

The correlation between out-of-school and in-school reading resources with primary school students' reading attainment

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Introduction. This study examines the impact of the availability of reading resources in the school, the classroom, the home and the social environment on the reading proficiency of Grade Four primary school students in Hong Kong.

Method. Data about the reading performance of Hong Kong students in the 2011 Progress in International Reading Literacy Study is reported. The survey data of 3,875 Hong Kong primary school students' reading performances were analysed.

Analysis. The survey data of 3,875 Hong Kong primary school students' reading performances and their access to out-of-school or in-school reading resources were statistically analysed using multilevel modeling.

Findings. The analysis revealed that the number of books at home, the time readers spent reading at home, the literacy facilities in the school and in the home and the children's use of school and local libraries significantly impacted their reading attainment. The results also showed the positive impact of home reading facilities and encouragement, and the use of public and school resources on the students' reading attainment.

Conclusion. This study applied multilevel modeling to simultaneously evaluate the impact of reading resources located in family, classroom and library on students' reading attainments. It demonstrated the importance of access to reading materials in home and family environments for students' reading attainment.

Introduction

Previous research studies have investigated the effects of the use of multiple resources within or outside school on the reading attainment of primary school students. Three major factors have been examined by research studies. A very common and significant factor is the classroom setting, including its resources and the instruction time provided to children. The use of library resources is another major outside-school factor which is usually free to access and relies more on a child's own initiative ([Aabo and Audunson, 2012](#); [Johnson, 2012](#); [Johnson and Donham, 2012](#)). On the other hand, family resources are more determined by parents' cultural capital, restricted by families' socio-economic background and are less dependent on children themselves ([Evans, Show and Bell, 2000](#); [Neuman, 1996](#); [Tan and Liu, 2018](#); [Cheng, 2018](#)). Several studies have showed that parents play important roles in assisting their children with academic work regardless of their financial background ([Calvo and Bialystok, 2014](#)).

English and Chinese are both held in equal status as official languages in Hong Kong. Chinese cultures, with Confucian origin ([Confucius, 1979](#)), encourage docility, respect for authority and a strong emphasis on learning ([Gibson, 1988](#); [Ogbu, 1987](#); [Butler 2014](#)). Not surprisingly, in this study, Chinese parents adopted these cultural characteristics and tended to have high expectations of learning

achievement and seemed quite supportive in helping their children learn to read. They provided their children with great assistance but also with intense pressure (Schneider and Lee, 1990). For example, parents would provide interesting educational resources at home. They bought a variety of reading materials and spent a lot of time on home literacy activities with their children. They also routinely read bedtime stories. Such interventions have been found to be significant predictors of emergent literacy skills and later reading performance (Jacobson and Lundberg, 2000; Purcell-Gates, 1996; Rowe, 1991). Also, their own reading behaviour was very important given that parents' behaviour is often observed and imitated by children (Bandura, 1986). The result of this environment was that children in Hong Kong had good reading attainment scores in the Progress in International Reading Literacy Study 2011.

Previous studies usually examined these factors separately due to the limitation of data availability. The current study took a more comprehensive approach in filling empirical research gaps by systematically looking at the effects of resource use from the perspectives of family, school and community. For instance, library usage was holistically examined in terms of variables associated with each library resource. This study is important because it is able to assist those in a position to make policy in choosing how to direct resources, whether in the form of in-school or at-home materials or, in the context of government policymakers, educational resources more broadly.

Literature review

When conducting this literature review, the goal was to synthesise the literature in order to find places where they are in agreement or tension with one another and locate gaps in knowledge. Pertinent literature and factors positively influencing literacy development in Hong Kong were reviewed from three perspectives: the use of school and public libraries; the value of classroom reading corners; and the home literacy environment.

Library resources

Turning first to Hong Kong children's use of libraries, Hong Kong school and public libraries are managed by professional librarians who administer the service, recommend reading resources and organise reading programmes for students. Students may freely use both types of libraries. The organisation and operation of both types of libraries are similar, and school libraries are positively associated with the enhancement of students' reading development in primary schools (Johnson and Donham, 2012). The availability and use of school library books has been found to correlate positively with the time students say they engage in after-school voluntary reading (Houle and Montmarquette, 1984), which is important in developing reading literacy (Krashen, 1996). Students who have easy access to books are likely to read more and show more positive attitudes towards reading (Shoham, 1997). The frequency of visiting the school library also influences students' reading attainment. According to Francis, Lance, and Lietzau (2010), primary school students in the Third and Fifth grades who paid more visits to libraries were found to significantly outperform their peers on reading comprehension tests. The link found in these studies between library resources and reading performance might reflect that reading resources in libraries facilitate students' independent reading and ultimately improve their reading performance (Tunnell and Jacobs, 1989; Turner, 1995; Yi et al., 2018).

School libraries

School librarians play an important role in promoting students' reading literacy and providing well-

chosen reading resources (Deci and Ryan, 2002; Albelda and Mano, 2017). They offer students opportunities to select their own reading materials and offer them meaningful advice, both of which have been found to enhance and sustain reading interest and improve reading performance ([Deci and Ryan, 2002](#); [Guthrie, Winfield and Perencevich, 2004](#)). Since 2001, all primary schools in Hong Kong have had their own teacher-librarian ([Hong Kong Education Bureau, 2002](#)) who, besides managing the daily operation of the library, is actively involved in coordinating and promoting reading resources to enhance the development of students' reading. They work closely with teachers to meet students' literacy needs, create reading programmes, and develop school-based curriculum strategies to encourage reading interest and promote reading habits ([Hong Kong Education Bureau, 2002](#)).

