Effects of L1 single-text and multiple-text comprehension on L2 integrated writing

Abstract

Integrated writing entails synthesis of information and coordination of language skills. It constitutes an integral part of Hong Kong's language curriculum at the secondary school level. This study explored the relationships between reading comprehension, including single-text and multiple-text comprehension, and integrated writing performance in Chinese (the students' first language, L1) and English (their second language, L2). 322 students from four secondary schools participated in this study. The results of latent variable path analysis revealed that L1 single-text comprehension directly affected the ability to coordinate multiple texts in the same language. L1 reading comprehension was positively associated with L1 and L2 integrated writing. Cross-language transfer from L1 integrated writing to L2 was also observed with L1 reading comprehension playing a significant role in the transfer. The findings suggest that the ability to write from sources in L2 could capitalize on the ability that have already acquired in L1. This study contributed to existing literature by substantiating the cross-language connection between reading and writing in integrated writing. It also supports the adoption and early implementation of integrative pedagogy of reading and writing to better facilitate the development of L2 integrated writing competence.

Keywords: reading comprehension, integrated writing, reading-writing connection, cross-language transfer

1. Introduction

The ability to write from multiple sources has been highlighted as one of the key competencies that students need to develop to succeed in higher education in which the ability to manipulate and organize information is an essential prerequisite for problem solving and decision making (Breivik, 2005; Cumming et al., 2018). Given that great importance has been attached to information literacy, performance-based assessment that requires integrated use of language skills has become an integral part of language proficiency tests, such as Test of English as a Foreign Language (TOEFL) and Canadian Academic English Language (CAEL), as an important indicator of college readiness. In tune with the growing consensus that real-life communication necessitates the ability to coordinate different language modalities in an integrated rather than separate manner (Oxford, Lee, Snow, & Scarcella, 1994; Plakans & Gebril, 2012), integrated language assessment has been incorporated into Hong Kong's public college entrance examination[1] since 2007 to evaluate secondary school graduates' information literacy in Chinese language (students' first language, L1) and English language (students' second language, L2). The changes to Hong Kong's curriculum and assessment frameworks in the two key learning areas at the secondary school level are aimed at cultivating bi-literate learners and equipping students for tertiary education (Curriculum Development Council, 2017).

The popularity of integrated writing assessment has led to a proliferation of research into the factors that underlie integrated writing performance, such as writers' use of source texts (Plakans & Gebril, 2012, 2013; Yu, 2009), discourse synthesis strategies (Keck, 2014; Plakans, 2009; Yang & Plakans, 2012), and the relationship between integrated writing and

[1] The current public college entrance examination is the Hong Kong Diploma of Secondary Education Examination (HKDSE); it has been administered since 2012, taken by students at the end of Grade 12.

HKDSE was preceded by the Hong Kong Certificate of Education Examination (HKCEE), which was administered between 1978 and 2011, taken by students at the end of Grade 11.

other language skills (Asención Delaney, 2008; Zhu, Li, Yu, Cheong, & Liao, 2016). This line of research has pointed to the pivotal role of text comprehension in integrated writing processes in which writers need to deal with information intra-textually as well as inter-textually. In addition, cross-linguistic transfer has attracted considerable attention in bilingual education research. Several recent studies have found the transferability of L1 to L2 in reading comprehension (Y.-S. G. Kim & Piper, 2019), expository writing (Pae, 2019), and integrated writing (Cheong, Zhu, Li, & Wen, 2019). These studies suggest that L1 literacy skills are predictive of concurrent and subsequent L2 achievement. Given the centrality of biliteracy in Hong Kong's language education framework and the importance of integrated writing at the secondary school level, this study set out to explore the relationships of reading comprehension, including single-text and multiple-text comprehension, and integrated writing performance of secondary students in both L1 and L2 settings.

2. Literature review

2.1. Connections between reading and writing

Research on the reading-writing relationship has found that reading and writing entail similar knowledge and cognitive operations that can facilitate the development of the other skill, calling for an integration of reading and writing instruction in language classrooms (Fitzgerald & Shanahan, 2000; Graham et al., 2018; Y.-S. G. Kim, Petscher, Wanzek, & Al Otaiba, 2018; Shanahan, 2016). Writers create meaning through transcribing and translating ideas into words, and reading involves an analogous meaning-making process in which readers interpret the meaning of a text and form mental representations of it. Although they are not identical skills, the similar meaning-making processes that reading and writing entail have attracted considerable attention of researchers to investigate how reading comprehension contributes to written composition. Significant correlations between reading comprehension and the quality of narrative writing were observed over time in a longitudinal

study by Babayiğit and Stainthorp (2011). A meta-analysis by Graham et al. (2018) provided evidence for the assumption that reading interventions can enhance students' overall writing performance, with reading comprehension instruction in particular yielding a statistically significant effect size. Examining the developmental relations between reading and writing, Y.-S. G. Kim et al. (2018) found a unidirectional relation from reading to writing at lexical and discourse levels. Grade 3 reading comprehension status significantly predicted the status of Grade 3 written composition. Ahmed, Wagner, and Lopez (2014) tracked students' performance on a battery of literacy assessments from Grades 1 through 4 and found that achievement in reading comprehension consistently contributed to the growth in writing ability over time. These studies provide ample evidence supporting the contribution of reading comprehension to writing performance and the development of writing competency.

The line of research on reading-writing connection has also extended to integrated writing assessment, a more complex test setting in which writers are required to employ different language skills simultaneously to deal with information from various sources. Investigating the shared processes of reading and writing in integrated writing assessment, Plakans, Liao, and Wang (2019) found that comprehension-related processes (e.g., monitoring comprehension and rereading) were the most frequently occurred operations in the reading, writing, and reading-into-writing processes. Sawaki, Quinlan, and Lee (2013) identified comprehension ability as an overarching factor associated with integrated writing performance at the word, sentence and discourse levels; the researchers also pointed out that comprehension ability is substantially influenced by language proficiency level. Cheong, Zhu, and Liao (2018) further indicated that single-text reading comprehension contributed to test-takers' performance on a listening-reading-writing task more than listening comprehension did. They also noted that the joint predictive strength of reading and listening comprehension was statistically significant, but relatively small, accounting for 17.2% of the

variance of the integrated writing scores. Their findings lend support to the connection between reading comprehension and integrated writing; however, the relatively small predictive strength also implies that the ability to comprehend single-text information might not suffice to explain integrated writing performance. Given that integrated writing tasks require writers to demonstrate an integrated understanding of information from multiple sources in their written products, more attention is needed to explore the relationship between multiple-text comprehension and integrated writing quality.

