

VOCABULARY AT THE CENTRE: SHARED LINGUISTIC RESOURCES, READING COMPREHENSION AND WRITING COMPETENCE AMONG PAKISTANI UNDERGRADUATE EFL LEARNERS

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Abstract

Reading comprehension and writing competence are increasingly viewed as interdependent literacy skills that draw upon a shared pool of linguistic resources, although evidence on how these resources connect the two skills among adult foreign language learners remains limited (Kim, 2020; Shanahan, 2016). Guided by the Interactive Dynamic Literacy (IDL) Model (Kim, 2020), this study examined the relationship between reading comprehension and writing competence among Pakistani undergraduate EFL learners and the contribution of three shared linguistic components, namely vocabulary knowledge, sentence structure and spelling. A quantitative, cross-sectional correlational design was adopted, and 150 sixth- and eighth-semester English majors at a public sector university in Punjab completed tests of vocabulary, sentence structure, spelling and reading comprehension (literal, inferential and text-structure subskills), together with a timed composition scored on a four-dimension analytic rubric. The data were analysed through Pearson correlation, simultaneous multiple regression and component-specific bootstrap mediation. All constructs were positively and significantly intercorrelated, and reading comprehension and writing competence were moderately correlated ($r = .46$). Vocabulary emerged as the strongest correlate and predictor of both skills; vocabulary and sentence structure uniquely predicted overall reading comprehension, whereas vocabulary alone uniquely predicted writing competence ($\beta = .69$, $R^2 = .62$). The mediation analyses indicated that the effect of vocabulary on writing was direct, whereas the effects of sentence structure and spelling were partially mediated by reading comprehension (approximately 23% and 25% of the total effects). The dominance of vocabulary persisted when the vocabulary dimension was removed from the writing composite. It is argued that the shared-resource architecture of the IDL Model is weighted towards vocabulary and differentiated by pathway in this population, and that integrated, vocabulary-centered literacy instruction is warranted in Pakistani higher education.

1. INTRODUCTION

For much of the twentieth century, reading and writing were treated as distinct skills that were taught, tested and theorised separately; over the last four decades, however, this premise has been steadily questioned, and the two are now widely regarded as interdependent processes resting upon a common foundation of knowledge (Fitzgerald & Shanahan, 2000; Graham & Hebert, 2011). In this regard, the shared-knowledge explanation suggests that reading and writing are related because they draw upon the same underlying repertoire of linguistic knowledge and cognitive processes, so that the resources which allow a learner to understand a text are, to a considerable extent, those which allow the learner to produce one (Fitzgerald & Shanahan, 2000; Shanahan, 2016).

Building upon this tradition, the Interactive Dynamic Literacy (IDL) Model conceptualises reading and writing as separate but mutually reinforcing skills that sit upon a shared pool of linguistic and cognitive resources, organised hierarchically from lower-level constrained skills to higher-level unconstrained skills and connected to the two literacy outcomes through direct and indirect pathways whose relative importance changes with development (Kim, 2020). It is pertinent to note, however, that the model has been developed and tested largely with first-language children in Western school settings (Kim & Schatschneider, 2017; Kim et al., 2018), so that its applicability to adult foreign language learners in higher education remains an open empirical question.

The question carries particular weight in Pakistan, where English is a co-official language, the medium of instruction in higher education and a compulsory subject throughout schooling (Government of Pakistan, 2009). Consequently, the ability to comprehend and produce academic English text is a decisive factor in the academic success of Pakistani university students, many of whom are reported to experience persistent difficulty with vocabulary range, grammatical accuracy, spelling and organisation in writing (Fareed et al., 2016). Nonetheless, reading and writing are commonly taught in separate courses and assessed separately, on the tacit assumption that competence in one has little bearing on the other, an assumption which the shared-resource view calls into question (Kim, 2020; Shanahan, 2016).

Moreover, it is suggested that the international evidence cannot simply be transferred to this context. Reading-writing relations have been reported to be weaker and less consistent among second and foreign language learners, whose developing linguistic systems may constrain the extent to which shared resources connect the two skills (Carson et al., 1990; Grabe, 2009), and most correlational studies have related global reading scores to global writing scores without identifying which resources carry the relationship (Shanahan, 2016). The present study, therefore, examines the relationship between reading comprehension and writing competence among Pakistani undergraduate EFL learners at the level of three shared linguistic components, namely vocabulary knowledge, sentence structure and spelling, within the framework of the IDL Model (Kim, 2020).

The study was guided by the following research questions:

1. What is the relationship among vocabulary knowledge, sentence structure, spelling, reading comprehension and writing competence among Pakistani undergraduate EFL learners?
2. What are the unique contributions of vocabulary knowledge, sentence structure and spelling to literal, inferential and text-structure comprehension and to writing competence?
3. To what extent do the three components predict overall reading comprehension, and does reading comprehension mediate the relationship between each component and writing competence?