Public libraries

Hong Kong public libraries are also important resources that students can use to supplement their reading literacy. Comparatively speaking, they possess wider reading materials than school and classroom libraries, and provide students with more varied access to fascinating reading materials. Additionally, public libraries provide school-age children with such educational services as hosting literacy lectures and programmes and offering story-reading classes that support students' reading development ([Arnold, 2003](#); [Becker, 2012](#); [Whitehead, 2004](#); [Karbach, 2016](#)). Whitehead (2004) found that students who visited public libraries invariably outperformed peers on reading tests who paid no such visits.

Classroom resources

Classroom libraries are critical for the development of reading literacy ([Fractor, Woodruff, Martinez and Teale, 1993](#); [Neuman, 1996](#); [Young and Moss, 2006](#); [Schoerning, Hand, Shelley and Therrien, 2015](#)). A plentiful and diverse supply of books in the classroom library can promote students' reading interests and skills ([Neuman, 1996](#)). Several studies have indicated that students who have ready access to books in classroom libraries hold more positive and enduring attitudes about reading than do their peers ([Young and Moss, 2006](#)) and tend to spend more time reading ([Cunningham and Allington, 1999](#); [Krashen, 1996](#); [Routman, 2003](#)). Moreover, access to classroom libraries increases the incidence of students' voluntary reading, which further improves their reading attainment ([Guthrie, Schafer, Von seker and Alban, 2000](#); [Krashen, 2004](#)).

Teachers can indirectly promote students' reading literacy and interests with the help of classroom libraries. Teachers who introduce reading materials daily and get students to frequently interact with books in the classroom library will invariably enhance students' engagement in reading ([Neuman, 1996](#)). In addition, they may also use reading strategies to stimulate reading interest and promote reading comprehension. For example, teachers may apply joint learning in small groups in which students are actively involved in face-to-face interactions with peers while reading. Teachers can also make use of inquiry-based learning with the collaboration of school librarians to encourage students working in groups to search for and evaluate information themselves. Both approaches have been identified as effective ways to motivate reading interest and improve reading performance ([Chu, Tse, Loh and Chow, 2011](#); [Guthrie, et al., 2004](#); [Slavin, 2005](#)).

Hong Kong primary school teachers work collaboratively with teacher-librarians to choose reading resources and develop reading strategies with the aim of enhancing students' reading motivation and encouraging their use of school and classroom reading resources. Working alongside one another, teachers and teacher-librarians set up classroom libraries in standard fashion across classes in primary

schools ([Hong Kong Education Bureau, 2002](#)).

A number of teachers operate classroom libraries in Hong Kong, using library materials to extend and supplement classroom reading instruction ([Chien, Chen, Ko, Ku and Chan, 2015](#); [Chiu and Cheng, 2017](#)). Students' reading interests may not appear to be their priority when teachers direct students to choose from pre-selected reading material. Here, the function of the classroom library is different from that of school and public libraries in Hong Kong, a possibility given special attention in this paper.

Home literacy environment

A positive home literacy environment significantly influences students' competence and progress in learning to read and forming the habit of reading for pleasure as well as for information, especially during the early years of learning how to read ([Burgess, Hecht and Lonigan, 2002](#); [Molfese, Modglin and Molfese, 2003](#); [Scarborough and Dobrich, 1994](#); [Siriboe and Harfitt, 2018](#)). Although there is no universal definition of what constitutes an effective home literacy environment, researchers generally agree that it refers to the number of books, magazines and newspapers in the household, and locations where people in the home read for pleasure or for information. Parents and literate relatives serve as role models ([Niklas and Schneider, 2010](#)). It has been found in many countries that the number of reading materials and books at home is closely related to students' reading development and progress. Many reading researchers have reported that students who acquire literacy skills in school at an early age usually have access to rich reading resources in the home ([Krashen, 1996](#); [Sangkaeo, 1999](#); [Tse, 2012](#)). Conversely, lacking access to reading materials in the home, adults who set an example, and an expectancy that reading is pleasurable has been found to delay students' acquisition of cognitive and linguistic knowledge ([Neuman, 1996](#)). Simply living and being raised in a place where books, magazines and other forms of reading materials are present helps to establish an environment that encourages students to read ([Morni and Sahari, 2013](#)).

The parents' role in helping children develop reading habits is very significant. Parents' attitudes towards reading have been shown to influence students' interest in reading and literacy development, and research has indicated that parents are prime role models who inspire children to acquire an enduring habit of reading ([Clark, 2009](#); [Morni and Sahari, 2013](#)). Students from families where parents value books and encourage reading are themselves more likely to enjoy reading ([Morni and Sahari, 2013](#)). Parents who visit libraries, read for pleasure and information in the home, give or receive books as gifts and read regularly have a sustained impact on students' reading performance ([Morni and Sahari, 2013](#)).