2.2. Single-text and multiple-text comprehension

Integrated writing tasks involve both intra- and inter-textual processing, making the composing process more demanding than traditional independent writing tasks particularly in terms of writers' ability to manipulate information from multiple sources simultaneously. This complex process requires construction as well as integration of meanings. Writers need to comprehend individual texts and then build an integrative and coherent understanding of multiple texts. Previous studies used the ability to draw valid inferences across multiple texts as an indicator of deeper-level reading comprehension (Braasch, Bråten, Strømsø, & Anmarkrud, 2014; Cheong et al., 2019; Karimi, 2015, 2017). These studies adopted intertextual inference verification tasks that required students to judge the validity of a statement related to the materials by indicating yes as valid inference or no as invalid. While the inference verification tasks were widely used, some researchers have pointed out the limitations of this approach regarding the 50% chance of guessing correct answers inherent in the yes/no questions and the need to modify the tasks to improve reliability (Bråten, Anmarkrud, Brandmo, & Strømsø, 2014; Cheong et al., 2019).

Afflerbach and colleagues (Afflerbach & Cho, 2009; Afflerbach, Cho, & Kim, 2015) emphasized the importance of higher-order thinking in complex tasks that require readers to "manage constructive and integrative processes" at the same time, such as writing from

sources (Afflerbach et al., 2015, p. 204). Building upon the revised Bloom's taxonomy of cognitive processes (Krathwohl, 2002), the researchers suggest that assessments that involve multiple-text comprehension and integration should elicit students' ability to summarize each text and make evaluative judgements about the suitability of source texts in light of task requirements; the writers are also expected to differentiate between relevant and irrelevant information in order to produce a coherent written product. The core of multiple-text comprehension is to establish intra- and inter-textual relations through the operations of comparing, contrasting, relating, and differentiating information across several texts (Afflerbach & Cho, 2009; Afflerbach et al., 2015).

A positive relationship between single-text comprehension and multiple-text comprehension has been established in previous studies (Florit, Cain, & Mason, 2019; Hagen, Braasch, & Bråten, 2014; Strømsø, Bråten, & Britt, 2010). Although the two constructs are correlated, they require differing cognitive processing. Compared to single-text comprehension, coordinating multiple texts that present consistent or competing viewpoints, entails learners using more reading strategies, such as highlighting, note-taking, and summarizing (Kobayashi, 2009a). Furthermore, single-text comprehension depends more on readers' topic knowledge, whereas multiple-text comprehension involves more elaborative processing through comparing, contrasting, and synthesizing contents across texts (Bråten & Strømsø, 2011). Researchers have also noted that, apart from its direct effect, single-text comprehension plays a mediating role in multiple-text comprehension. Kobayashi (2009b) found that recall of arguments in individual texts mediated the effect of topic knowledge on comprehending the inter-textual relations of controversial texts. In Karimi (2017), the indirect effect of language proficiency on multiple-text comprehension through single-text comprehension was larger than its direct effect. A recent study by Florit et al. (2019) also showed that single-text comprehension not only had a direct effect but also mediated the

effect of word reading fluency and comprehension monitoring respectively on multiple-text comprehension.

2.3. L2 literacy development

Cummins' (1979) hypotheses of linguistic interdependence and linguistic threshold have given rise to a burgeoning interest in the relationship between L1 and L2 literacy skills. Prior research has shown that L1 literacy skills are predictive of concurrent and subsequent L2 achievement (Shum, Ho, Siegel, & Au, 2016; Sparks, 2012; Sparks, Patton, Ganschow, & Humbach, 2009, 2012). Y.-S. G. Kim and Piper (2019) found longitudinal cross-language transfer of reading comprehension ability between Kiswahili and English, the two official language used in Kenya, and that the effects were bidirectional. Sparks, Patton, and Luebbers (2019) found consistent individual differences in students' Spanish (L2) achievement and their English (L1) literacy skills, supporting the hypothesis of cross-linguistic transfer in literacy development. Pae (2019) indicated the existence of cross-language transfer from L1 (Korean) to L2 (English) in reading and writing among Korean ninth graders, with the contribution of L1 writing to L2 writing stronger than that of L1 reading to L2 reading. Moreover, cross-language reading-writing connection was observed. L2 writing was contributed by L1 reading and L1 writing respectively. Pae (2019) also found that L2 proficiency significantly affected the transfer of L1 writing ability to L2.

Using open-source data from a large-scale assessment of English reading proficiency of Taiwanese EFL ninth graders, Chuang, Joshi, and Dixon (2012) found that in the context of Chinese as the first language, Chinese reading ability accounted for 62.8% of the variance in the students' performance on the English reading test. The predictive strength of L1 is considerably higher than that of other predictors such as school district and gender. In their longitudinal study of the L2 literacy development of primary school students in Hong Kong, Shum et al. (2016) found that Chinese (the children's L1) reading-related skills in grade 1

explained 16-28% of the variance in English (the children's L2) reading comprehension and writing fluency in grades 3-4. The researchers further indicated that the children who were identified as struggling L1 readers in grade 1 performed poorly in L2 reading comprehension and writing in later years.

A recent study by Author (2019) further investigated the cross-linguistic effect in the context of integrated writing assessment and found that Chinese (L1) integrated writing ability contributed significantly to students' performance on English (L2) integrated writing assessment. Similar findings were reported by van Weijen, Rijlaarsdam, and van den Bergh (2019). Undertaking a within-writer cross-language comparison, the researchers found that a relatively high positive correlation in text quality between L1 and L2 source-based argumentative writing. In addition, writers' source use features and argumentation behaviors did not differ substantially between languages. The researchers posited that there might be common ground that underlies source-based writing across languages.

Previous studies have consistently established the positive relationship between reading and writing and supported the contribution of L1 literacy skills to L2 achievement. However, empirical evidence from integrated writing research is limited. Integrated writing assessment involves close interaction between reading and writing, that demands more complex intra- and inter-textual processing. The relationships between writers' reading ability and integrated writing performance require further investigation. In addition, cultivating bi-literate learners who can write from sources fluently in Chinese (L1) and English (L2) is the core objective of the language education policy in Hong Kong. The present study aims to examine the relations between reading and writing and the transferability between L1 and L2 integrated writing to offer pedagogical insights into the development of L2 integrated writing ability.