2. Literature Review

2.1 Reading-Writing Relations and Their Linguistic Foundations

Early syntheses established that better writers tend to be better readers, that better writers read more, and that better readers tend to produce more syntactically mature writing (Stotsky, 1983), whereas reading

and writing were conceptualised as essentially similar composing processes (Tierney & Pearson, 1983). Subsequently, model comparison indicated that an interactive account of the relationship was better supported than either a purely reading-to-writing or a purely writing-to-reading account (Shanahan & Lomax, 1986), and meta-analytic evidence later showed that writing about texts and instruction in writing improve reading comprehension (Graham & Hebert, 2011). It is pertinent to note, however, that the correlation between the two skills, although consistently positive, is moderate, leaving substantial variance unexplained (Shanahan, 2016).

Likewise, the shared-knowledge tradition identified the kinds of knowledge that underlie both skills, including knowledge of universal text attributes such as vocabulary and syntax (Fitzgerald & Shanahan, 2000). Among these, vocabulary has been the most consistently reported predictor of literacy in first and second language contexts (Nation, 2001; Qian, 2002), and lexical knowledge has been identified as the principal determinant of second language writing performance (Schoonen et al., 2003). The Lexical Quality Hypothesis offers a mechanism for this dual role, since precisely specified and tightly bound representations of form and meaning are argued to be retrieved rapidly in both comprehension and production (Perfetti, 2007; Perfetti & Hart, 2002).

Furthermore, sentence structure is argued to support comprehension by enabling readers to integrate information across clauses and to construct a coherent representation of the text (Perfetti et al., 2005), while in writing it underpins both grammatical accuracy and the complexity with which relations among ideas are expressed (Wolfe-Quintero et al., 1998). Similarly, spelling reflects orthographic knowledge that is shared by reading and spelling (Ehri, 2000, 2014), and non-automatic transcription is known to consume working memory resources that would otherwise be available for planning and composing (Graham & Harris, 2000; McCutchen, 2000). In second language settings, however, the reading-writing relationship has been reported to be shaped by learners' first language literacy and second language proficiency (Carson et al., 1990), so that the relative contribution of these components cannot be assumed.

2.2 The Interactive Dynamic Literacy Model

The present study is grounded in the IDL Model, which views reading comprehension and writing competence as interacting, reciprocal skills sharing a common base of linguistic and cognitive resources (Kim, 2020). Four propositions are central to the model: component skills are organised hierarchically, from constrained skills such as spelling to less constrained skills such as vocabulary and syntax; components are related to reading and writing both directly and indirectly; reading and writing are related bidirectionally, so that difficulties in the two tend to co-occur; and these relations are dynamic, changing with development and with the manner in which skills are assessed (Kim, 2020). Empirical support has been reported among first-language children for direct and indirect effects of component skills on writing (Kim & Schatschneider, 2017) and for reciprocal relations between reading and writing across the upper primary grades (Kim et al., 2018).

It is pertinent to note that the present study draws upon the model selectively (Kim, 2020). Since the data were collected at a single time point, the dynamic, developmental proposition is not tested directly, and since only one direction of mediation is estimated, the bidirectional proposition is examined only in part. In this study, therefore, the model is used to specify the components, the outcomes and the direct and indirect pathways through which each component may relate to writing, with reading comprehension modelled as a theoretically motivated intermediate variable.

2.3 The Research Gap

In a nut shell, four gaps are identified in the literature (Kim, 2020; Shanahan, 2016). First, the evidence base derives predominantly from first-language children in Western settings, and the IDL Model has not, to the authors' knowledge, been tested with adult EFL learners in Pakistani higher education. Second, Pakistani studies have tended to examine writing difficulties in isolation (Fareed et al., 2016) rather than the components linking reading and writing. Third, correlational EFL studies have largely related global reading and writing scores, leaving unexamined which resources carry the relationship (Carson et al., 1990). Fourth, few studies have estimated mediation separately for each component, which is necessary if differences among the pathways are not to be masked by aggregation (Kim & Schatschneider, 2017). The present study addresses these gaps.

3. Methodology

3.1 Research Design

A quantitative, non-experimental, cross-sectional correlational design was adopted within a post-positivist orientation, in which knowledge claims are treated as probabilistic and theory-driven hypotheses are tested empirically (Creswell & Creswell, 2018). Since no variable was manipulated and all variables were measured at one time point, the analyses describe association, prediction and indirect association rather than causation; consequently, the mediation analysis is interpreted as testing whether the observed relationships are consistent with theoretically proposed indirect pathways, and not as establishing a causal mechanism or temporal precedence (Hayes, 2022). Multiple regression with bootstrapped mediation was preferred to structural equation modelling, since each construct was measured by a single indicator and the research questions concerned the unique contribution of each component and specific indirect pathways (Tabachnick & Fidell, 2019).