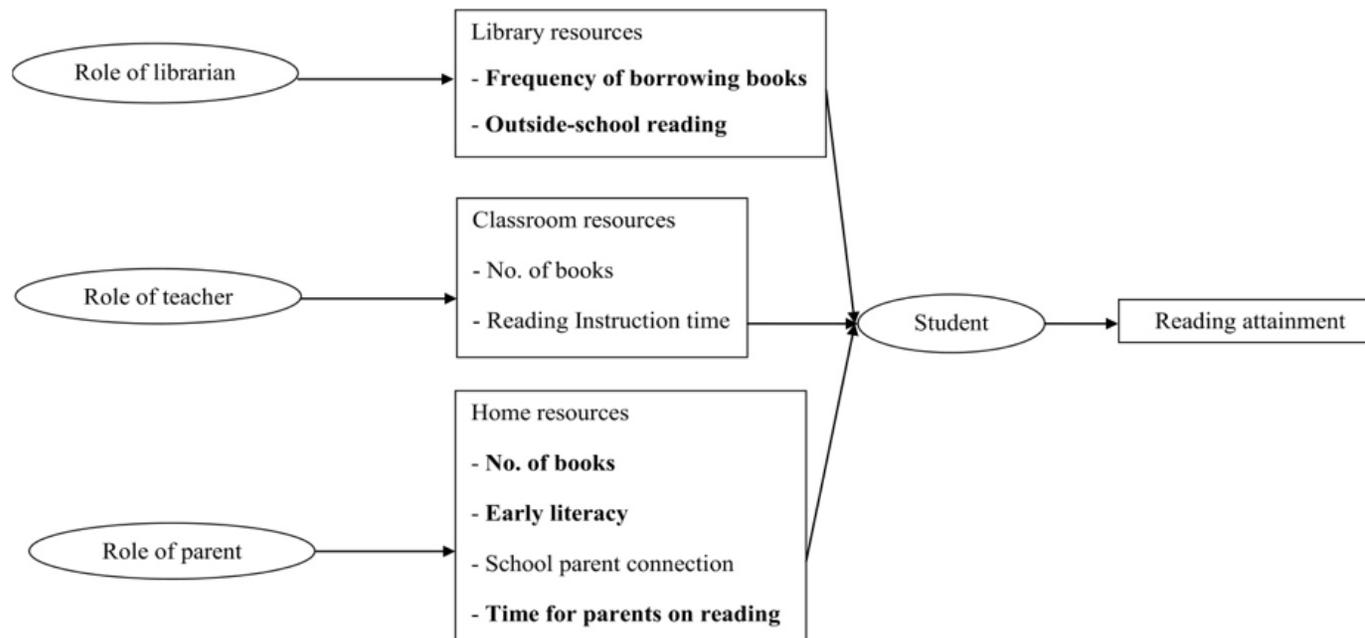
The frequency of parent-initiated home-based reading-related activities has been shown to influence students' reading literacy, vocabulary, and language ([Bus, van Ijzendoorn and Pellegrini, 1995](#); [Leseman and de Jong, 1998](#)). Parents who regularly engage in reading activities at home serve as models and they often encourage children indirectly to continue to engage in reading ([Snow, Burns and Griffin, 1998](#)). In addition to providing a favourable home literacy environment, many parents may actively involve themselves in their children's school academic performance and progress ([Epstein and Sanders, 2000](#); [Fan and Chen, 2001](#); [Meinck, Stancel-Piatak and Verdisco, 2018](#)). Parent-school interaction usually takes two forms: (a) parents may be active in helping their children learn at home and complete home assignments, and (b) teachers may deliberately involve parents in school activities and helping children practice what they have learned in school at home ([Powell, Song, File and Juan, 2010](#)). Active parental participation in school-based activities allows parents to follow their children's learning development in school, which has been indicated to contribute to their children's higher

performance and quicker adjustment in school ([Epstein and Sanders, 2000](#); [Fantuzzo, Davis and Ginsburg, 1995](#); [Powell, 2001](#)). Teacher responsiveness to parents has been found to be highly correlated with parent participation in school activities and their children's learning and scholastic attainment ([Kohl, Lengua and McMahon, 2002](#)). However, as studying parent-school involvement is a relatively young field, there is limited literature about the most effective forms of parent-teacher interaction for promoting learning in schools.

The presence in the home of a literacy-favourable, reading-related environment is consistently related to children's emergent literacy skills and reading development ([Bus, et al., 1995](#); [Evans, Show and Bell, 2000](#); [Scarborough and Dobrich, 1994](#)). There may be informal and formal reading-related activities at home ([Sénéchal and LeFevre, 2002](#)). Informal reading-related activities refer to a home literacy environment where reading is a common and normal activity. This encourages children to appreciate reading for information and pleasure and may involve reading material in books and magazines and on electronic devices in the home. Formal activities represent children's exposure to print, for example, their parents' teaching of language and reading skills ([Sénéchal and LeFevre, 2002](#)).

Research evidence about the impact of formal activities and instruction in the home on children's reading development is inconsistent. Some studies indicate that parental teaching, such as teaching decoding skills, has had a positive outcome on children's reading performance ([Hood, Conlon and Andrews, 2008](#); [Sénéchal and LeFevre, 2002](#)). However, other research reveals that parental formal reading-related activities had insignificant impact on the development of reading skills ([Chen and Stevenson, 1989](#); [Cooper, Lindsay and Nye, 2000](#)). One reason for the mixed results is that there are differing patterns of children being exposed to formal home-based activities. Many teachers are aware that some children who have had no formal reading instruction at home or in a school can already read some words before they start school, a point also reported by Donaldson ([1978](#)). Furthermore, once some children receive systematic reading instruction in school, the influence of parents' teaching of reading at home sometimes diminishes ([Silinskas, et al., 2012](#)). However, generally speaking, the findings on the effect of informal home-based reading-related activities are positive. Many previous research studies report that informal reading activities, such as parents and children sharing reading, promote vocabulary acquisition ([Sénéchal, 2006](#); [Sénéchal and LeFevre, 2002](#)) and indirectly contribute to the development of children's reading skills in the primary school ([Hood, et al., 2008](#); [Sénéchal, 2006](#); [Sénéchal and LeFevre, 2002](#)). Of the literature sampled for this study, newer research seemed more likely to demonstrate a strong link, while older research was more likely to show the opposite. Further research may be required to investigate whether this is the result of methodology, differences inherent to the culture of the present day, or simply coincidence.

Many research studies have examined the effects of the use of multiple resources outside school on the reading attainment of primary-school students in the classroom ([Evans, et al., 2000](#); [Johnson and Donham, 2012](#); [Neuman, 1996](#)). However, many of the researchers cited have only examined the impact of one or two factors in the home and social environment on students' reading development. For instance, few have explored parental involvement from a comprehensive perspective. A research framework (see Figure 1) was established from the literature, describing various library resources to be investigated in the study.



