

The Effects of Online Reading Engagement and Relevant Page Hit on New and Old Reading Literacy: A Mediation Analysis

Ya-Chun Peng, Yuan-Hsuan Lee and Jiun-Yu Wu⁺

Institute of Education, National Chiao Tung University, Taiwan, ROC

Abstract: The concept of reading literacy includes reading digital text and printed text in the age of information and communication technologies. The current study intends to explore the relationship between the two forms of reading literacy by investigating the effect of engagement in social and information-searching online reading activities through the mediator of students' navigation skills. The result shows social reading activities have no indirect effect on both printed text and digital text but information seeking activities have a positive effect on both printed and digital text. The navigation skills can explain the mechanism behind this relationship.

Keywords: Social-Reading Activities, Information-Searching Activities, Mediation Analysis, Navigation Skills, Reading Literacy

1. Introduction

Nonlinearity is the most distinguishable feature in reading digital text. In order to read in the digital environment, readers need to (a) identifying important questions; (b) locating information; (c) critically evaluating information; (d) synthesizing information, and (e) communicating information based on Leu (2004). In addition, readers also need to evaluate the quality as well as credibility of the texts (Burbules & Callister, 2000).

OECD(2011) stated that (1) dynamic windows and frames, (2) networking and hyperlinking, (3) multimedia and augmented reality, (4) online discussion and social network are new forms of reading in the digital environment. When reading in the networked environment or reading hypertexts, people get distracted more easily and the depth of reading is relatively shallow compared to reading printed texts (Birkerts, 2006; Liu, 2005; Miall & Dobson, 2006). The popular use of youtube, Facebook, and MySpace creates a new style of reading in people's life.. People keep a weblog, join discussion forums, and interact with people in these social entertainment and social network sites. "[T]hese activities require a mastery of reading comprehension and written skills, even though the genres and forms of texts that are involved appear relatively new" (OECD, 2011, p. 35). These online reading activities can be categorized into information seeking and social networking activities. Reading emails, online news, consulting an online dictionary or Wikipedia, and searching for a particular topic or practical information using search engines are among the activities in information-seeking. Playing collaborative online games, chatting on line, maintaining a personal website/blog, and joining discussion forum and virtual communities, such as MySpace or Facebook belong to social networking activities. These online activities have mixed effects on students' reading comprehension as well as their academic achievement (Fox, Rosen, & Crawford, 2009; Lee & Wu, 2012)

The current study uses PISA 2009 database to explore the effect of these two distinct online reading activities on the performance of reading printed text and digital text. Moreover, the study includes the variable of "relevant page hit" while reading digital text as the mediator to investigate the mechanism of the effect of information seeking and social networking activities on the performance of reading printed text and digital text. Specifically, the study aims to answer the following research questions:

- How will the information-seeking and social networking activities influence PISA 2009 reading literacy and electronic reading assessment (ERA)?
- How will the information-seeking and social networking activities influence the relevant page hit when participants are reading the digital text?

⁺ Corresponding author. Institute of Education, National Chiao Tung University, 1001 University Road, Hsinchu City, Taiwan 300, ROC. Tel.: +886-3-5712121 ext 58073; fax: +886-3-5738083.
E-mail address: jiunyuwu@mail.nctu.edu.tw.

- Will the effect of information-seeking and social networking activities on ERA mediated by the relevant page hit?

2. Method

2.1. Participants

PISA 2009 data was used in this study. Two-stage stratified sampling method were used: at the 1ststage, at least 15 schools were selected proportional to their size from a national list of schools for each country; at the 2ndstage, a random sample of 35 fifteen years old students was selected from each selected schools. For the current study, we used data from regions with available PISA digital reading literacy score and the navigation skills, especially the measure of relevant page hit. The resulting sample size is 33788students.

2.2. Measures

Social networking activities include 2 items assessing the frequencies of student use of social reading activities on the Internet. Information seeking activities include 4 items assessing the frequencies of student use of information-seeking reading activities on the Internet.

Relevant page hit: An index measure of navigation skill which indicated the frequency of students visited the informative and relevant pages in the digital version of PISA reading test.

Reading literacy: Both the printed version and the digital version of PISA reading test were used.