2.4. The present study

The present study adopted a structural equation modelling (SEM) approach, specifically latent variable path analysis, to investigate the relationships between L1 reading comprehension and integrated writing performance in both L1 and L2 settings. The study included two observed variables, including L1 single-text and L1 multiple-text comprehension. Two latent variables were Chinese integrated writing and English integrated writing. The specific research questions are as follows:

1. What are the relationships between L1 single-text reading comprehension and L1 and L2 integrated writing performance?
2. What are the relationships between L1 multiple-text reading comprehension and L1 and L2 integrated writing performance?
3. Is there a cross-linguistic effect from L1 integrated writing to L2?

In light of the abovementioned literature, we proposed a hypothesized model (see Figure 1) to demonstrate the relationships between reading comprehension variables and integrated writing performance. The model also illustrates the cross-language effect from L1 to L2 integrated writing. The rectangles represent the observed variables (i.e., single-text reading comprehension and multiple-text reading comprehension) and the four indicators of integrated writing performance. The ellipses illustrate the latent variables (i.e., Chinese integrated writing and English integrated writing). Students' performance in the two integrated writing tests were measured by four indicators, including contextual awareness, citation and synthesis, opinion and argument, and written expression. Considering that measurement errors could exist in each indicator, we used latent variables rather than observed variables to represent integrated writing performance with the aim of ensuring the accuracy of the measurement model. The scoring rubrics and procedures will be explained in detail in the section of 3.2.1.

The presumed path between two variables is indicated by a unidirectional arrow. We hypothesized that L1 single-text reading comprehension would be directly associated with L1 multiple-text reading comprehension. In addition, there would be a direct path between L1 single-text reading comprehension and L1 and L2 integrated writing. It was also expected that L1 multiple-text reading comprehension would be directly associated with L1 and L2 integrated writing. Furthermore, we assumed a cross-linguistic effect from L1 to L2 integrated writing. Apart from the direct paths between variables, we also hypothesized indirect relationships that would affect L2 integrated writing. Specially, L1 integrated writing would mediate the relationship between L1 single-text comprehension and L2 integrated writing. L1 integrated writing would also play a mediating role between L1 multiple-text comprehension and L2 integrated writing. L1 multiple-text comprehension would mediate the relationship between L1 single-text comprehension and L2 integrated writing.

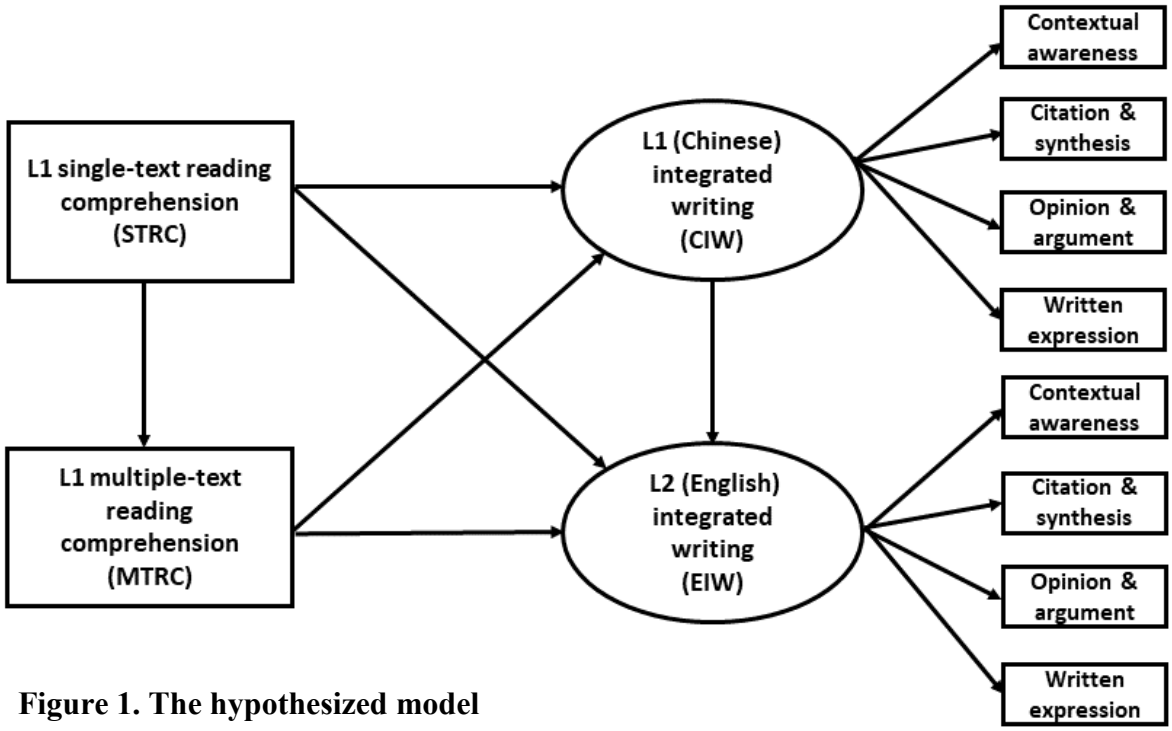

Figure 1. The hypothesized model

3. Methods

3.1. Participants

The study sample consisted of 322 Secondary four (i.e., Grade 10) students from four secondary schools in Hong Kong. The gender distribution was 154 females and 168 males, with an average age of 15.78 (*SD* = 0.70). With regard to school type, the data released by Education Bureau of Hong Kong in 2018 (Education Bureau, 2018) showed that there were 506 secondary day schools in Hong Kong, with aided schools constituting the largest proportion (361 schools, 71.34%), followed by direct subsidy scheme schools (60 schools, 11.86%), government school (31 schools, 6.13%), and private schools (54, 10.67%).[2] This study involved the four schools, including three aided schools and one direct subsidy scheme school, that covered the two major school types in the local context. The four schools also participated in a two-year university-school partnership project undertaken by the authors. Participation in the study was entirely voluntary. Written consent forms were obtained from the participants.

3.2. Instruments

The research team undertook a research project to investigate L1 and L2 integrated writing performance of secondary school students and developed a set of assessment instruments, including integrated writing tasks, scoring rubrics, and reading comprehension tests. Most of the instruments used in this study have been applied in the authors' earlier work (Cheong et al., 2019; Cheong et al., 2018), and the processes of designing and validating the integrated writing tasks have been described in Cheong et al. (2019).