Note. Bolded variables predicted students' reading attainment positively in the present study.

Figure 1: Framework of the study

Method

In light of the above review, the investigation had two main aims: the first to compare the impact of usage of library, classroom and home resources on students' reading attainment; the second to examine the predictive value of these variables on Hong Kong Grade Four students' reading comprehension. Reliable and valid attainment data gathered during the 2011 Progress in International Reading Literacy Study survey of reading standards allowed the writers to examine the impact on reading performance of students' formal and informal use of library, classroom, home and social reading resources. Various researchers in the West have examined the impact on reading of the above variables, but few large-scale studies have involved Chinese-speaking youngsters. Hong Kong Primary Four students maintain their high levels of reading literacy by using various resources. The reading literacy performance of Hong Kong Primary Four (P4) students was ranked first out of forty-five countries or regions and demonstrated their outstanding performance in the Progress in International Reading Literacy Study (PIRLS) 2011 (Mullis, Martin, Foy and Drucker, 2012). This latter statistic has attracted the interest of reading teachers worldwide keen to learn why Hong Kong students had performed so well in the Progress in International Reading Literacy Study 2011. It is because of this international curiosity that the PIRLS dataset from 2011 was used despite newer data being available.

Participants

To ensure the representativeness of the participants from the different countries surveyed in the Progress in International Reading Literacy Study, the International Association for the Evaluation of Educational Achievement (hereafter, the International Association) uses a rigorous sampling approach.

Two-stage stratified sampling is employed, with the sampling of schools in the first stage and sampling of students in the second stage ([Joncas, 2007](#)). Specifically, in each country, around 150 schools representing a broad spectrum are randomly selected, and then some thirty students from each school are randomly selected. Following standard sampling procedures, IEA-approved researchers selected 3875 students from 132 schools in Hong Kong. The mean age of the students was about ten years old.

Measures

In the PIRLS data-gathering procedure, a representative sample of students in each participating country had to complete a set of specially constructed tests of their reading proficiency and fill in a questionnaire about their learning experiences both inside and outside school. In addition, specifically designed questionnaires were delivered to students, parents, teachers, school principals, and administrators so that education authorities could gather information about students' socioeconomic background, school characteristics, and social contexts that might contribute to their proficiency.

The International Association works closely with experts from the participating countries to create and verify equivalent test items on the reading comprehension tests and to establish suitable validity and reliability of the attainment data ([Mullis, Martin, Gonzalez and Kennedy, 2003](#); [Mullis, Martin, Kennedy and Foy, 2007](#)). They also check the cross-national validity and reliability of the data gathered in each participating country ([Gonzalez and Kennedy, 2003](#); [Trong and Kennedy, 2007](#)).

The reading literacy test

The International Association developed reading comprehension tests to assess Grade Four students' reading literacy in the Progress in International Reading Literacy Study 2011 assessment survey. The test package was comprised of ten passages with questions for which the context and linguistic level were commonly encountered by Grade Four students in their regular classroom setting. Five passages were designed to assess students' ability with literary reading materials (e.g. short stories, narrative extracts and traditional tales). Another five passages were designed to measure students' ability to comprehend informational text (e.g., expository passages, instructions, timetables and manuals).

To reduce the influence of fatigue and learning effects resulting from completing a long test, a balanced incomplete block design was used for PIRLS. As each student responded to only part of the total number of test items, a multiple imputation technique was used to create five sets of plausible values of reading scores for the whole sample ([Foy, Galia and Li, 2007](#)). To maximise the evaluative precision of the test, an item response theory approach was used to integrate and scale students' responses in the test using a balanced incomplete block design (i.e., estimate reading attainment scores of students based on their responses to a subset of questions from the overall test). Accordingly, raw reading scores were adjusted to item response theory scale scores with an international mean of 500 and a standard deviation of 100.

The test package had an excellent reliability co-efficient in Progress in International Reading Literacy Study 2006, however, the reliability of reading attainment tests used in PIRLS 2011 was not available due to administrative restriction. The inter-scorer reliabilities of the construct-responses were checked by looking at the scores given by independent scorers and found to be 96% for the Hong Kong sample tested in PIRLS 2006 ([Martin, Kennedy and Trong, 2007](#)).

Questionnaires and variables

The content validity of the questionnaires has been established in the PIRLS questionnaire development group and national research coordinators from different countries ([Barth, Kennedy and Trong, 2007](#)). In the questionnaires, answers were mostly in the form of Likert scales. Five variables were present: the frequency of borrowing books from school or local libraries, the amount of time that students spent on out-of-school reading, the number of books at home, the amount of time that parents spent on reading, and early home literacy activities. The descriptive statistics of these five variables are shown in Table 1. Another three variables (the number of books in the classroom library, amount of time spent receiving reading instruction at school, and school-parent connections) were used as student-level and school-level predictors. For the purpose of this study, some variables were derived from individual items measuring the same latent construct in the student, home, school and teacher questionnaires for multilevel analysis. Detailed approaches for deriving all the variables in the analysis of this study are presented in [Appendix 1](#).

| Variable | Possible maximum score | Mean | Std. Dev. |
|---|------------------------|--------|-----------|
| Reading attainment | — | 571.04 | 60.79 |
| No. of books at home | 5 | 2.81 | 1.14 |
| Time parents spend reading | 4 | 2.3 | 0.91 |
| Early home literacy activities | 27 | 18.37 | 3.25 |
| Frequency of borrowing books from school or local libraries | 4 | 3.17 | 0.94 |
| Time students spend on outside-school reading | 4 | 1.86 | 0.96 |

Table 1: Possible maximum scores, means and standard deviations of reading attainment scores and the student-level variables for all participants (n=3875).