2.3. Data Analysis

We used Mplus 6.11 (Muthén & Muthén, 2010) to perform the mediation analysis (MacKinnon, 2008) with replicate weights and plausible values to best fit the nature of the PISA two-stage stratified sampling scheme, and to simulate the participants' true ability (OECD, 2009). In order to investigate the indirect effect, the Sobel test (1982) was conducted with the delta method standard error to test statistical significance (Krull & MacKinnon, 1999, 2001) of the path estimates from predictors to printed/electronic reading literacy through relevant page hit. As for the model evaluation, we reported CFI (Comparative Fit Index, Bentler, 1990), RMSEA (Root Mean Square Error of Approximation, Steiger, 1998) and SRMR (Standardized Root Mean Square Residual, Hu & Bentler, 1999).

3. Result

All study variables were positively and significantly correlated (r ranged from $-.01$ to $.864$, $p < .01$) except for Male and ST26Q07, which were not statistically significant ($r = -.006$, $p = .238$), as shown in Table 1. The mediation model demonstrated an adequate model fit to the observed data (RMSEA = .072, CFI = .954, SRMR = .060) according to the commonly used thresholds (Hu & Bentler, 1998). The unstandardized path coefficients were reported so the model coefficients can be interpreted on meaningful metrics.

Table 1 Correlations between study variables.

	1	2	3	4	5	6	7	8	9	10	11	12
1 PVIREAD	1	.85	.62	.11	-.01*	.10	.22	.15	.05	.16	.37	-.18
2 PVIERA	.85	1	.68	.14	.04	.11	.20	.15	.07	.17	.41	-.12
3 Relevant Page Hit	.62	.68	1	.15	.09	.11	.23	.16	.08	.16	.26	-.09
4 ST26Q01 (social)	.11	.14	.15	1	.39	.31	.28	.28	.22	.26	.20	-.06
5 ST26Q02 (social)	-.01*	.04	.09	.39	1	.34	.25	.20	.31	.25	.12	-.03
6 ST26Q03 (Inform)	.10	.11	.11	.31	.34	1	.42	.37	.30	.37	.11	.06
7 ST26Q04 (Inform)	.22	.20	.23	.28	.25	.42	1	.55	.29	.41	.17	-.02
8 ST26Q05 (Inform)	.15	.15	.16	.28	.20	.37	.55	1	.27	.47	.19	.03
9 ST26Q07 (Inform)	.16	.17	.16	.26	.25	.37	.41	.47	.35	1	.16	-.01
10 ESCS	.37	.41	.26	.20	.12	.11	.17	.19	.04	.16	1	.01
11 Male	-.18	-.12	-.09	-.06	-.03	.06	-.02	.03	.10	-.01	.01	1

Note. Bolded font indicates the significant level $p < 0.01$; * indicates $p < 0.05$.

3.1. Main Model

We put the focus on the direct and indirect paths from engagement in online social and information seeking activities to PISA printed and electronic reading literacy, passing through the relevant page hit. The direct paths from online social activities frequency significantly negatively predicted PISA printed and electronic reading literacy ($b_{SOCIAL \rightarrow PV_READ} = -28.142$, $p < .001$ and $b_{SOCIAL \rightarrow PV_ERA} = -13.402$, $p < .001$, respectively), but insignificantly predicted the relevant page hit. For every 1-unit increase in online social activities frequency, students' PISA printed and electronic reading literacy decreased 28.142 units and 13.402 points, holding all else constant. Unlike online social seeking activities, the online information seeking activities frequency significantly positively predicted PISA printed and electronic reading literacy, and the relevant page hit ($b_{INFOR \rightarrow PV_READ} = 25.346$, $p < .001$; $b_{INFOR \rightarrow PV_ERA} = 12.820$, $p < .001$; $b_{INFOR \rightarrow RELPAGE} = 2.866$, $p < .001$, respectively). For every 1-unit increase in online information seeking activities frequency, students' PISA printed and electronic reading literacy increased 25.346 units and 12.820 points, and the relevant page hit increased 2.866 points, controlling for all other variables.

The mediator, relevant page hit, also positively predicted PISA printed reading literacy ($b_{RELPAGE \rightarrow PV_READ} = 5.392$, $p < .001$), and PISA electronic reading literacy ($b_{RELPAGE \rightarrow PV_ERA} = 6.150$, $p < .001$). For every 1-unit increase in relevant page hit, PISA printed and electronic reading literacy increased 5.392 points and 6.150 points, adjusting for other predictors.