3.2.1. Integrated writing tasks

[2] In Hong Kong, secondary schools can be categorized into four types based on sources of finance and governing bodies. Government schools are funded and governed by the Education Bureau. Aided schools are government-funded and run by voluntary management bodies. Direct subsidy schools receive government funding in accordance with the Direct Subsidy Scheme and have greater autonomy in school management. Private schools including international schools are mostly self-financed and run by independent educational organizations.

The official integrated writing assessments (i.e., the HKDSE Paper 3 in Chinese language and in English language) have three major components, including an audio recording, reading passages, and a writing prompt. The integrated writing assessments require students to compare and contrast the information from and across source materials and to use the source materials to build an argument or to support a proposition in their written products. In line with the framework of the HKDSE Paper 3, we developed a Chinese integrated writing task (CIW) and an English integrated writing task (EIW) to measure the students' integrated writing performance in L1 and L2 respectively. To ensure equivalence, the task requirements and materials were comparable in the two language settings. Each task comprised six reading passages, an audio recording, and a writing prompt that required students to compose a speech that included a summary of the varying perspectives presented in the source materials and their opinions on a given topic.

The topic of the CIW was filial piety. It represents the core values of Chinese culture, but meanwhile has given rise to controversy about its practicality in the modern age. In the CIW, students were required to summarize traditional and modern views on filial piety from across the source materials and then to argue for the practice of filial piety that they thought was more suitable in the modern age. The topic of the EIW was Cantonese opera. In spite of the inscription on UNESCO's Representative List of the Intangible Cultural Heritage of Humanity in 2009, Cantonese opera has been losing popularity among the younger generation. Consistent with the CIW, in the EIW, students were asked to summarize the positive and negative views on Cantonese opera that were presented in the source materials and then to argue for an approach that they thought were more beneficial to Hong Kong's future development. The two writing topics were debatable in nature and familiar to local secondary students. Local language teachers and assessment experts were consulted with

regard to task appropriateness and clarity and gave feedback that helped us modify the writing tasks.

Table 1 detailed the six reading passages and the listening material used in each task. The source materials presented similar, complementary, and competing views on the writing topics. For example, the second reading passage in CIW argued the repercussions of children being overly obedient to their parents, whereas the fourth passage advocated filial piety and described how filial behaviors moved everyone. In EIW, the third passage is a pie chart showing the decreasing popularity of Cantonese opera. In contrast, the fourth passage described the achievements of an iconic figure of Cantonese opera, Mr. Law Ka-ying, in promoting the art. The integrated writing tasks required students to differentiate and synthesize information to form an integral argument on a given topic. The six reading passages used in CIW amounted to 1608 Chinese characters, and those used in EIW amounted to 801 words.

Table 1 Specifications of source materials

	Chinese integrated writing (CIW)	English integrated writing (EIW)
Reading passage (1)	A poster outlining events of Chinese culture week and specifying the requirements of a speech contest	An email inviting students to give a speech and specifying the requirements of the speech
Reading passage (2)	An essay discussing the phenomenon of overparenting and the problems associated with it	A news report discussing the challenges facing Cantonese opera and the government's approaches to promote the art.
Reading passage (3)	A pie chart displaying the survey results of people's definitions of filial piety	A pie chart showing the survey results of the popularity of Cantonese opera
Reading passage (4)	Two ancient Chinese stories describing filial behaviors	A passage describing the achievements of Mr. Law Ka-ying
Reading passage (5)	Two excerpts from the Analects of Confucius regarding filial piety	A webpage describing the techniques and types of Cantonese opera

Reading passage (6)	Quotations demonstrating various views on filial piety	Quotations demonstrating various views on Cantonese opera
Audio recording	A discussion forum presenting differing perceptions of filial piety	A discussion forum presenting differing perceptions of Cantonese opera

3.2.2. Single-text reading comprehension test (STRC)

We used a six-item single-text comprehension test to measure students' ability to process intra-textual information. The test was adapted from the reading task that was developed by Cheong et al. (2018) to assess reading comprehension ability of local Secondary five students (i.e., 11th graders). The original reading task comprised two argumentative texts, followed by questions designed in accordance the Six Types of Reading Comprehension Process Model (Zhu, 2005a). The framework involves literal, inferential, and creative comprehension. Considering that in Cheong et al. (2018) the two comprehension tests altogether took 40 minutes, which was twice as much as the time we had for the test, only one argumentative text was used in this study with minor modifications. Two experienced Chinese language teachers were consulted with regard to the appropriateness and clarity of the text and the comprehension test.

The argumentative text discussed the differences between criticism and critique in academic discussion, followed by six short-answer questions. The test included two literal questions that required students to retrieve and summarize information directly from the source text. Two inferential questions were included that assessed students' ability to explain and elaborate on meanings of key concepts in the text. The last part of the test was two referential questions that asked students to present their opinions on an argument and to a hypothetical question. The total score was 20 points.

Table 2 Sample items for the STRC

Type of questions	Examples
Literal	Q3. What are the author's comments on the book review?
Inferential	Q4. According to the text, what is the rule of critique in academia?
Referential	Q6. If you disagree with your teachers' or other scholars' arguments, what will you do to show real respect to them in addition to the methods mentioned in the text.

3.2.3. Multiple-text reading comprehension test (MTRC)

Afflerbach and colleagues (2009; 2015) conceptualized multiple-text comprehension as constructive and integrative processes that entail higher-order cognitive operations of comparing, contrasting, relating, and differentiating information across multiple texts. Building upon this conceptualization, we developed a multiple-text reading comprehension test to measure students' ability to process inter-textual information. The topic of the test is artificial intelligence (AI). The test materials comprised five reading passages: (1) a brief definition of artificial intelligence excerpted from a popular science book, (2) a news article discussing the application of AI technologies in healthcare, (3) a news article arguing whether a robotic poet can express human emotions, (4) a brief account of the three laws of robotics by the science fiction writer Isaac Asimov, and (5) a summary of a research report that warned of the danger of malicious use of artificial intelligence. The MTRC test included multiple-choice questions and short questions. Three questions asked students to identify related information across source texts and develop a coherent account of a concept or statement. A table of three questions was used to assess students' ability to differentiate positive and negative views across texts and to briefly summarize each argument they identified. Three questions assessed students' ability to compare and contrast the reliability of source texts; they are also required to evaluate the usefulness of the texts in response to a given situation and explain reasons for their judgement. We collaborated with an experienced Chinese language educator to design the test. To ensure clarity and appropriateness of the

test, we then consulted two experienced practitioners and modified the test based on their feedback. The total score was 16 points.