Data analysis

Given the nested nature of the data (students in different schools), multilevel modeling proposed by Hox ([1995](#)) was applied to test the relationship between the suggested variables and students' reading attainment. Hierarchical Linear Modeling 7 software ([Raudenbush, Bryk and Congdon, 2010](#)) was used to execute the multilevel analysis. Such multilevel modeling allows assessment of the impact of library, classroom and family resources simultaneously, which are comprised of sets of variables. It also allows segregation of school effects and individual effects with appropriate assignment on fixed and random effects.

A variance components model was adopted in this study to investigate how much variance in students' reading attainment at each of the two levels was accounted by the suggested variables.

Student-level model: $Y_{ij} = B_{0j} + r_{ij}$ (1)

School-level model: $B_{0j} = \gamma_{00} + \mu_{0j}$ (2)

Y_{ij} is the reading attainment score for student 'i' in school 'j', B_{0j} is the intercept of students' reading attainment in school 'j' (i.e., the grand mean of students' reading attainment in school 'j'), γ_{00} is the grand mean intercept of students' reading attainment (i.e., the grand mean of all students' reading achievement), and r_{ij} and μ_{0j} are residuals at the student and school level, respectively.

Students' reading attainment was predicted by sets of two-level models. To compare the impact of sets of variables on students' reading attainment, the student-level and school-level variables centred with their grand means were entered stepwise in this order: 1. number of books at home, 2. time parents spent reading, 3. early home literacy activities, frequency of borrowing books from school or local library, 4. time students spent on outside-school reading, 5. number of books in classroom library, 6. time spent on reading instruction at school, and 7. school-parent connection.

Student-level model:

$$Y_{ij} = B_{0j} + B_{1j} \text{ number of books at home}_{ij} + B_{2j} \text{ time parents spent reading}_{ij} + B_{3j} \text{ early home literacy activities}_{ij} + B_{4j} \text{ frequency of borrowing books from school or local library}_{ij} + B_{5j} \text{ time for students to spend on outside-school reading}_{ij} + r_{ij} \quad (3)$$

School-level model:

$$B_{0j} = \gamma_{00} + \gamma_{01} \text{ number of books in classroom library}_j + \gamma_{02} \text{ time spent on reading instruction at school}_j + \gamma_{03} \text{ school-parent connection}_j + \mu_{0j}$$

$$B_{1j} = \gamma_{10} + \mu_{1j}$$

$$B_{2j} = \gamma_{20} + \mu_{2j}$$

$$B_{3j} = \gamma_{30} + \mu_{3j}$$

$$B_{4j} = \gamma_{40} + \mu_{4j}$$

$$B_{5j} = \gamma_{50} + \mu_{5j} \quad (4)$$

In the student-level regression model, B_{0j} is the intercept of students' reading attainment in school 'j'; B_{1j} to B_{5j} are the coefficients of student-level predictors (1. number of books at home, 2. time parents spent reading, 3. early home literacy activities, 4. frequency of borrowing books from school or local library, and 5. time for students on outside-school reading) for predicting student 'i's reading score in school 'j'; and r_{ij} is the residual of student 'i's reading score in school 'j'. In the school-level modeling, B_{0j} was estimated as a function of the mean intercept of students' reading attainment (γ_{00}) and the effects of number of books in classroom library (γ_{01}), time of reading instruction (γ_{02}), and school-parent connection (γ_{03}) of school 'j', plus the residual (μ_{0j}) of school 'j'; B_{1j} , B_{2j} , B_{3j} , B_{4j} , or B_{5j} was estimated as a function of the respective mean slope of students' reading attainment (γ_{10} , γ_{20} , γ_{30} , γ_{40} , or γ_{50}) and the respective residual of school 'j' (μ_{1j} , μ_{2j} , μ_{3j} , μ_{4j} , or μ_{5j}).

Findings

The multilevel model

Table 2 shows that the effects of most student-level predictors on reading attainment had a close relationship to the mean reading attainment scores (β_0). Table 3 presents the results of predictors' successive entry into the models after controlling for the effect(s) of the preceding predictor(s). Results for the null model indicate that 78% of the variance in students' reading attainment scores was explained at the student level and 22% of the variance was explained at the school level (see the null model in Table 3). These suggest substantial variance was occurred in both student level and school

level, so two-level modeling was potentially useful to model students' reading attainment score.