As for the indirect effect of engagement in online social activities on PISA printed and electronic reading literacy with relevant page hit as a mediator was not statistically significant ($b_{SOCIAL \rightarrow RELPAGE \rightarrow PV_READ} = -0.283$, $p = 0.761$ and $b_{SOCIAL \rightarrow RELPAGE \rightarrow PV_ERA} = -0.248$, $p = 0.761$, respectively). On the contrary, the indirect effect from online information seeking activities to PISA printed and electronic reading literacy through relevant page hit was statistically significant ($b_{INFOR \rightarrow RELPAGE \rightarrow PV_READ} = 17.626$, $p < .001$ and $b_{INFOR \rightarrow RELPAGE \rightarrow PV_ERA} = 15.454$, $p < .001$, respectively). Through relevant page hit, every 1-unit increase in online information seeking activities indirectly resulted in a change of 17.626 and 15.454 points in PISA printed and electronic reading literacy scores, holding all other variables constant.

3.2. Covariates

ESCS ($b_{ESCS \rightarrow RELPAGE} = 2.090$, $p < .001$) and MALE ($b_{MALE \rightarrow RELPAGE} = -1.669$, $p < .001$) statistically significantly predicted relevant page hit. Female students and the students who had higher ESCS had higher levels of relevant page hit. For PISA printed and electronic reading literacy, ESCS ($b_{ESCS \rightarrow PV_READ} = 21.709$, $p < .001$; $b_{ESCS \rightarrow PV_ERA} = 23.728$, $p < .001$), and MALE ($b_{MALE \rightarrow PV_READ} = -27.622$, $p < .001$; $b_{MALE \rightarrow PV_ERA} = -13.373$, $p < .001$) were significant demographic predictors. For every 1-point increase in ESCS, students' PISA printed and electronic reading literacy significantly increased 21.709 and 23.728 points, holding all else constant. On average, girls had higher PISA printed and electronic reading literacy scores than boys by 27.622 and 13.373 points, controlling for all other covariates.

4. Discussion

- The mediation analysis tackled into the mechanism that mediated the effect of social and information seeking reading activities on PISA reading literacy.
- Social reading activities and information –seeking reading activities have different impacts on reading literacy.
- Information –seeking reading activities have a positive impact on both the printed and electronic reading literacy while social reading activities have a negative impact on both the printed and electronic reading literacy.
- The mediator, relevant page hit, has a positive impact on both PISA printed and electronic reading literacy.
- The indirect effect of social activities on PISA printed and electronic reading literacy with relevant page hit as a mediator was not statistically significant, while the indirect effect of information-seeking

activities on PISA printed and electronic reading literacy with relevant page hit as a mediator was statistically significant.

- Information seeking reading activities leads to higher PISA printed reading literacy because the information-seeking behaviour contributes to more relevant page hits.
- Social reading activities have no indirect effect on PISA printed reading literacy because social reading behaviour does not contribute to gains in relevant page hits.

