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School and teacher level predictors for students' information literacy in Chinese rural and urban education

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Abstract: This study aimed to investigate the level of secondary school students' information literacy in China and examine the contribution of school and teacher level factors on students' information literacy between rural and urban schools. A total of 598 schools, 56415 students, and 18286 teachers participated in this study. The findings of this study were as follows: (1) the overall of secondary schools students' information literacy only reached an average level and urban school students' information literacy were significantly higher than that of rural school students; (2) In rural schools, teachers' ICT collaboration was a positive predictor for students' information literacy, while teachers' ICT use for learning was identified as a negative predictor of students' information literacy; (3) In urban schools, ICT management, ICT operation, and teachers' ICT self-efficacy were found to be significantly associated with students' information literacy. Based on the findings, suggestions for improving students' information literacy between rural and urban schools were discussed.

Keywords: Information literacy, Chinese secondary school students, rural and urban school.

1. Introduction

Information literacy is gaining recognition as being vital for students living, learning and working in the twenty-first century (European Commission, 2007; Kim & Lee, 2013) and the school has been widely acknowledged as an important place for equipping their students with new kinds of skills such as information literacy (Gerick, 2018). Previous studies have revealed that school and teacher level factors such as ICT infrastructure, ICT classes, teachers' ICT attitude, ICT self-efficacy, ICT use in class and ICT collaboration were major predictors for students' information literacy (Kim et al., 2011; Zhong,2011; Zhu et al., 2019; Guo & Tsai, 2014).

In recent years, the Chinese government has announced a series of education policies to support the cultivation of students' information literacy. For instance, in 2017, A new information technology curriculum standard was published for high schools to assist students to use computers with greater fluency (The ministry of education, 2017). To accurately measure students' information literacy level, the Chinese ministry of education regards the assessment of students' information literacy as an important task for the development of education information in the 2.0 age (The Ministry of Education, 2018).

Despite these efforts, there are still several problems that exist in Chinese information literacy education. A study showed that the overall level of Chinese secondary students was just "pass" (Li & Ranieri, 2010). Some researchers also pointed out that the development of students' information literacy was unbalanced in China (Zhang & Zhu, 2016). What is the level of students' information literacy in urban and rural schools in China? Is a significant influence of school and teacher level factors on students' information literacy between rural and urban schools? To best of our knowledge, little research has addressed these issues, especially in developing countries such as China.

Therefore, this study aims to investigate the students' information literacy concerning rural and urban schools from a national wide perspective. What's more, this study also aims to analyze the schools and teacher level predictors for students' information literacy in comparison to rural and urban schools. The results of our study are expected to help policymakers and authorities to understand the status of students' information literacy in China and identify effective strategies and policies to reduce the digital divide of students' information literacy between rural schools and urban schools.

2. Literature review

2.1 The definition of information literacy

Since the term of information literacy was coined by in 1974 by Paul Zurkowski, the concept of information literacy has been influenced by the evolution of the information society. Various institutions and researchers have put forward different definitions of information literacy. For example. UNESCO (2003) defined information literacy as the ability to identify, locate, evaluate, organize, and effectively create, use, and communicate information to address. Another resembling definition was provided by the Educational Testing Service (ETS), which treated the information literacy as the ability to use digital technology and networks to access, manage, integrate, evaluate, and create information (ETS, 2007). Besides, The Association of College and Research Libraries (ACRL) made a definition of information literacy as a set of comprehensive abilities encompassing the reflective discovery of information, the understanding of how information is produced, and the recreating new knowledge (ACRL, 2016). Furthermore, the Chartered Institute of Library Information Professionals (CILIP) put forward a new definition of information literacy, which emphasized the ability to think critically and express informed views (CILIP, 2018).

More recently, with the rapid development of art intelligence, big data and cloud computing, computational thinking (CT) is becoming an important element for future talents and many institutions have taken CT as a new dimension of students' information literacy (Bae et al. 2017; Kim, Ahn, & Kim, 2019; IEA, 2016). By consolidating the existing definition of information literacy and based on our previous studies (Zhu et al. 2017; Zhu, Yang, MacLeod, Yu, & Wu, 2019), four dimensions of information literacy in this study were been proposed as following: Information Awareness and Attitude, Information Knowledge and Skills, Information Thinking and Behavior, and Information Social Responsibility. Awareness and Attitude refer to one's information sensitivity including perception awareness, application awareness, and security awareness. Knowledge and Skills include fundamental knowledge of network, internet, PC, and a set of skills involved in the ability to use ICT. Thinking and Behavior involve the ability to think critically and use the appropriate information technology to solve complex problems, create and express ideas compellingly. Social Responsibility refers to moral principles and understanding of the rules governing information activities.