3.2 Participants

The participants were 150 undergraduate English majors at a public sector university in Punjab, Pakistan, comprising 81 sixth-semester learners (41 male, 40 female) and 69 eighth-semester learners (33 male, 36 female) (Table 1). Upper-semester learners were selected, since they had received sustained formal instruction in English and since reading and writing in English are directly implicated in their academic work (Grabe & Zhang, 2013). Learners who had completed the prior English coursework of the programme, attended all administration sessions and gave informed consent were included, and only learners with complete data on all instruments were analysed. It is pertinent to note that convenience sampling of intact classes was employed, so that the sample cannot be assumed to be statistically representative of Pakistani EFL learners in general.

Table 1 Composition of the Sample by Semester and Gender (N = 150)

Semester	Male	Female	Total
Semester 6	41	40	81
Semester 8	33	36	69
Total	74	76	150

With three predictors and 150 cases, the sample exceeded common recommendations for stable regression estimates (Tabachnick & Fidell, 2019). A sensitivity analysis indicated a power of .96 to detect a medium correlation ($r = .30$) and of .99 to detect a medium effect in a three-predictor regression ($f^2 = .15$) at $\alpha = .05$, with the smallest correlation detectable at 80% power being approximately $r = .23$ (Cohen, 1988). Consequently, the study was adequately powered for moderate effects but less sensitive to very small ones.

3.3 Instruments

Five researcher-developed instruments were used, constructed according to established principles of language test design (Heaton, 1988), with the writing rubric adapted from the ESL Composition Profile (Jacobs et al., 1981); the instruments are summarised in Table 2. The vocabulary test (20 items) measured receptive knowledge of word meanings typical of academic reading through recognition-based multiple choice items. The sentence structure test (20 items) measured knowledge of grammatical and syntactic structures through error identification, sentence combining and selection of the correct sentence. The spelling test (30 items) measured orthographic accuracy through dictation and identification of misspelled words, with a focus on patterns known to present difficulty for Urdu-speaking learners of English.

Table 2 Summary of the Research Instruments

Instrument	Format	Items	Maximum score	Construct measured
Vocabulary test	Objective	20	20	Receptive vocabulary breadth
Sentence structure test	Objective	20	20	Grammatical and syntactic knowledge
Spelling test	Objective	30	30	Orthographic accuracy
Reading comprehension test	Two passages with items	30	30	Literal, inferential and text-structure comprehension
Writing task with rubric	Analytic rubric	4 dimensions	20	Writing competence

The reading comprehension test comprised an expository and an argumentative passage followed by 30 items, of which 10 measured literal comprehension, 10 inferential comprehension and 10 text-structure comprehension, so that both overall comprehension and its subskills could be related to the components (Grabe, 2009). For the writing task, participants wrote a timed composition on a familiar general topic requiring no specialist knowledge, which was scored on four dimensions, namely vocabulary use, sentence structure, spelling and coherence and cohesion, each rated on a five-point scale (Jacobs et al., 1981). It is pertinent to note that the content dimension of the original profile was deliberately omitted, since the study is concerned with the linguistic and organisational realisation of writing rather than with the quality of ideas, so that “writing competence” is used in this restricted sense throughout (Weigle, 2002).

Content validity was established through review by a panel of experts in applied linguistics and language testing, who judged each item for relevance to the intended construct, clarity, level and domain coverage; ambiguous or misclassified items were revised or replaced by consensus, and the subskill classification of the reading items was confirmed in the same manner (Heaton, 1988). Internal consistency was estimated through Cronbach’s alpha computed over the subskill and dimension scores, since item-level responses were not retained, yielding $\alpha = .79$ for reading comprehension (three subskills) and $\alpha = .84$ for writing competence (four dimensions) (Taber, 2018). Since alpha computed over three or four components is a conservative, lower-bound estimate, these values are interpreted with caution.

3.4 Data Collection and Analysis

Data were collected during regular class sessions after permission had been obtained from the institution; participants were informed of the purpose of the study, assured of voluntary participation, confidentiality and the right to withdraw, and completed the instruments under standardised conditions with fixed time limits, identical instructions and the same order of administration (Creswell & Creswell, 2018). The objective tests were scored dichotomously against a key, the writing scripts were scored on the analytic

rubric, and all composite totals were checked against the sums of their subscores. No identifying information was attached to the scripts, and results are reported only at group level.