| | Fixed effects | | | | | | | | |
|--|-------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|----------------------------|---------------------------|
| | Null model | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 | Model 7 | Model 8 |
| Intercept (β_0) | | | | | | | | | |
| Intercept (γ_{00}) | 564.58 [†] (3) | 565.13 [†] (2.87) | 565.15 [†] (2.86) | 565.43 [†] (2.81) | 565.52 [†] (2.77) | 565.54 [†] (2.76) | 565.54 [†] (2.74) | 565.54 [†] (2.72) | 565.68 [†] (2.6) |
| NBCL slope (γ_{01}) | | | | | | | -3.41 (2.98) | -3.07 (3.03) | -3.38 (2.89) |
| TRI slope (γ_{02}) | | | | | | | | 1.90 (1.18) | 1.51 (1.23) |
| SPC slope (γ_{03}) | | | | | | | | | -1.42 ^{**} (0.5) |
| NBH slope (β_1) | | | | | | | | | |
| Intercept (γ_{10}) | | 4.76 [†] (1.21) | 4.29 [†] (1.23) | 3.66 ^{**} (1.23) | 3.16 [*] (1.21) | 2.41 [*] (1.21) | 2.41 [*] (1.21) | 2.41 [*] (1.21) | 2.43 [*] (1.21) |
| TPOR slope (β_2) | | | | | | | | | |
| Intercept (γ_{20}) | | | 3.46 ^{**} (1.25) | 2.56 ^{#1} (1.3) | 2.51 ^{#2} (1.28) | 2.40 ^{#3} (1.29) | 2.39 ^{#4} (1.29) | 2.41 ^{#5} (1.29) | 2.47 ^{#6} (1.28) |
| EHLA slope (β_3) | | | | | | | | | |
| Intercept (γ_{30}) | | | | 1.40 [†] (0.39) | 1.35 ^{**} (0.38) | 1.33 ^{**} (0.39) | 1.34 ^{**} (0.39) | 1.35 ^{**} (0.38) | 1.35 ^{**} (0.39) |
| FBBSLL slope (β_4) | | | | | | | | | |
| Intercept (γ_{40}) | | | | | 5.24 [†] (1.31) | 4.59 [†] (1.38) | 4.60 [†] (1.38) | 4.58 [†] (1.38) | 4.59 [†] (1.38) |
| TSOOR slope (β_5) | | | | | | | | | |
| Intercept (γ_{50}) | | | | | | 3.69 ^{**} (1.18) | 3.70 ^{**} (1.18) | 3.70 ^{**} (1.18) | 3.66 ^{**} (1.18) |
| <p>Note: NBH = Number of books at home; TPOR = Time parents spend on reading; EHLA = Early home literacy activities; FBBSLL = Frequency of borrowing books from school or local libraries; TSOOR = Time spent by students on outside-school reading; NBCL = Number of books in classroom library; TRI = Time for reading instruction; SPC = School-parent connection. For fixed effects, standard errors are in parentheses; for random effects, standard deviations are in parentheses.</p> <p>*p < 0.05; **p < 0.01; [†]p < 0.001; #1, #2, #3, #4, #5, #6 p = 0.06.</p> | | | | | | | | | |

Table 2: Summary of hierarchical linear modelling of the effects of student-level and school-level predictors on reading attainment

Number of books at home

When the number of books at home was entered into the model, it accounted for an extra 1% of the student-level variance and 3% of the total variance in students' reading scores (see the null model and model 1 in Table 3). The regression coefficient of 4.76 for the variable indicates that, on average, students scored 4.76 points higher per extra 1-point increase in the number of books at home (see model 1 in Table 2).

| | Random effects | | | | | | | | |
|-------------------------------|--------------------------|-----------------------------|----------------------------|--------------------------|-----------------------------|---------------------------|----------------------------|-----------------------------|----------------------------|
| | Null model | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 | Model 7 | Model 8 |
| Level 2 intercept (μ_0) | 840.99 [†] (29) | 765.75 [†] (27.67) | 756.42 [†] (27.5) | 728.87 [†] (27) | 700.88 [†] (26.47) | 696.9 [†] (26.4) | 686.19 [†] (26.2) | 678.54 [†] (26.05) | 637.1 [†] (25.24) |
| NBH slope | | 16.32 (4.04) | 18.71 (4.33) | 21.31 | 17.92 (4.23) | 17.77 (4.22) | 17.84 (4.22) | 17.81 (4.22) | 18.3 |

| | | | | | | | | | |
|--|-----------------|-----------------|----------------|----------------|-----------------|-----------------|-----------------|-----------------|----------------|
| (μ 1) | | | | (4.62) | | | | | (4.28) |
| TPOR slope (μ 2) | | | 7.28 (2.7) | 8.22 (2.87) | 8.18 (2.86) | 10 (3.16) | 10.18 (3.19) | 10.34 (3.22) | 10.2 (3.19) |
| EHLA slope (μ 3) | | | | 0.6 (0.78) | 0.84 (0.92) | 0.83 (0.91) | 0.87 (0.93) | 0.88 (0.94) | 0.94 (0.97) |
| FBBSLL slope (μ 4) | | | | | 20.15 (4.49) | 27.02 (5.2) | 27.27 (5.22) | 27.17 (5.21) | 27.63 (5.26) |
| TSOOR slope (μ 5) | | | | | | 16.85 (4.1) | 16.99 (4.12) | 16.92 (4.11) | 16.92 (4.11) |
| Level 1 (r) | 2998.25 (54.76) | 2963.63 (54.44) | 2948.41 (54.3) | 2927.7 (54.11) | 2891.29 (53.77) | 2864.17 (53.52) | 2863.49 (53.51) | 2863.32 (53.51) | 2861.74 (53.5) |
| Remaining variance | | | | | | | | | |
| School-level | 840.99 (29) | 765.75 (27.67) | 756.42 (27.5) | 728.87 (27) | 700.88 (26.47) | 696.9 (26.4) | 686.19 (26.2) | 678.54 (26.05) | 637.1 (25.24) |
| Student-level | 2998.25 (54.76) | 2963.63 (54.44) | 2948.41 (54.3) | 2927.7 (54.11) | 2891.29 (53.77) | 2864.17 (53.52) | 2863.49 (53.51) | 2863.32 (53.51) | 2861.74 (53.5) |
| Increase in variance explained | | | | | | | | | |
| School-level | 0.22 | 0.09 | 0.01 | 0.04 | 0.04 | 0.01 | 0.02 | 0.01 | 0.06 |
| Student-level | 0.78 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 |
| Total variance explained | | 0.03 | 0.01 | 0.01 | 0.02 | 0.01 | 0.00 | 0.00 | 0.01 |
| <p>Note. NBH = Number of books at home; TPOR = Time parents spend on reading; EHLA = Early home literacy activities; FBBSLL = Frequency of borrowing books from school or local libraries; TSOOR = Time students spend on outside-school reading; NBCL = Number of books in classroom library; TRI = Time for reading instruction; SPC = School-parent connection. For fixed effects, standard errors are in parentheses; for random effects, standard deviations are in parentheses.</p> <p>*p <0.05; **p<0.01; †p <0.001</p> | | | | | | | | | |

Table 3: Summary of hierarchical linear modelling of the effects of student-level and school-level predictors on reading attainment (continued)

Time parents spent reading

The length of time students' parents spent on reading had a substantial impact on their children's reading attainment since the time parents spent reading accounted for an additional 1% of the student-level variance and 1% of the total variance in the reading scores when entered into the model (see models 1 and 2 in Table 3). Overall, students scored 3.46 points higher for every 1-point increase in time their parents spent on reading, after controlling for the preceding variables entered (see model 2 in Table 2).