2.2 School factors influencing students' information literacy

Concerning school-level variables, prior studies have reported that ICT infrastructure, school size, computer curriculum, and ICT management were major predictors for students' information literacy. For example, some studies revealed that ICT availability at schools and the proportion of ICT equipment per student own were significantly associated with students' information literacy (Kim, Kil & Shin, 2014; Zhong,2011; Seo et al., 2009). Kim (2014) found that students who had a higher completion rate of computer-related coursed showed a relatively high level of information literacy. Similarly, other studies showed the number of ICT classes positively correlated with the grade of students' information literacy (Baek et al., 2008; Kim et al., 2011). As for the impact of school location on students' information literacy, the results were inconsistent. For instance, Kim et al. (2011) reported that students living in urban areas have a higher ICT literacy level than do students living in rural areas. Whereas in other studies, students who live in provincial areas had superior information literacy compared with students living in major cities (Seo et al., 2009; Baek et al., 2008). However, little research has examined the schools' influence on secondary students' information literacy between rural schools and urban schools in China.

2.3 Teacher factors influencing students' information literacy

Regarding teacher-related variables, precedent studies reported that teachers' ICT capabilities, ICT attitude, ICT self-efficacy, and ICT usage were major influential factors of students' information literacy. For example, Meelissen and Drent (2008) claimed that teachers' attitudes towards ICT had an indirect effect on students' information literacy through influencing students' ICT attitude. Aesaert, Vanderlinde, and Tondeur (2015) reported that ICT usage in class was associated with students' information literacy. Teachers' ICT self-efficacy refers to their belief in completing ICT-related tasks. Previous studies found that teachers' ICT self-efficacy was a positive determinant of students' information literacy (Meelissen & Drent, 2008; Zhu et al 2019). For the teachers' ICT collaboration, Lai, Guo, and Tsai (2014) claimed that a collaborative teaching approach had a positive impact on students' information literacy. As far as we know, no study has investigated the impact of teachers' factors on secondary students' information literacy between rural and urban schools in China.

2.4 The present study

To balance the development of students' information literacy in China, it is necessary to understand the status of students' information literacy and analyze the key predictors of students' information literacy concerning rural and urban schools. Although there is an extensive body of studies that have documented several influential factors of students' information literacy, little research has analyzed predictors of students' information literacy by differentiating the type of schools. Besides, no large-scale assessment has been conducted so far to investigate the students' information literacy in developing countries such as China.
Therefore, this study aims to assess Chinese secondary schools' students' information literacy skills and examine the different influential factors of students' information literacy by comparison between rural and urban schools. The following research questions are addressed in this study:
RQ1: What's the level of students' information literacy between rural schools and urban schools?
RQ2: What are the major predictors of students' information literacy at the school level? Is there a difference between urban school and rural schools?
RQ3: What are the major predictors of students' information literacy at the teacher level? Is there a difference between urban school and rural schools?

3. Methodology

3.1 Sampling

This study was conducted from October 2018 to December 2018. Three-stage of sampling method were used to collect data. In the first stage, 368 municipal and county areas were selected from 31 provinces in China according to their economic level. Well-developed and underdeveloped areas are in half in each province respectively. In the second stage, 3 to 5 junior schools were selected within each of the selected areas. The proportion of rural schools and urban schools was equal. In the third stage, students from seventh and eighth grades were randomly selected from each school. Ninth-grade students were excluded from this survey because of entrance academic stress. This survey included 598 schools, 64.05% of them were urban schools and 35.95% of them were rural schools. A total of 56415 students and 18286 teachers also participated in this survey. Among these participants, 36162 students and 11712 teachers were from urban schools, and 20253 students and 6574 teachers were from rural schools.