The analyses were conducted in Python (pandas, NumPy, SciPy and statsmodels) at $\alpha = .05$, with effect sizes and 95% confidence intervals reported (Cohen, 1988). Pearson correlations, with confidence intervals obtained through Fisher's z transformation, addressed the first research question. Simultaneous multiple regressions, with standardised coefficients and squared semi-partial correlations (sr^2), addressed the second and third questions. Mediation was estimated separately for each component following PROCESS Model 4 procedures, with indirect effects tested through bias-corrected bootstrap confidence intervals based on 5,000 resamples (Hayes, 2022). Supplementary analyses comprised group comparisons by semester and gender, a sensitivity analysis removing the vocabulary dimension from the writing composite, and tests of the stability of the reading-writing association across cohorts.

4. Results

4.1 Preliminary Analyses and Descriptive Statistics

All skewness values (-0.58 to 0.50) and kurtosis values (-1.26 to -0.26) fell within conventional bounds (Tabachnick & Fidell, 2019). Variance inflation factors ranged from 1.69 to 1.88 (tolerance .53 to .59), Durbin-Watson values were 1.72 and 1.45 for the comprehension and writing models, no standardised residual exceeded $|3.29|$, the maximum Cook's distance was .121, and the maximum Mahalanobis distance (12.71) was below the critical value of $\chi^2(3) = 16.27$ at $p < .001$, so that all 150 cases were retained. It is pertinent to note that the overall comprehension model showed slight heteroscedasticity (Breusch-Pagan LM = 7.99, $p = .046$) and slight non-normality of residuals (Shapiro-Wilk W = .982, $p = .046$), whereas the writing model showed neither; since these departures were small and the mediation analysis relies upon bootstrapping, ordinary least squares estimation was retained.

Table 3 Descriptive Statistics for All Study Variables (N = 150)

Variable	M	SD	Min	Max	Skewness	Kurtosis
Vocabulary knowledge (/20)	13.71	5.03	3	20	-0.31	-1.26
Sentence structure (/20)	11.81	3.55	2	19	0.07	-0.52
Spelling (/30)	20.11	4.48	8	29	-0.25	-0.55
Literal comprehension (/10)	6.88	2.36	1	10	-0.50	-0.70
Inferential comprehension (/10)	6.75	2.41	1	10	-0.55	-0.70
Text-structure comprehension (/10)	5.81	1.88	1	9	-0.48	-0.59
Reading comprehension total (/30)	19.44	5.62	4	28	-0.58	-0.30
Writing: vocabulary use (/5)	2.64	0.95	1	4	-0.10	-0.96
Writing: sentence structure (/5)	2.23	0.68	1	4	0.06	-0.26
Writing: spelling (/5)	3.25	0.84	2	5	0.13	-0.39
Writing: coherence and cohesion (/5)	1.90	0.83	0	4	0.50	-0.42
Writing competence total (/20)	10.02	2.73	5	16	0.24	-0.89

As shown in Table 3, performance was moderate across measures, with learners obtaining 69% of the

available marks in vocabulary, 67% in spelling and 59% in sentence structure (Cohen, 1988). Among the comprehension subskills, the highest mean was obtained for literal comprehension ($M = 6.88$), followed by inferential ($M = 6.75$) and text-structure comprehension ($M = 5.81$), whereas among the writing dimensions, spelling was the highest ($M = 3.25$ of 5) and coherence and cohesion the lowest ($M = 1.90$ of 5). Overall, learners obtained 65% of the maximum in reading comprehension but only 50% in writing competence, and all measures displayed substantial dispersion without floor or ceiling effects.

4.2 Association among the Constructs (RQ1)

All constructs were positively and significantly intercorrelated, with coefficients ranging from .46 to .78 (Table 4), and the three components were moderately to strongly related to each other ($r = .55$ to .61) (Cohen, 1988). Vocabulary showed the strongest associations with both outcomes, correlating $r = .78$, 95% CI [.71, .84], with writing competence, which corresponds to approximately 61% shared variance, and $r = .59$, 95% CI [.47, .69], with reading comprehension. Sentence structure correlated $r = .56$, 95% CI [.44, .66], with comprehension and $r = .55$, 95% CI [.43, .65], with writing, whereas spelling showed the weakest associations, $r = .49$, 95% CI [.36, .60], with comprehension and $r = .52$, 95% CI [.39, .63], with writing.

Table 4 Pearson Correlations among the Components, Reading Comprehension and Writing Competence (N = 150)

Variable	1	2	3	4	5
1. Vocabulary knowledge	1				
2. Sentence structure	.61	1			
3. Spelling	.59	.55	1		
4. Reading comprehension	.59	.56	.49	1	
5. Writing competence	.78	.55	.52	.46	1

Note. All coefficients significant at $p < .001$.

The correlation between reading comprehension and writing competence was $r = .46$, 95% CI [.32, .58], a moderate association corresponding to approximately 21% shared variance (Cohen, 1988). Furthermore, the vocabulary-writing correlation was significantly stronger than the comprehension-writing correlation, Steiger's $Z = 6.09$, $p < .001$, which indicates that writing competence was more closely associated with vocabulary knowledge than with reading comprehension itself.