Early home literacy activities

When the effects of the preceding variables are controlled, students' early home literacy activities added an extra 1% of the student-level variance and 1% of the total variance in reading scores (see models 2 and 3 in Table 3). In addition, this variable resulted in a 1.4-point difference in reading scores (see model 3 in Table 2).

Frequency of borrowing books from school or local libraries

Students' reading scores were associated with the frequency of borrowing books from school and local libraries. On average, a 1-point increment in frequency of borrowing books from school or local libraries predicted students' gains of 5.24 points in reading scores, controlling for the preceding variables (see model 4 in Table 2). This added variable explained an additional 1% of the student-level variance and 2% of the total variance (see models 3 and 4 in Table 3).

Time students spent on outside-school reading

The time students spent on outside-school reading accounted for 1% of the student-level variance and 1% of the total variance in reading scores (see models 4 and 5 in Table 3). Students gained 3.69 points of reading scores per extra 1-point increase in this variable, after controlling for the effects of other variables (see model 5 in Table 2).

Number of books in the classroom library

The number of books in the child's classroom library was associated with students' reading scores. After controlling for the effects of the preceding variables, this variable explained an additional 2% of the school-level variance but explained no added variance in total (see models 5 and 6 in Table 3).

Time for reading instruction

The time teachers spent giving reading instruction accounted for an additional 1% of the school-level variance but explained no added variance in the total (see models 6 and 7 in Table 3).

School-parent connection

School-parent connection was found to be reversely associated with students' reading scores (see model 8 in Table 2). About 6% of the school-level variance and 1% of the total variance were explained by this added variable (see models 7 and 8 in Table 2).

Altogether, all predictors explained 19% of the school-level variance, 5% of the student-level variance, and 8% of the total variance in the reading scores (see the null model and model 8 in Table 2). Among these predictors, time students spent on outside-school reading appeared to be the most powerful predictor after controlling for the effects of all other student-level predictors, whereas school-parent connections appeared to be the most important school-level predictor.

Discussion

The relationship between available library resources and reading attainment in Hong Kong students

One of the main aims of the study was to compare the incidence of the children using and time spent on library, classroom and home resources in predicting their reading attainment. The data show that the number of books in the class library and time spent receiving reading instruction did not make any significant contribution to their reading attainment in the presence of other variables. On the other hand, the time the students spent on out-of-school reading and the frequency of borrowing books from school or local libraries were significant predictors of reading attainment after controlling for the effects of other variables. These results emphasise the crucial role of independent reading practice in explaining students' reading attainment levels. A strong association between independent reading and

academic achievement has been well documented in the literature (Cullinan, 2000; Tunnell and Jacobs, 1989). A major reason that independent reading practice is important for reading attainment is that reading practice provides reading autonomy as an internal motivation for reading (Yoon, 2002). Learners have an internal need for self-determination and are more likely to be interested in and committed to activities that are selected by themselves (Deci, Vallerand, Pelletier and Ryan, 1991; Turner, 1995). In the current study, both out-of-school reading and borrowing books from school or local libraries increased the time students spent on independent reading. The importance of independent reading may increase with the development of reading skills, as independent reading relies heavily on a reader's reading ability and enhances autonomy. Students in the intermediate grades read fairly fluently and, in fact, silent reading may be a better way to foster reading attainment than oral reading, as it involves more engagement from the student (Anderson, Wilson and Fielding, 1988; Leinhardt, Zigmund and Cooley, 1981). Meanwhile, independent reading outside of school allows students to choose what to read, as no assessment is actually needed, which is a clear form of intrinsic motivation.

In contrast, the finding that the number of books in the classroom library and time spent on reading instruction did not contribute to reading attainment significantly, suggests that classroom teaching and reading practice may not give adequate independent reading for students. Both the teachers' and students' oral reading in the classroom are common instruction methods in teaching primary grade students. They encourage students to develop linguistic skills, like letter-sound relation for word decoding, build up and enrich vocabulary and contribute to reading fluency. Despite the significant effect of reading-aloud practice on reading growth, intermediate grade teachers have been shown to read to their students less frequently than primary grade teachers (Jacobs, Morrison and Swinyard, 2000). It is because reading aloud may specifically affect lower or fundamental reading skills (e.g., word recognition) and may not help students to develop higher-order skills for reading comprehension (e.g. predicting words and inferring text meanings).

The findings suggest that access to a quality school or public library may result in good reading attainment, an important finding since access to interesting reading material and time to read are available to almost all young people (Krashen, 2004).

The relationship between classroom resources and the reading attainment among Hong Kong students

Two kinds of reading-related resources are typically found in Hong Kong in classrooms: the number of books in the classroom and the amount of time devoted to class reading instruction. Interestingly, the analyses show that the amount of classroom resources made no significant contributions to the Hong Kong students' reading scores in the Progress in International Reading Literacy Study 2011. It is worth noting that this result does not contradict a common finding in the literature that classroom resources are an important contributor to reading performance. In fact, the findings suggest that classroom resources play a less important role than library and home resources, with the only school-related resource that had an impact on the total variance (the interaction between parents and the school) falling into a grey area between school and home resources.

This finding was not consistent with the previous finding that reading instruction was a significant correlate of students' reading performance. In Hong Kong, the materials and resources habitually used by teachers often come in for criticism as they do not cover a wide range of reading topics. In fact, teachers have been encouraged to build up a good environment and supply of books for students to read

for pleasure. The findings suggest that Hong Kong primary teachers might profitably increase the amount of time allocated to independent reading in class.