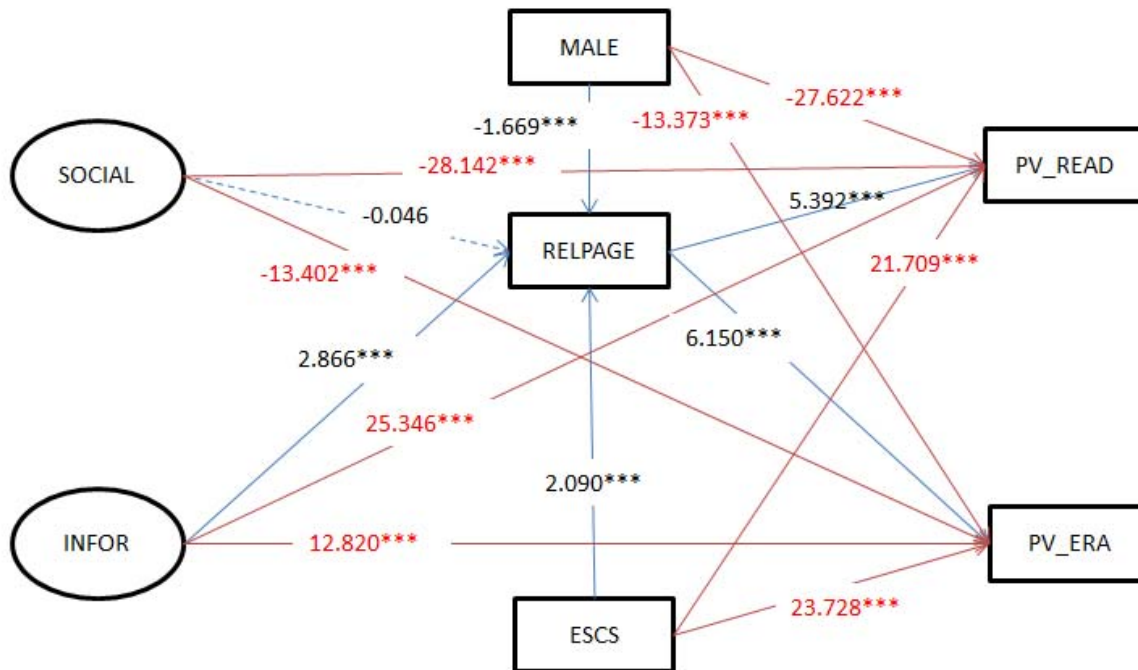


Fig. 1: Illustration of Hypothesized Mediation Model.

5. Acknowledgements

The authors are indebted to the supports and the grants from the National Science Council, Taiwan (NSC-100-2410-H-009-057).

6. References

- [1] Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychological Bulletin*, 107, 238–246.
- [2] Birkerts, S. (2006). *The Gutenberg elegies: The fate of reading in an electronic age*. Boston, MA: Faber & Faber.
- [3] Burbules, N. C., & Callister Jr, T. A. (2000). *Watch IT: The Risks and Promises of Information Technologies for Education*. Boulder, CO: Westview Press,.
- [4] Fox, A. B., Rosen, J., & Crawford, M. (2009). Distractions, distractions: Does instant messaging affect college students' performance on a concurrent Reading comprehension Task? *CyberPsychology & Behavior*, 12(1), 51–53. doi:10.1089/cpb.2008.0107
- [5] Hu, L., & Bentler, P. M. (1998). Fit indices in covariance structure modeling: Sensitivity to underparameterized model misspecification. *Psychological methods*, 3, 424–453.
- [6] Hu, Li-tze, & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, 6(1), 1–55. doi:10.1080/10705519909540118
- [7] Krull, J. L., & MacKinnon, D. P. (1999). Multilevel mediation modeling in group-based intervention studies. *Evaluation Review*, 23(4), 418.
- [8] Krull, J. L., & MacKinnon, D. P. (2001). Multilevel modeling of individual and group level mediated effects.

- [9] Lee, Y.-H., & Wu, J.-Y. (2012). The effect of individual differences in the inner and outer states of ICT on engagement in online reading activities and PISA 2009 reading literacy: Exploring the relationship between the old and new reading literacy. *Learning and Individual Differences*, 22(3), 336–342.
- [10] Leu Jr, D. J., Kinzer, C. K., Coiro, J., & Cammack, D. W. (2004). Toward a theory of new literacies emerging from the Internet and other information and communication technologies. In R.B. Ruddell & N.J. Unrau (Eds.), *Theoretical models and processes of reading (5th ed., pp. 1570–1613)*. Newark, DE: International Reading Association.
- [11] Liu, Z. (2005). Reading behavior in the digital environment: Changes in reading behavior over the past ten years. *Journal of Documentation*, 61(6), 700–712. doi:10.1108/00220410510632040
- [12] MacKinnon, D. P. (2008). *Introduction to statistical mediation analysis*. New York, NY: Erlbaum Psych Press.
- [13] Miall, D. S., & Dobson, T. (2006). Reading hypertext and the experience of literature. *Journal of Digital Information*, 2(1). Retrieved from <http://journals.tdl.org/jodi/article/viewArticle/35/37>
- [14] Muthén, L. K., & Muthén, B. O. (2010). *Mplus user's guide* (Sixth ed.). Los Angeles, CA: Muthén & Muthén.
- [15] OECD. (2009). *PISA Data Analysis Manual SAS® SECOND EDITION*. Paris, France: OECD publications.
- [16] OECD. (2011). *PISA 2009 results: Students on line. Digital technologies and performance (Volume VI)*. Paris, France: OECD publications.
- [17] Sobel, M. E. (1982). Asymptotic confidence intervals for indirect effects in structural equation models. *Sociological Methodology*, 13, 290–312.
- [18] Steiger, J. H. (1998). A note on multiple sample extensions of the RMSEA fit index. *Structural Equation Modeling*, 5, 411–419.