At the subskill level, inferential comprehension showed the weakest correlations with all three components ($r = .37$ to .42), whereas literal and text-structure comprehension correlated more strongly, particularly with vocabulary ($r = .53$ and .57) (Table 5) (Grabe, 2009). Among the writing dimensions, vocabulary correlated very strongly with the vocabulary use dimension ($r = .82$), and each of the other two components correlated most strongly with its corresponding dimension, spelling with written spelling ($r = .51$) and sentence structure with written sentence structure ($r = .35$). Likewise, among the comprehension subskills, text-structure comprehension was most strongly related to writing competence ($r = .51$), followed by literal ($r = .42$) and inferential comprehension ($r = .27$).

Table 5 Correlations of the Components with the Comprehension Subskills and of All Measures with the Writing Dimensions (N = 150)

Variable	Literal	Inferential	Text structure	Wr: vocabulary	Wr: sentence	Wr: spelling	Wr: coherence	Wr total
Vocabulary knowledge	.53	.42	.57	.82	.52	.60	.58	.78
Sentence structure	.52	.42	.49	.52	.35	.48	.43	.55
Spelling	.38	.37	.49	.48	.29	.51	.40	.52
Literal comprehension				.45	.26	.33	.30	.42
Inferential comprehension				.30	.20	.22	.14	.27
Text-structure comprehension				.47	.36	.43	.42	.51
Reading comprehension total				.48	.31	.37	.33	.46

Note. All coefficients significant at $p < .01$, except inferential comprehension with writing coherence ($p = .085$). The comprehension subskills intercorrelated at .57 (literal and inferential), .65 (literal and text structure) and .50 (inferential and text structure).

4.3 Unique Contributions of the Components (RQ2)

The three components jointly explained 34.6% of the variance in literal comprehension, 22.8% in inferential comprehension and 37.7% in text-structure comprehension (Table 6) (Cohen, 1988). Vocabulary was a significant unique predictor of all three subskills, and was the strongest predictor of literal ($\beta = .33$) and text-structure comprehension ($\beta = .35$). Sentence structure uniquely predicted literal ($\beta = .31$) and inferential comprehension ($\beta = .22$) but fell just short of significance for text-structure comprehension ($\beta = .16$, $p = .060$), whereas spelling made a unique contribution only to text-structure comprehension ($\beta = .19$, $p = .024$). It is pertinent to note that the inferential model was the weakest, leaving approximately 77% of the variance unexplained, and that the confidence intervals of its two significant predictors lay close to zero, so that these estimates are regarded as provisional.

Table 6 Multiple Regression of the Comprehension Subskills on the Three Components (N = 150)

Outcome and predictor	B	SE	β	t	p	sr ²	95% CI for B
Literal comprehension							
Vocabulary knowledge	0.157	0.043	.33	3.65	< .001	.059	[0.072, 0.243]
Sentence structure	0.208	0.059	.31	3.52	< .001	.056	[0.091, 0.324]
Spelling	0.006	0.046	.01	0.13	.898	.000	[-0.085, 0.096]
Inferential comprehension							
Vocabulary knowledge	0.099	0.048	.21	2.07	.041	.023	[0.004, 0.193]
Sentence structure	0.150	0.065	.22	2.30	.023	.028	[0.021, 0.279]
Spelling	0.070	0.051	.13	1.38	.170	.010	[-0.030, 0.170]
Text-structure comprehension							

Outcome and predictor	B	SE	β	t	p	sr ²	95% CI for B
Vocabulary knowledge	0.132	0.033	.35	3.96	< .001	.067	[0.066, 0.198]
Sentence structure	0.086	0.046	.16	1.89	.060	.015	[-0.004, 0.177]
Spelling	0.081	0.036	.19	2.28	.024	.022	[0.011, 0.151]

Note. Literal: $R^2 = .346$, adjusted $R^2 = .333$, $F(3, 146) = 25.79$, $p < .001$. Inferential: $R^2 = .228$, adjusted $R^2 = .213$, $F(3, 146) = 14.41$, $p < .001$. Text structure: $R^2 = .377$, adjusted $R^2 = .364$, $F(3, 146) = 29.45$, $p < .001$.

On the other hand, writing competence displayed a markedly different profile (Table 7) (Cohen, 1988). The three components explained 62.0% of its variance, considerably more than in any comprehension model, but vocabulary was the only significant unique predictor ($\beta = .69$, $sr^2 = .252$), whereas sentence structure ($\beta = .09$, $p = .193$) and spelling ($\beta = .06$, $p = .330$) contributed no significant unique variance, despite their substantial bivariate correlations with writing ($r = .55$ and $.52$). This contrast illustrates the difference between bivariate association and unique prediction, since much of the variance that sentence structure and spelling share with writing is shared with vocabulary as well.