Table 3 Sample items for the MTRC

Type of questions	Examples
Relate	Q1. Which two texts mentioned the process of machine learning? Q2. Explain the process of machine learning based on the two texts you selected in Q1.
Differentiate	Q5. There are various views on AI in relation to its benefits and threats. Identify the positive and negative views from the source materials and summarize the main arguments briefly.
Compare and contrast	Q7. You are planning to submit an article to a science journal to argue the benefits of AI to developing countries. Which text will you use to support your argument and why?

3.3. Procedure

This study comprised two phases. The first phase involved the integrated writing assessments, and the second phase involved the reading comprehension tests.

3.3.1. Integrated writing assessments

The two integrated writing tasks were carried out in 2017 when the students were in Secondary four (i.e., Grade 10). The students completed both the CIW and EIW in two days as regular assessments in relatively natural classroom settings at their schools. We followed the same procedure to administer the two tasks. In each task, the students first spent three minutes reading six passages and then listened to a recording for approximately twelve minutes. The recording was played only once, whereas the six reading passages were available to the students throughout the test. After the listening part, the students had one hour to complete an assay.

In terms of the scoring procedure, we used analytic integrated writing scoring rubrics to mark the students' essays. In each task, the essays were marked by a pair of raters, including

a primary and a secondary rater, making a total of four raters in this study. All the raters have a master's degree in a relevant field and teaching experience in Chinese or English language in the local context. To establish inter-rater reliability, we held two standardization meetings for each task before the actual marking. In the meetings, the raters got together to discuss the appropriateness and clarity of the scoring rubrics and mark anchor essays that were selected to represent different proficiency levels. A few modifications to the rubrics were made in light of the results of trial marking. The written products collected from the CIW and EIW were assessed against a set of analytic integrated writing scoring rubrics, adapted from Author (2005b) and used in the previous studies (Cheong et al., 2019; Cheong et al., 2018; Zhu et al., 2016). A similar four-trait marking scheme has also been applied to the current Chinese language examination of the HKDSE (Hong Kong Examinations and Assessment Authority, 2018). The rubrics address four dimensions of integrated writing: (1) contextual awareness, (2) citation and synthesis, (3) opinion and argument, and (4) written expression and organization. Table 4 summarized descriptors of the highest performance level (i.e., Marks 9 to 10) for each criterion.

Table 4 Descriptors of the highest performance level for each criterion

Criterion	Level descriptor
1. Contextual awareness	(1) A good sense of self and audience is established with a correct form to address the audience and a clear self-introduction. (2) An appropriate text type is used with a fitting ending to conclude the speech and show acknowledgement for the audience. (3) The communicative purposes are achieved with excellence.
2. Citation and synthesis	(1) Important information is comprehensively and concisely quoted or rephrased from the source texts or the recording. (2) Differing perspectives (from the source texts and the recording) are concisely synthesized.

	(3) An effective connection between the source information and the writer's prior knowledge or experience is shown consistently.
3. Opinion and argument	(1) Constructive and creative opinions are provided to explain a position. (2) Sound and convincing evidence for the opinions is provided.
4. Written expression and organization	(1) Decent expressions are used to demonstrate the right attitude towards the audience (e.g., showing respect to the principal, guests, and teachers). (2) Interaction with the audience is effective and consistent (e.g., by engaging the audience with questions in different ways). (3) The text is well organized with the opening and the ending complementing each other. Ideas are clearly and cohesively presented. (4) Sentences are meticulously crafted to form cohesion. A wide range of vocabulary is used accurately.

Students' performance in each of the four dimensions was assessed on a scale of zero to ten. The scale demonstrated increase in language proficiency in a continuous manner, with the score zero representing the lowest proficiency level and ten the highest. The primary rater marked all the 322 essays, and the secondary rater marked a third of the essays (i.e., 108 essays). All the raters worked independently. A third rater was involved when a discrepancy in scores between the primary and the secondary rater was larger than two marks. The final score was the average of the score assigned by the third rater and the closest score assigned by the original rater. We then examined inter-rater reliability between two raters for each of the four subscales. In the CIW, the inter-rater reliability estimates of the four subscales ranged from 0.66 to 0.85 using the Pearson product-moment correlation. As for the EIW, the inter-rater reliability estimates of the four subscales ranged from 0.67 to 0.74.

3.3.2. Reading comprehension tests

Consistent with the integrated writing assessments, the reading comprehension tests were carried out in class as regular classroom assignments in two days at the four secondary schools. The tests were administered in 2018 when the same students moved to Secondary five (i.e., Grade 11). In the single-text reading comprehension test (STRC), the students had 20 minutes to read a text and respond to six short-answer questions. In the multiple-text reading comprehension test (MTRC), the students read five reading passages and answered four multiple-choice questions and four short-answer questions in 30 minutes. Two research assistants were trained for two weeks to mark students' responses. One of them marked the STRC and the other marked the MTRC under the supervision of the second author. We held four trial marking sessions prior to the actual marking. Students' responses in each test were marked using a standardized marking scheme. The test scores represented the sum of the marks the students got in each test. The Cronbach's α for the STRC was 0.64, and 0.71 for the MTRC. The reliability estimate of the STRC was slightly lower than expected, but was still deemed acceptable according to Hair, Black, Babin, and Anderson (2010), who suggested values of 0.6 to 0.7 as the lower limit of acceptability. In addition, the result was consistent with Cheong et al. (2018) and previous studies using comprehension tests (Braasch et al., 2014; Bråten & Strømsø, 2010).

3.4. Data analysis

The data collected from the two integrated writing tasks and reading comprehension tests were coded and entered into IBM SPSS Statistics 25 for descriptive statistics and correlational analysis. We carried out exploratory factor analysis (EFA) to evaluate the construct validity of CIW and EIW, and then performed latent variable path analysis with Mplus 7.4 to examine the effects of L1 reading comprehension on L1 and L2 integrated writing and the cross-language effects of L1 integrated writing on L2. Several fit indices,

including the root mean square error of approximation (RMSEA), comparative fit index (CFI), and Tucker-Lewis index (TLI) were used to assess model fit.