3.2 Instrumentation

The instruments of this study included three parts:
1) Students' information literacy test. A total of 41 multiple choice questions on the web platform were designed to measure students' information literacy. The four dimensions of information literacy are as following: information awareness and attitude (10 items), information knowledge and skills (15 items), information thinking and behavior (10 items), and information social responsibility (6 items). The overall reliability coefficients (a) of students' information literacy test was 0.84. Information awareness and attitude refer to students' sensitivity and judgment on information, including information perception awareness, application awareness, and security awareness. A sample item is, "What should you do if you travel to a strange place and get lost". Information knowledge and skills refer to students' information science knowledge and the skills to use specific ICT applications such as word, excel and Photoshop, etc. A sample item is, "Which of the following devices belongs to the computer output device?". Information thinking and behavior refer to students' ability for using technological tools to take part in learning activities independently and innovatively. For example, students are asked to draw the structure of a learning topic using a mind mapping tool. Information social responsibility refers to moral principles and understanding of the rules governing information activities. A sample item is, "The following ACTS in accordance with the network ethics is?".

2) A school questionnaire. The school questionnaire consisted of 21 web-based items to collect data about school ICT infrastructure, ICT resources, ICT operations, teacher ICT tanning, and ICT management. The items of the school questionnaire were adopted from a previous study (Wu, Li, Zhou, Tsai, & Lu, 2019). The Cronbach's alpha values for these scales were 0.70, 0.65, 0.68, 0.72, and 0.60 respectively.

3) A teacher questionnaire. Teachers' data were collected via five scales including ICT self-efficacy (14 items), ICT use for teaching (10 items), ICT use for students' learning (13 items), ICT collaboration (5 items), and ICT attitude (8 items). All the items of the teacher questionnaire were adopted from previous studies (Luan, Fung, Nawawi, & Hong, 2005; Aesaert et al., 2015). The Cronbach's alpha values obtained in this study were as follows: ICT self-efficacy (alpha=0.92), ICT use for teaching (alpha= 0.92), ICT use for students' learning (alpha=0.97), ICT collaboration (alpha= 0.86), and ICT attitude (alpha= 0.86).

3.3 Data collection and analysis Procedures

With the help of provincial education administrative departments and local education administrative departments, students were arranged in the computer lab of each sample school to complete the information literacy test. At the same time, teachers and chief of educational information of each selected school were required to finish the teacher questionnaire and school questionnaire respectively. Students and teachers were matched through the schools' names. All participants were informed of the research purposes and were required to sign formal consent to participate in the study.
SPSS 22.0 software was used in this study. Descriptive statistics were used to describe the overall level of students' information literacy and regression analyses were conducted to explore the effect of school and teacher level factors on students' information literacy in rural and urban schools respectively.

4. Results

4.1 Students' information literacy between urban and rural schools

To answer Q1, t-test companions were conducted to examine the difference in students' information literacy between urban and rural schools. On average, the information literacy of students from urban schools is 60.99, and the information literacy of students from rural schools is 54.94. The information literacy and other dimensions including information awareness and attitude, information knowledge

and skills, information thinking and behavior, information social responsibility of students from urban schools were significantly better than that of students from rural schools.

Table 1. *Students' Information Literacy Comparison Between Urban and Rural Schools*

	Urban		Rural		F
	M	SD	M	SD	
Information literacy	60.99	15.55	54.94	15.52	10.46***
Awareness and cognition	28.82	7.40	26.55	7.56	6.42**
Knowledge and skills	9.88	3.12	8.74	3.25	9.05***
Thinking and behavior	9.58	2.53	8.48	2.25	15.05***
Social responsibility	12.71	4.40	11.18	4.59	8.32***

*Note: **p<0.01, ***p<0.001*

4.2 School-level factors predicting students' information literacy

To answer the second question, stepwise regression analysis was conducted to explore the relationship between school-level factors and students' information literacy, as shown in Table 2. School ICT related factors were viewed as predictors to explain the variations in students' information literacy. In urban areas, ICT operations ($t=2.21$, $p<0.05$) and ICT management ($t=2.40$, $p<0.05$) could make significant predictions (6 % explained) for the students' information literacy. While in rural areas, school-level factors were found less significantly associated with students' information literacy.