Table 7 Multiple Regression of Writing Competence on the Three Components (N = 150)

Predictor	B	SE	β	t	p	sr ²	95% CI for B
Vocabulary knowledge	0.374	0.038	.69	9.83	< .001	.252	[0.299, 0.449]
Sentence structure	0.068	0.052	.09	1.31	.193	.004	[-0.035, 0.171]
Spelling	0.040	0.040	.06	0.98	.330	.002	[-0.040, 0.119]

Note. $R^2 = .620$, adjusted $R^2 = .612$, $F(3, 146) = 79.32$, $p < .001$.

4.4 Overall Prediction and Mediation (RQ3)

The three components explained 43.0% of the variance in overall reading comprehension, $F(3, 146) = 36.72$, $p < .001$, with vocabulary ($\beta = .35$, $p < .001$) and sentence structure ($\beta = .28$, $p = .001$) as significant unique predictors, whereas spelling was not significant ($\beta = .13$, $p = .134$) (Table 8) (Cohen, 1988). Consequently, it is suggested that comprehension drew more evenly upon lexical and syntactic knowledge, whereas writing depended predominantly upon vocabulary.

Table 8 Multiple Regression of Overall Reading Comprehension on the Three Components (N = 150)

Predictor	B	SE	β	t	p	sr ²	95% CI for B
Vocabulary knowledge	0.388	0.098	.35	3.96	< .001	.066	[0.194, 0.581]
Sentence structure	0.444	0.134	.28	3.31	.001	.046	[0.179, 0.709]
Spelling	0.157	0.104	.13	1.51	.134	.010	[-0.049, 0.363]

Note. $R^2 = .430$, adjusted $R^2 = .419$, $F(3, 146) = 36.72$, $p < .001$.

Mediation was estimated in one theoretically motivated direction, from each component through reading comprehension to writing competence, and separately for each component so that differences among them would not be masked by aggregation (Hayes, 2022). As shown in Table 9, the three components displayed distinct patterns. For vocabulary, the indirect effect was not significant, $ab = -0.002$, 95% bootstrap CI [-0.039, 0.034]; although vocabulary strongly predicted comprehension ($a = 0.664$, $p < .001$), comprehension did not predict writing once vocabulary was controlled ($b = -0.003$, $p = .928$), and the direct effect ($c' = 0.426$) was virtually identical to the total effect ($c = 0.424$), which indicates no mediation.

Table 9 Component-Specific Mediation of the Effect of Each Component on Writing Competence through Reading Comprehension (N = 150; 5,000 Bootstrap Resamples)

Path	Vocabulary	Sentence structure	Spelling
a (component to comprehension)	0.664** (0.074)	0.890** (0.107)	0.609** (0.090)
b (comprehension to writing, controlling component)	−0.003 (0.031)	0.108* (0.040)	0.131** (0.038)
c (total effect)	0.424** (0.028)	0.420** (0.053)	0.318** (0.043)
c' (direct effect)	0.426** (0.035)	0.323** (0.063)	0.238** (0.047)
ab (indirect effect)	−0.002	0.096	0.080
Bootstrap SE	0.018	0.033	0.024
95% bootstrap CI	[−0.039, 0.034]	[0.033, 0.162]	[0.037, 0.130]
Standardised indirect effect	−.003	.126	.131
Proportion mediated	Not applicable	23.0%	25.2%

Note. Unstandardised coefficients with standard errors in parentheses. * $p < .01$. ** $p < .001$.

In contrast, the indirect effect of sentence structure was significant, $ab = 0.096$, 95% bootstrap CI [0.033, 0.162], and the direct effect, although reduced from $c = 0.420$ to $c' = 0.323$, remained significant, which indicates partial mediation, with approximately 23.0% of the total effect transmitted through comprehension (Hayes, 2022). Similarly, the indirect effect of spelling was significant, $ab = 0.080$, 95% bootstrap CI [0.037, 0.130], and the direct effect was reduced from $c = 0.318$ to $c' = 0.238$, which indicates partial mediation of approximately 25.2% of the total effect. In a nut shell, vocabulary was related to writing directly, whereas sentence structure and spelling were related to writing both directly and indirectly through reading comprehension.

4.5 Supplementary and Sensitivity Analyses

Since the writing rubric included a vocabulary use dimension while vocabulary knowledge also served as a predictor, the vocabulary dimension was removed from the writing composite and the analyses were repeated (Tabachnick & Fidell, 2019). The vocabulary-writing correlation fell from $r = .78$ to $r = .67$, while the regression on the reduced composite still explained 47.2% of the variance, $F(3, 146) = 43.45$, $p < .001$, with vocabulary remaining the only significant unique predictor ($\beta = .55$, $p < .001$) and sentence structure ($\beta = .11$, $p = .179$) and spelling ($\beta = .10$, $p = .210$) remaining non-significant. It is, therefore, suggested that construct overlap accounted for part, but not the substance, of the dominance of vocabulary.