4. Results

Descriptive statistics of the four measures were presented in Table 5. The mean scores for the STRC and MTRC were 7.75 and 10.39 respectively, and the mean scores for the CIW and EIW were 16.56 and 19.57 respectively. With regard to multivariate normality, the absolute values of skewness ranged from .29 to 1.24, and that of kurtosis ranged from .03 to 2.46. All of the absolute values fell within the acceptable range, representing normal distributions of the variables according to Kline (2016) who suggested that an absolute value should be considered severely skewed if it is larger than 3.0 and severe kurtosis if it is larger than 10.

Table 5 Descriptive statistics for the four measures (*N*=322)

	Min	Max	*M*	*SD*	Skewness	Kurtosis
1. Single-text reading comprehension test (STRC)	.00	16.00	7.75	3.02	-.29	.03
2. Multiple-text reading comprehension test (MTRC)	.00	15.00	10.39	2.69	-1.24	2.46
3. Chinese integrated writing assessment (CIW)	.00	28.75	16.56	5.25	-1.19	1.89
4. English integrated writing assessment (EIW)	.00	34.50	19.57	7.50	-.79	.10

Table 6 Correlations between variables

	1	2	3	4
1. Single-text reading comprehension test (STRC)	1			
2. Multiple-text reading comprehension test (MTRC)	.51**	1		
3. Chinese integrated writing assessment (CIW)	.40**	.50**	1	
4. English integrated writing assessment (EIW)	.49**	.45**	.51**	1

** $p<.01$

Table 6 shows the results of correlational analysis of the four variables. The four variables were positively correlated as expected with correlation coefficients ranging from .40 to .51, all at the $p<.01$ level. STRC was moderately correlated with MTRC and integrated writing performance in both L1 and L2 settings. A moderate correlation was also found between MTRC and CIW and between MTRC and EIW. These correlations established the relationship between reading and integrated writing and the cross-linguistic relationship between L1 reading and L2 integrated writing. In addition, CIW and EIW was moderately correlated with each other, suggesting a cross-linguistic relationship between L1 and L2 integrated writing.

We carried out EFA on the two latent variables, CIW and EIW, to evaluate their construct validity. CIW and EIW were measured by four indicators in Chinese and English respectively: (1) contextual awareness, (2) citation and synthesis, (3) opinion and argument, and (4) written expression and organization. With regard to multivariate normality, in CIW, the four variables had absolute skewness values ranging from .51 to 1.3, and the absolute kurtosis values ranging from .54 to 1.89. In EIW, the absolute skewness values ranged from .60 to.83 and from .04 to .37 for the kurtosis values. All of the absolute values fell within the acceptable range according to Kline (2016). The values of the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy were .81 for the CIW and .84 for the EIW, both exceeding the cut-off value of .60 (Tabachnick & Fidell, 2007), suggesting the suitability of the data for factor analysis. We than performed Bartlett's test of sphericity, and the results for CIW and EIW were both at the significant level ($p < .001$), indicating that the correlation matrices were not independent; therefore, factor analysis is appropriate for the data. The initial factor extraction of CIW produced four eigenvalues, one of which was larger than 1.0, accounting for 78.00% of the variance. The CIW had high factor loadings which ranged from .81 to .95. The initial factor extraction of EIW produced four eigenvalues, one of which

was larger than 1.0, explaining 88.20% of the variance. The EIW also had relatively high factor loadings which ranged from .90 to .96. One factor was derived from the observed variables of CIW and EIW respectively, that explained well the total variance in both cases. The EFA results established the construct validity of the CIW and EIW and revealed that both of them are unidimensional variables.