Table 2. *The Regression Analysis of School-level Factors*

Predictors	Rural				Urban			
	B	SE	β	t	B	SE	β	t
ICT infrastructure	1.98	7.58	0.02	0.26	4.83	5.74	0.05	0.84
ICT resource	8.95	8.13	0.10	1.10	-1.30	5.49	-0.01	-0.24
ICT operations	5.19	6.80	0.07	0.76	12.32	5.57	0.15	2.21*
Teacher ICT training	-4.91	6.70	-0.06	-0.73	-5.35	5.05	-0.07	-1.06
ICT Management	0.13	8.06	0.00	0.02	13.03	5.44	0.15	2.40*

4.3 Teacher-level predictors on students' information literacy

To answer RQ3, stepwise regression was employed to investigate the relationship between teacher-level factors and students' information literacy. As shown in Table 3. In rural schools, ICT collaboration could make a positive significant prediction for students' information literacy. However, teachers' ICT use for learning made a negative influence on students' information literacy. In urban schools, only teachers' ICT self-efficacy did a significant impact on students' information literacy.

Table 3. *The Regression Analysis of Teacher-level Factors.*

Predictors	Rural				Urban			
	B	SE	β	t	B	SE	β	t
ICT self-efficacy	21.09	20.92	0.11	1.01	33.84	14.27	0.17	2.37*
ICT attitude	-22.00	20.84	-.12	-1.06	-11.47	16.16	-0.06	-0.71
ICT collaboration	54.43	19.73	0.29	2.78**	25.52	16.21	0.14	1.58
ICT use for teaching	42.28	23.13	0.31	1.83	9.01	19.32	0.08	0.47
ICT use for learning	-62.56	25.24	-.43	-2.48*	-18.43	21.34	-0.15	-0.86

Note: *p < .05; **p < .01

5. Discussion and conclusion

The results of this study demonstrated that the overall Chinese secondary school students' information literacy only reached an average level. However, it must be noted that the significant diversity of students' information literacy still exists in rural and urban schools. The Chinese government should pay more special efforts to reduce the digital divide in terms of students' information literacy (Chetty et al., 2018). More importantly, this study analyzed different factors affecting students' information literacy from school and teacher aspects in rural and urban schools. The results could provide more insight for understanding differentiated needs regarding information literacy education between rural and urban schools.

In rural schools, the results indicated that teachers' ICT collaboration significantly associated with students' information literacy, the result was consistent with the previous studies (Lai, Guo &Tsai, 2014; Zhu et al 2019). Teachers were found to feel less work stressful, gain a better understanding of the curriculum and be more willing to adopt new technology in the classroom through mutual collaboration among colleagues (Eickelmann, 2010; Fraillon et al. ,2014; Cheung & Slavin, 2012). A collaborative atmosphere of school culture and regular ICT training activities can contribute to ICT-related collaboration among teachers (Drossel, Eickelmann, & Schulz-Zander, 2017). However, it is should be noted that rural teachers' ICT use for learning was found to be a negative predictor of students' information literacy. This result could be explained that due to the lack of ICT integration knowledge and ICT related competence, rural school teachers often improperly selected ICT tools in the teaching activities without the aim of developing students' information literacy (He & Wray, 2017).

In urban schools, the results indicated that school-level factors such as ICT management and ICT operation were positive predictors of students' information literacy. The findings are in line with earlier studies, which claimed that ICT supporting conditions is a major challenge facilitating ICT application in schools and school leadership can be identified as relevant for students' acquisition of information literacy (Wu et al., 2019; Lorenz, Eickelmann, & Gerick, 2015). As for teacher-level factors, only teachers' ICT self-efficacy was found to be positively associated with students' information literacy. This result implied that urban schools' teachers were more confident to use ICT in daily instruction which had a positive impact on students' information literacy (Aesaert et al., 2015; Papastergiou, 2010).

To conclude, secondary school students' level of information literacy has much room for improvement in China and there is a significant difference in influencing factors of students' information literacy between urban and rural schools in terms of school and teacher level factors. Differentiated strategies are needed to be considered for improving students' information literacy between rural and urban schools. Briefly, the results of this study also confirm that the digital divide represents a big social challenge on a global level and reveals that schools and policy-makers still have to develop effective strategies to improve students' information literacy both in China and in Western countries.

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