Furthermore, eighth-semester learners obtained significantly higher reading comprehension scores ($M = 21.93$, $SD = 3.45$) than sixth-semester learners ($M = 17.32$, $SD = 6.23$), Welch's $t(128.4) = 5.71$, $p < .001$, $d = 0.90$, whereas writing competence did not differ between the cohorts ($M = 9.99$ and 10.04), $t(148) = 0.10$, $p = .922$, $d = -0.02$ (Cohen, 1988). It is pertinent to note that comprehension scores were considerably less dispersed in the eighth semester, and that no gender differences were observed for comprehension, $t(148) = 0.13$, $p = .898$, or writing, $t(148) = -0.40$, $p = .689$.

Table 10 Stability of the Reading-Writing Association across Cohorts (N = 150)

Analysis	Statistic	p
Zero-order correlation (full sample)	$r = .46$	$< .001$
Semester 6 only (n = 81)	$r = .59$	$< .001$
Semester 8 only (n = 69)	$r = .32$	.008

Analysis	Statistic	p
Partial correlation, controlling for semester	$r_p = .51$	< .001
Semester $\times$ reading comprehension interaction	$B = -0.026$, $SE = 0.047$, $t = -0.56$	.576

Note. Interaction model: $R^2 = .259$, adjusted $R^2 = .244$.

Finally, the reading-writing association was significant in both cohorts (Table 10), and the partial correlation controlling for semester ($r_p = .51$) was slightly higher than the zero-order correlation, which indicates that the association was not inflated by pooling the cohorts (Tabachnick & Fidell, 2019). It is pertinent to note, however, that the correlation was descriptively stronger in the sixth semester, and that the difference between the two cohort correlations reached significance when tested through Fisher's z ($z = 2.07$, $p = .039$), although the interaction term for the unstandardised slope did not ($p = .576$); since comprehension scores were more restricted in range among eighth-semester learners, this difference is interpreted cautiously. Similarly, the association was of comparable magnitude for male and female learners ($r = .45$ and $.47$, both $p < .001$), with a partial correlation controlling for gender of $r_p = .46$.

5. Discussion

The results indicate that reading comprehension and writing competence are moderately related among these learners and that the three linguistic components are interrelated with both, which is consistent with the shared-resource proposition of the IDL Model (Kim, 2020). The magnitude of the reading-writing correlation, corresponding to approximately one fifth of shared variance, is in line with the observation that the two skills are related but far from identical (Shanahan, 2016), and with reports that the relationship is attenuated among second and foreign language learners (Carson et al., 1990). It is, therefore, argued that reading and writing in this population are better understood as separate skills drawing upon common resources than as a single competence.

Of these resources, vocabulary emerged as the most prominent, correlating most strongly with both outcomes and, notably, more strongly with writing than writing correlated with comprehension itself (Nation, 2001; Schoonen et al., 2003). The Lexical Quality Hypothesis offers a plausible account of this prominence, since precisely specified lexical representations are argued to support rapid retrieval in both comprehension and composition (Perfetti, 2007; Perfetti & Hart, 2002). Moreover, the prominence observed here may also reflect the instructional context, since, where reading is largely confined to prescribed texts, instruction is examination oriented and exposure to English outside the classroom is limited, differences in lexical resources may discriminate sharply between learners in both skills (Grabe, 2009). Consequently, it is suggested that the weight of vocabulary may be partly context specific, which comparative studies in other EFL settings would be required to establish.

Furthermore, the regression results indicate that the components contribute to literacy in a differentiated rather than uniform manner (Kim, 2020). Lexical and syntactic knowledge jointly predicted literal comprehension, which is consistent with the view that retrieving explicit information depends upon both word meaning and the syntactic relations in which words occur (Perfetti et al., 2005), whereas inferential comprehension was the least well explained outcome, which suggests that inference draws upon background knowledge, reasoning and strategic processing beyond the three components measured (Kintsch, 1988; Grabe, 2009). Likewise, the limited unique contribution of spelling is consistent with the hierarchical proposition of the IDL Model, according to which constrained transcription skills cease to be salient predictors once they become largely automatised, as may be expected among upper-semester undergraduates (Kim, 2020; Graham & Harris, 2000). The single exception, a unique contribution of spelling to text-structure comprehension, is not readily explained and warrants replication.

On the other hand, writing competence was uniquely predicted by vocabulary alone, which suggests that

written production in this population is constrained above all by the lexical resources that writers can retrieve (Olinghouse & Wilson, 2013; McCutchen, 2000). Where the available lexicon is limited, lexical search is argued to compete for working memory resources otherwise available for planning and organisation (McCutchen, 2000), and the strong association of vocabulary with the coherence and cohesion dimension ($r = .58$) is consistent with the role of lexical relations in creating cohesion (Halliday & Hasan, 1976). It is pertinent to note, however, that vocabulary was measured receptively whereas writing is productive, and that receptive and productive vocabulary are known to develop at different rates (Laufer, 1998), so that the vocabulary-writing association reported here is to be understood as a relation between receptive breadth and productive performance.