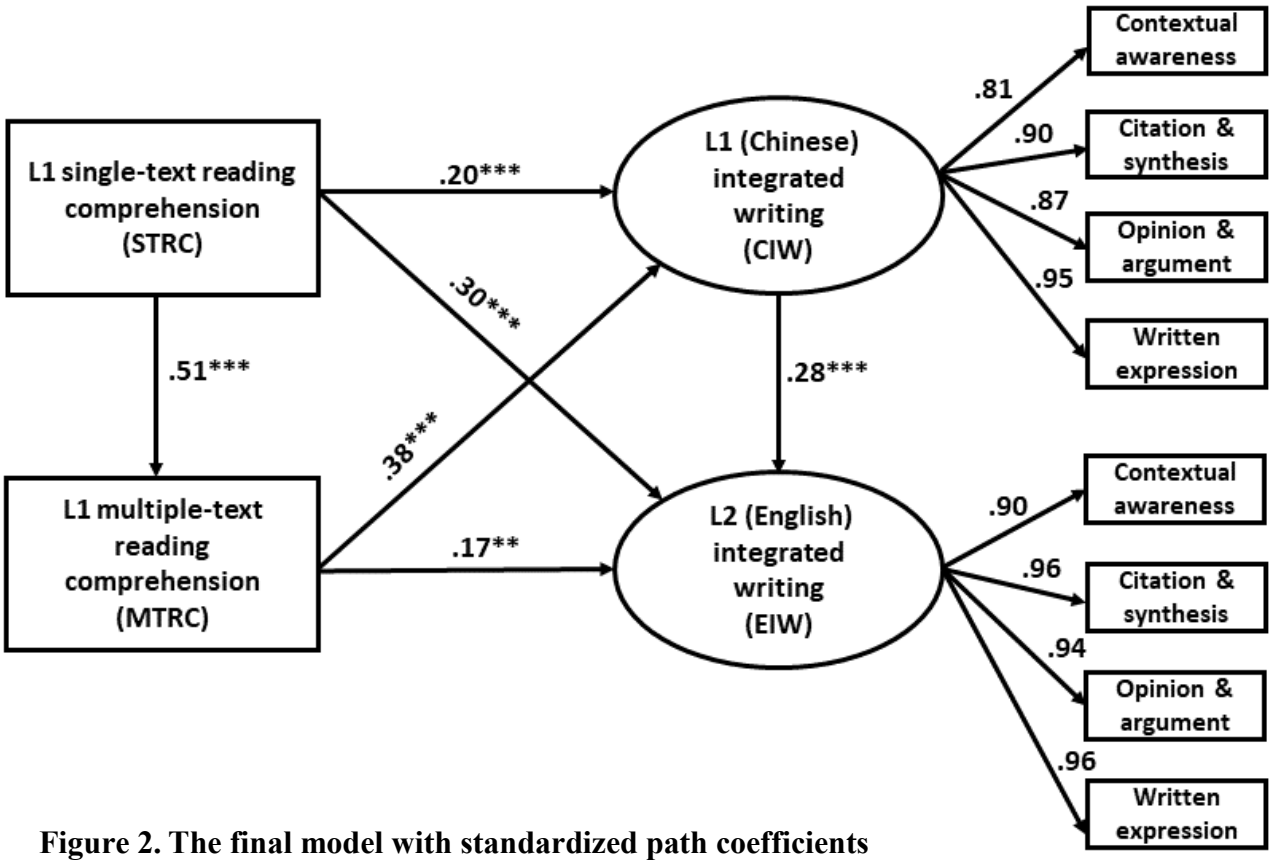

Figure 2. The final model with standardized path coefficients

Measures of model fit indicated that the model is an adequate explanation of the data: χ^2 (30) =82.65, RMSEA=0.07, TLI=0.97, CFI=0.98. The overall model fit explained adequately the relationship between L1 reading comprehension variables and integrated writing in both L1 and L2 settings. Figure 2 shows the final model with the standardized path coefficients for the significant paths between variables.

As expected, STRC had a positive direct effect on MTRC, showing that the ability to process inter-textual information can be built upon the intra-textual processing ability. STRC and MTRC both directly associated with L1 and L2 integrated writing. However, the patterns of the paths varied between languages. The relationship between MTRC and CIW was higher than that between STRC and CIW. In the case of L2, the relationship between STRC and EIW was higher than that between MTRC and EIW. The differing patterns might imply a closer relationship between single-text reading comprehension and L2 integrated writing. Furthermore, a direct cross-language path from CIW to EIW was observed, suggesting the transferability of integrated writing competence from L1 to L2. These findings indicate that both L1 integrated writing and L1 reading comprehension are significant factors affecting L2 integrated writing. Cross-linguistic transfer existed in the cases of reading comprehension as well as integrated writing.

In addition to the direct paths between the variables, indirect relationships were also examined to offer more insights into the development of L2 integrated writing competence. Three significant paths were noteworthy. STRC had indirect relationships with EIW via the mediation of MTRC ($\beta = .09$, $p < .01$), and via CIW ($\beta = .06$, $p < .01$). In addition, a significant indirect relationship between STRC and EIW was mediated by MTRC and then CIW ($\beta = .05$, $p < .001$).

5. Discussion

This study examined the relationships between L1 reading comprehension and integrated writing in both L1 and L2 settings. It was found that single-text and multiple-text comprehension each had significant positive relationships with L1 and L2 integrated writing performance. In addition to direct paths, indirect paths as well as cross-language connections were observed.

5.1. Reading-writing connection in integrated writing

Integrated writing involves intra-textual and inter-textual processing. In tune with previous studies (Florit et al., 2019; Hagen et al., 2014; Karimi, 2017), this study found the positive effect of STRC on MTRC, showing that the ability to make meaning of individual texts is predictive of the developmental level of information literacy that learners can draw upon when working with multiple texts (Bråten & Strømsø, 2011). The results of latent variable path analysis revealed that reading comprehension, including STRC and MTRC was positively associated with integrated writing performance. The positive relationships between reading and writing echo the reading-writing connection as shown in the previous studies (Ahmed et al., 2014; Graham et al., 2018; M. Kim & Crossley, 2018; Kobayashi, 2009b), in which reading comprehension was predictive of concurrent writing performance and subsequent writing development. The present study lent empirical support for the reading-writing connection in the context of integrated writing. The findings also suggest that integrated writing entails knowledge and cognitive operations that are shared by reading comprehension; therefore, adopting an integrative approach to teaching reading and writing (Fitzgerald & Shanahan, 2000; Graham et al., 2018; Shanahan, 2016) would be beneficial to the development of integrated writing competence.

Apart from the positive relationships between reading comprehension and integrated writing, we observed the differing path patterns among the variables. It seemed that CIW was associated more with MTRC and that EIW was associated more with STRC. The differing patterns we observed might imply that CIW seemed to better reflect the resource-demanding nature of integrated writing. The differences between L1 and L2 integrated writing have also been found in the previous work (Cheong et al., 2019), in which the effects of intertextual inference and discourse synthesis strategies on L1 integrated writing were greater than the effects on L2. van Weijen et al. (2019) also found that when writing from sources in L2, writers tended to argue in a straightforward manner, focusing more on texts that are

consistent with their own stance than on counter-arguments. As the authors argued, this approach could lead to less nuanced argumentation. Compared to single-text comprehension, multiple-text comprehension entails more strategic processing to achieve a coherent understanding of a topic of interest (Afflerbach & Cho, 2009; Bråten & Strømsø, 2011; Kobayashi, 2009a). The ability to work with multiple texts strategically is associated with learners' language proficiency (Karimi, 2017; Sawaki et al., 2013). Pae (2019) also indicated that L2 proficiency had a greater effect on L2 reading and writing than L1 abilities did. In other words, there exists a linguistic threshold (Cummins, 1979) that learners need to overcome to write from sources effectively in L2. Limited language resources in L2 might be a factor that led to the differences we observed in path patterns in CIW and EIW. It is expected that once the students clear the hurdle of making meaning of individual texts, they will demonstrate a greater awareness and ability to build an integrative argument across multiple texts using their second language.

5.2. Cross-language transfer and L2 integrated writing competence

This study substantiates Cummins' (1979) hypothesis of linguistic interdependence between reading and writing and extends further this line of research to integrated writing, a more complex and cognitively demanding test setting. The latent variable path analyses revealed significant cross-language effect of CIW on EIW. The ability to write from multiple texts in L1 is predictive of the ability in L2. The finding not only confirms the association between L1 and L2 integrated writing competence (van Weijen et al., 2019) but also substantiates the transferability of integrated writing competence from L1 to L2 (Cheong et al., 2019). Moreover, cross-language connections also existed from L1 reading comprehension to L2 integrated writing. STRC and MTRC each had a direct significant relationship with EIW. The findings lent support for the cross-language reading-writing connection as shown in Pae (2019) and the longitudinal study carried out in the Hong Kong

context by Shum et al. (2016) in which first graders' Chinese reading abilities were associated with their English writing proficiency in later years. These results suggest that literacy skills are transferable from L1 to L2 within the same skill domain (e.g., integrated writing). Given the significant relationships among L1 reading comprehension variables and L2 integrated writing, a further exploration of the causal relationship among the variables would lend empirical support for the cross-language transferability between literacy skills (e.g., from reading to writing).

