keys to unlocking cognitive and linguistic resources.

Children leave distinct developmental footprints in their writing that reflect their cognitive, linguistic and unfolding early literacy abilities. There are several constraints placed on this achievement, most importantly the control over the lower level developmental skills. This factor explains how children are able to unlock linguistic and cognitive resources that produce both qualitatively and quantitatively better writing that is visible in grade 3 writing.

For many youngsters, especially English language learners, vocabulary instruction will need to be allocated greater priority in the curriculum (August, Carlo, Dressler & Snow, 2005; Biemiller 2001). Already at this early stage of literacy learning, we note differences in the low frequency threshold between weaker and stronger writers, indicating a need for enhanced vocabulary instruction. Sustaining literacy development from early to academic literacy is increasingly dependent on vocabulary knowledge, thus makes this an instructional mandate for an increasing number of children. The findings presented in this study indicate the importance of this variable.

The writing task, the protocol for its administration, and the assessment framework must be carefully considered to account for the early literacy concepts and skills, cognitive and linguistic reach that may be expected at this age (7-8 years). Pre-writing activities including drawing and coloring before setting the children to work on their writing is important in the transfer of thought to language to print.

Literacy development underpins all of the higher order thinking skills that have been identified as the essential skills for 21st century learning. Alberta's (and Canada's) children can and must do better, but they can only do so if curriculum redevelopment is mindful of this need. Children take delight, pride and develop self-confidence in themselves as young writers and thinkers when they realize the power of the printed word.

Future large scale and multi-year studies are encouraged, to glean fine grained insights into children's developmental patterns in literacy development over time. These can inform curriculum design, professional development and classroom level instructional approaches that have tangible impact on literacy outcomes.

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Hetty Roessingh is a Professor in the Werklund School of Education, University of Calgary. Her research continues to focus on the role of vocabulary knowledge in literacy development over time, noting patterns in different learner profiles that can inform classroom instruction, assessment practices and policy.

Susan Elgie is a Research Consultant located in Toronto, Canada. Retired from this role at the University of Toronto, she continues her work in language learning, educational evaluation and social research methods.

Appendix 1: The Calgary Zoo prompt

Task requirements:

The Calgary Zoo is going to be completely rebuilt over the next few years. A committee at the zoo is accepting proposals for how the 'new zoo' can be rebuilt. Your task is to write a proposal that will convince the committee that your ideas are the best way for making the Calgary Zoo the #1 zoo in the world!

Most students will create a persuasive voice, but the **style** and **tone** of the writing will be influenced by how the write chooses to address the task. Students may use a variety of **forms**: letter, speech or description.

The **audience** for this writing task is a committee of zoo Board members and the purpose is to inform and convince. The **content** may be realistic or imaginative.

Classroom context for teacher:

Prior to writing, teachers and students may read together, and orally discuss and clarify the directions and the task. No ideas about the topic are recorded. Talk only.

The classroom environment should not be altered (i.e. word walls, charts, books do not need to be removed or covered).

Students plan and write in English within a 60 minute limit. Children are encouraged to draw, sketch and color before beginning to write. This work is to be done independently and unassisted.

After writing, the students are given time to complete the 'student input' section of the page.

Appendix 2: Marking rubric (HLAT). From Edmonton Public School Board (2008)

Performance Criteria-Grid Format

WRITING ELEMENTS	4 EXCELLENT	3 PROFICIENT	2 ADEQUATE	1 LIMITED
TASK FULFILLMENT	The writer fulfills the task and purposefully crafts a convincing proposal.	The writer fulfills the task and uses supportive details to present a credible proposal.	The writer addresses the task, and uses sufficient details to make a plausible proposal.	The writer addresses the task to some degree and shares a sketchy proposal.
UNITY AND COHERENCE	The paper shows overall unity and reasoning is compelling.	The paper reads smoothly and reasoning is systematic and believable.	The paper generally reads smoothly and reasoning has a resemblance of actuality.	The paper is often awkward to read and reasoning displays inconclusive support.
AUDIENCE	The writing sustains the reader's interest and engages the audience.	A consideration of audience is maintained throughout the writing.	A consideration of audience is conveyed but may not be sustained throughout.	Consideration of audience may be vague.
CONTENT AND TOPIC DEVELOPMENT	The ideas are focused and purposeful; topic development is skillful.	The ideas are clear and interesting; topic development is effective.	The ideas are general and often repetitive; topic development is predictable.	The ideas are reasonable but often underdeveloped; topic development is superficial.
VOCABULARY AND USAGE	Vocabulary and usage are often clever, and chosen intentionally for the form and purpose.	Vocabulary and usage choices are precise and suitable for the form and purpose.	Vocabulary and usage choices are generally suitable for the form and purpose.	Vocabulary and usage choices are within a narrow range.
ORGANIZATION AND STYLE	The organization of the paper is controlled, and the style creates a sense of voice unique to the writer.	The organization of the paper is logical and the voice and style are appropriate.	The organization of the paper is straightforward and may ramble.	There is evidence of difficulty in organizing ideas.
MECHANICS	Spelling, grammar, capitalization and punctuation applications are controlled to enhance the impact of writing; errors are hardly noticeable.	Spelling, grammar, capitalization and punctuation applications are effective; errors are few and do not interfere with the writer's intended meaning.	Spelling, grammar, capitalization and punctuation applications are uncomplicated; errors are evident and do not significantly interfere with the writer's intended meaning.	Spelling, grammar, capitalization and punctuation applications are inconsistent; errors may interfere with the writer's intended meaning.
KEY WORDS	Convincing Skillful Engaging Controlled	Credible Effective Interesting Logical	Plausible Predictable Straightforward Repetitive	Sketchy Superficial Vague Awkward

**Appendix 3: Rubric for assessing quality of writing
(adapted from Alston, 1983, 1985)**

Quality:	Shape	Size	Spacing
1. Labored: very difficult to decipher			
2. Legible: readable without effort			
3. Controlled: consistency in all of the elements			
4. Fluent: gives an impression of 'push behind the pencil'			

By the end of grade 2, look for controlled to fluent printing. Automaticity + speed will open up more working memory for concentrating on the text generation process. Shifting to cursive writing (i.e. joining the letters) will contribute to speed.

Appendix 4: Rubric for assessing spelling (Adapted from Gentry, 1982).

Summary chart

Stage:	Features:	Approx. age/Grade
1. Semiphonetic	Begins to reflect understanding that letters have sounds. Left to right. Alphabet knowledge and letter formation.	Short stage! Age 5
2. Phonetic/letter naming stage 75- 85% correct	Wide variety of writing forms (signs, lists, notes, labels, captions, cards). Systematic inventions, perceptually correct. Letters assigned on the basis of sound (e.g. kat, babe, ate for 80).	Age 6
3. Transitional 85–95% correct	Moves from relying on phonology to visual and morphological representations. Letter reversals. Can benefit from formal spelling instruction. Relies on various means to spell: memory, patterns, phonics knowledge. Look for systematic errors that 'make sense'.	Grade 1–2
4. Correct 95%+% correct	Masters a certain corpus of word that has been designated as 'grade level' (see Gentry's lists). Teach word awareness, and interest in word origins; extended knowledge of word structure (prefixes, suffixes, compound words, homonyms, Latinate forms). Ramp up the writing expectations.	Grade 3 →Stretches over several years as spelling evolves, becomes more complex.

Gentry, R. (1982). An analysis of developmental spelling in GNYS AT WRK. *The Reading Teacher*, 36(2), 192–200.