The mediation results add a further dimension, since the components were found to relate to writing through different pathways (Hayes, 2022; Kim, 2020). The effect of vocabulary on writing was entirely direct, whereas the effects of sentence structure and spelling were partially transmitted through comprehension. It is suggested that this pattern reflects the different functions of the components: vocabulary is drawn upon directly at the point of composition, since words must be retrieved before a sentence can be formulated, whereas syntactic and orthographic knowledge support the parsing and rapid word recognition through which learners process the texts that provide models and input for their own writing (Ehri, 2005; LaBerge & Samuels, 1974). This differentiated structure is broadly consistent with the direct and indirect effects reported among first-language children (Kim & Schatschneider, 2017), although it is not consistent with strong versions of the reading-to-writing hypothesis, according to which reading is the principal channel through which linguistic resources enter writing (Krashen, 2004), since comprehension did not carry the effect of the most influential component.

Moreover, the supplementary analyses indicated an asymmetry, in that eighth-semester learners outperformed sixth-semester learners substantially in comprehension but not at all in writing (Cohen, 1988). If writing depends heavily upon productive lexical resources, which develop slowly and more through use than through exposure (Laufer, 1998; Nation, 2001), then the absence of a cohort difference in writing is not unexpected, particularly where opportunities for extended writing with formative feedback are limited and writing improvement is known to depend upon explicit instruction (Graham & Perin, 2007). It is pertinent to note, however, that the comparison is cross-sectional, so that cohort effects cannot be ruled out and no developmental conclusion can be drawn.

In a nut shell, it is argued that the findings support the shared-resource proposition of the IDL Model in a population in which it had not previously been tested, while refining it in two respects (Kim, 2020). First, the shared resources do not contribute equally, since vocabulary carried the greater part of the predictive weight for both skills and especially for writing. Second, the resources relate to writing through different pathways, since vocabulary was related to writing directly, whereas sentence structure and spelling were related to it both directly and through comprehension, a distinction that would have been concealed had the components been combined into a single composite.

The findings carry several pedagogical implications, although these are derived from correlational evidence and indicate where instructional effort may be focused rather than demonstrating the effects of particular approaches (Shanahan, 2016). First, systematic, cumulative and productive vocabulary instruction appears warranted, extending beyond recognition to collocations, word families and the retrieval of academic vocabulary in learners' own writing (Nation, 2001). Second, integrated reading-to-write tasks, such as summarising, response writing, text reconstruction and writing from sources, may exploit the common linguistic base of the two skills (Grabe & Zhang, 2013; Hirvela, 2004), although the mediation results suggest that improved comprehension cannot be expected to transfer to writing automatically, so that lexical resources need to be built explicitly. Third, since inferential comprehension was least explained by linguistic knowledge, explicit strategy instruction for inference and text structure is suggested alongside language work (Grabe, 2009). Finally, the absence of a cohort difference in writing

suggests that extended writing practice with formative feedback deserves deliberate attention at programme level (Graham & Perin, 2007).

6. Conclusion

This study examined the relationship between reading comprehension and writing competence among 150 Pakistani undergraduate EFL learners and the contribution of vocabulary knowledge, sentence structure and spelling to that relationship within the framework of the IDL Model (Kim, 2020). It was found that the two skills are moderately related and that all three components are associated with both; vocabulary and sentence structure uniquely predicted reading comprehension, whereas vocabulary alone uniquely predicted writing competence, and the dominance of vocabulary persisted when construct overlap was controlled. Furthermore, the effect of vocabulary on writing was direct, whereas the effects of sentence structure and spelling were partially mediated by comprehension. It is, therefore, concluded that the two skills are linked chiefly through a shared base of linguistic resources, in which vocabulary occupies the central position.

The findings are, however, to be interpreted in the light of several limitations (Creswell & Creswell, 2018). The cross-sectional correlational design permits conclusions about association and indirect association but not about causation or development, and the cohort comparison reflects differences between groups rather than change over time. The convenience sample was drawn from a single institution, writing was assessed through a single composition on one topic, vocabulary was measured receptively, and reliability was estimated at the level of subskills and dimensions rather than items, while writing scripts were scored without a reported estimate of inter-rater agreement. Consequently, future studies might employ longitudinal designs, productive vocabulary measures, multiple writing tasks across genres, double scoring of scripts with inter-rater reliability, item-level reliability analysis, probability samples across institutions and, with larger samples, latent variable modelling of the component-specific pathways.

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