Apart from its direct relationships with L1 and L2 integrated writing, STRC was associated with EIW indirectly through the mediation of MTRC and CIW. In addition, STRC was associated with CIW indirectly via MTRC. These significant direct and indirect paths from STRC to CIW and EIW are in tune with previous studies suggesting the overarching role of L1 reading comprehension in both L1 and L2 integrated writing (Cheong et al., 2018; Plakans et al., 2019; Sawaki et al., 2013). The ability to make meaning of individual texts in L1 might serve as a foundation for dealing with more complex literacy tasks that require learners to construct a coherent mental representation of information from multiple sources; this ability is also entailed in tasks that require writers to present an integral argument from multiple texts in a second language.

In summary, the significance of L1 reading comprehension abilities and L1 integrated writing competence lies in their relationships with L2 integrated writing. The cross-language effect from L1 to L2 integrated writing observed in this study supports van Weijen et al.'s (2019) assertion that writing from sources is a generic skill between languages. It is expected that the ability to write from sources in L2 can capitalize on the literacy skills that students have already acquired in L1 and that L1 literacy skills could function as common ground underpinning source-based writing across languages (van Weijen et al., 2019).

5.3. Implications

Several pedagogical implications can be drawn from the findings of this study. The latent variable path analyses support the positive cross-language connections between literacy skills, including the relationships between L1 reading comprehension and L2 integrated writing and the transferability of integrated writing from L1 to L2. This study supports the advocacy of integrative pedagogy of reading and writing in language classrooms (Fitzgerald & Shanahan, 2000; Graham et al., 2018). Instead of teaching reading and writing separately, an integrated instructional approach that encourages learners to use reading and writing skills simultaneously is beneficial to better equipping them with essential information literacy skills for college readiness and lifelong learning. In real life communications, language skills are mostly used in an integrative rather than separate manner (Plakans & Gebril, 2012). Furthermore, integrated language tasks that engage learners in complex meaning-making processes of multiple-text integration and extended responses, help promote higher-order thinking skills and problem-solving ability, both of which are crucial for academic and career success (Ahmed et al., 2014; Wang & Matsumura, 2019). The significant contribution of L1 integrated writing to L2 identified in this study also holds implications for the early implementation of integrated writing instruction in the local context in which the notion of integrated writing is usually introduced to students in Secondary four (i.e., Grade 10) to prepare students for the HKDSE (Zhu & Wu, 2013). The early implementation of integrated writing has been proved achievable at the upper primary level (Martínez, Mateos, Martín, & Rijlaarsdam, 2015; Wissinger & De La Paz, 2016) through explicit strategy instruction on selecting, connecting, and organizing arguments from sources and through the use of thinking prompts and graphic organizers to facilitate logical thinking. It is expected that explicit L1 integrated writing instruction can promote the transfer and contribute to the development of L2 integrated writing competence. Furthermore, the cross-language connections between literacy skills have been substantiated in the present and several recent studies (Cheong et al.,

2019; Pae, 2019; Sparks et al., 2019), particularly the positive relationships between L1 reading and L2 integrated writing. A bilingual approach that engages students in reading in L1 and then writing in L2 might serve as a scaffold that helps mitigate the difficulty in L2 integrated writing in the early stage and move toward reading and writing from sources entirely in L2.

5.4. Limitations

Several limitations in this study must be noted. First, it should be noted that the present study only examined the relationships between reading comprehension and integrated writing. Further examinations would be needed to verify whether students' integration practices varied between language. That is, students would employ more inter-textual processing when writing in L1, whereas when writing from sources in L2, they would focus more on comprehension of individual text and less aware of the relations among texts. Second, modifications of the single-text reading comprehension measure would be helpful, given the slightly low reliability estimate obtained in the present study. In addition, we needed to accommodate the tight schedule of each school to carry out the reading comprehension tests. Under limited time constraints, we had to narrow down the test items after consulting experienced teachers. Given the aforementioned constraints, findings inferred from the STRC should be treated with caution. On the other hand, the present study agrees with the previous studies that single-text comprehension and multiple-text comprehension are correlated constructs (Bråten & Strømsø, 2011; Kobayashi, 2009a). However, the differing path patterns we discussed in section 5.1 suggest that the two constructs required differing cognitive processing. Thus, more test items for single-text reading comprehension might be used in future studies to better examine reading comprehension competence and offer more insights into the relationships between reading and writing in integrated writing assessments.

Third, this study involved students at the senior secondary level (Grade 10 and 11) where integrated writing is usually implemented for examination purposes. Although we had tried to ensure the tasks were undertaken in natural classroom settings, we could not exclude the effects that test-taking could have on the students' writing performance, such as test anxiety and the use of test-taking strategies. Therefore, the sample may not be considered genuinely representative, and the results should be interpreted carefully. Future research may consider recruiting students at the upper primary or junior secondary level where the teaching and learning of integrated writing will be comparatively low-stakes in nature. The writing tasks used in this study require not only information integration but also articulation of personal opinions. It is possible that a model that includes argumentation skills as independent variables might add depth to the findings of this study. Finally, this study established the contribution of reading comprehension to integrated writing in a one-way direction. Considering a growing interest in the reciprocal relations between reading and writing and the inconsistent research findings from previous studies (Y.-S. G. Kim & Piper, 2019; Pae, 2019), researchers may explore further the reciprocity of literacy skills in the context of integrated writing through an investigation of composing processes illustrated by participants' think-aloud protocols or retrospective interviews to shed more light on the connections between reading and writing in integrated writing.

6. Conclusions

Integrated writing constitutes an integral part of Hong Kong's language curriculum to prepare secondary school graduates for college and career readiness. This study explored the effects of reading comprehension on integrated writing. The results of SEM analyses revealed the positive causal relationships between reading comprehension, including single-text and multiple-text reading comprehension, and integrated writing with the effects differing between languages. The findings also substantiated the transferability of integrated writing

competence from L1 to L2 and the overarching role of L1 reading comprehension in facilitating the cross-language transfer. This study contributed to existing literature by establishing the cross-language connection between reading and writing in the context of L2 integrated writing. It also provided evidence that supports the adoption and early implementation of integrative pedagogy of reading and writing in L1 to better facilitate the development of L2 integrated writing competence.

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