The relationship between home resources and reading attainment among Hong Kong students

Bronfenbrenner (1979) has pointed out that, to know more about human development, researchers put the entire social system into consideration, composed of the socially organised subsystems in which growth occurs. One such subsystem is the home literacy environment, generally found to have a direct influence on students' reading attainment. Results from this study support the idea of an important role for the home literacy environment in promoting students' reading attainment. In particular, the number of books in the home, the time parents spent on reading, and other early home literacy activities significantly impact on reading attainment.

As mentioned earlier, the number of books at home accounted for 3% of the total variance found by the study. The amount of time that parents spent reading and early home literacy activities accounted for another 1% each, resulting in 5% of total variance that can be explained by home resources. This is a full point higher than the combined total of the other variables, suggesting that this group's role in literacy attainment is absolutely critical. This is further underlined by the fact that one of the remaining variables, interaction between parents and school, could also reasonably be seen to fall under this category and would increase the total explained by home resources to 6%.

Limitation

The major limitation of the present study was the omission of a number of important variables. As depicted in Figure 1, librarians, teachers and parents are assumed to have an impact on how reading resources are set up in different settings (library, classroom and home). However, the role of the librarian, teacher and parent in the relationship between library, classroom and home resources and reading attainment was not examined in the present study. Therefore, this is an important issue to be examined in further investigations. Specifically, librarians' professional skills, teaching approach parents' reading attitude and parental expectations of their children should be included in future studies. Students' reading attitudes should also be included. Due to administrative restrictions, the reliability of the reading attainment tests used in the Progress in International Reading Literacy Study 2011 was not available. In order to test the result reliability, a comparative survey will be conducted along with Progress in International Reading Literacy Study 2011 data in the future.

Conclusions

The primary goal of this study was to compare the effects of reading-related resources in the classroom, home and family environments on Hong Kong Grade 4 students' reading attainment. It is of paramount import to identify the main factor behind students' variation on reading performance as it could give directions on resource allocation at the family, school and public community levels.

The findings suggest a very significant role for home resources and parental involvement. Summaries and suggestions are highlighted as the following:

- The number of books parents provide in the home and the time they themselves spend on reading, the early home literacy activities they arrange and the length of time their children spend on outside-school reading are crucial for their offspring's reading progress. However, this does not

imply that the resources allocation at school and public community level should be reduced.

- As inequality of family resources created variance in reading performance, government and educators should reconsider how public and school resources can be used effectively and efficiently to close the gap in students' reading performance.
- Home resources were by far the most significant indicator of literacy achievement in this study. That simply suggests that more resources need to be devoted to studying various methods of improving literacy in the classroom so that disadvantaged students are not left behind.

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Appendix 1 Creation of the variables in the multilevel modelling analyses

| Name of variable | Items | Values of derived variable |
|---|---|---|
| Frequency of borrowing books from school or local libraries | How often do you borrow books from your school or local library? Choices: at least once a week, once or twice a month, a few times a year, never or almost never | NA |
| Time spent by students on outside-school reading | How much time do you spend reading outside of school on a normal school day? Choices: less than 30 minutes, 30 minutes up to 1 hour, from 1 hour up to 2 hours, 2 hours or more | NA |
| Number of books at home | About how many books are there in your home? (Do not count magazines, newspapers, or your school books.) Choices: none or very few (0–10 books), enough to fill one shelf (11–25 books), enough to fill one bookcase (26–100 books), enough to fill two bookcases (101–200 books), enough to fill three or more bookcases (more than 200) | NA |
| Time spent by parents on reading | In a typical week, how much time do you usually spend reading for yourself at home, including books, magazines, newspapers, and materials for work (in print or electronically)? Choices: less than one hour a week, 1–5 hours a week, 6–10 hours a week, more than 10 hours a week | NA |
| Early home literacy activities | Before your child began primary or elementary school, how often did you or someone else in your home do the following activities with him or her? —Read books —Tell stories —Sing songs —Play with alphabet toys (e.g., blocks with letters of the alphabet) —Talk about things you had done —Talk about what you had read —Play word games —Write letters or words —Read aloud signs and labels Choices: often, sometimes, never or almost never | The sum of parents' responses to the component items. |
| Number of | About how many books are in your classroom | |

| | | |
|-----------------------------------|--|--|
| books in classroom library | library? Choices: 0–25, 26–50, 51–100, more than 100 | NA |
| Time given to reading instruction | Regardless of whether or not you have formally scheduled time for reading instruction, in a typical week about how much time do you spend on reading instruction and/or activities with the students? Include things you do across curriculum areas and during formally scheduled time for reading instruction. | NA |
| School-parent connection | <p>How often does your school do the following for parents concerning individual students?</p> <ul style="list-style-type: none"> —Inform parents about their child's learning progress —Inform parents about the behaviour and well-being of their child at school —Discuss parents' concerns or wishes about their child's learning —Support individual parents in helping their child with schoolwork <p>How often does your school do the following for parents in general?</p> <ul style="list-style-type: none"> —Inform parents about the overall academic achievement of the school (e.g., results of national tests, results of inspections of learning) —Inform parents about school accomplishments (e.g., tournament results, facility improvements) —Inform parents about the educational goals and pedagogic principles of the school —Inform parents about the rules of the school —Discuss parents' concerns or wishes about the school's organization (e.g., rules and regulations, time tables, safety measures) —Provide parents with additional learning materials (e.g., books, computer software) for their child to use at home —Organize workshops or seminars for parents on learning or pedagogical issues <p>Choices: never, once a year, 2–3 times a year, more than 3 times a year</p> | The sum of school principals' responses to the component items |

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